

Energy Statement

Caldershaw Centre, Ings Lane, Rochdale

Prepared on behalf of:
IQ Mouldings LTD

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Issue	Issue Date	Written by	Notes
VI	13/08/2024	Ceris Fussell	First issue

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Executive Summary

This report has been produced on behalf of IQ Mouldings LTD to demonstrate how the application for a new retail development at Caldershaw Centre, Ings Lane, Rochdale can address the carbon reduction and sustainability requirements set by the Stafford Borough Local Plan 2020-2040. The energy assessment has been prepared in accordance with 'Energy Planning –guidance on preparing energy assessments and local guidance documents from Stafford Borough under its Local Plan.

About the development

The proposed development will be located on disused land within a long-established industrial area of the Caldershaw Business Centre at Ings Lane. It will consist of 9 single storey units with areas ranging from 84 m² – 164m², and will contain toilet facilities and potential office, workshop/warehouse spaces. The scale of the development aims to be in keeping with the surrounding industrial buildings, with ample service areas for lorries and van parking to the southeast. The development makes use of rooflights to correspond and relate to neighbouring buildings and the elevations show large vehicle access doors and fire escape doors to the front of the units. There is limited soft landscaping as part of the development to minimise maintenance across the site and will benefit from channel drainage to remove surface water.

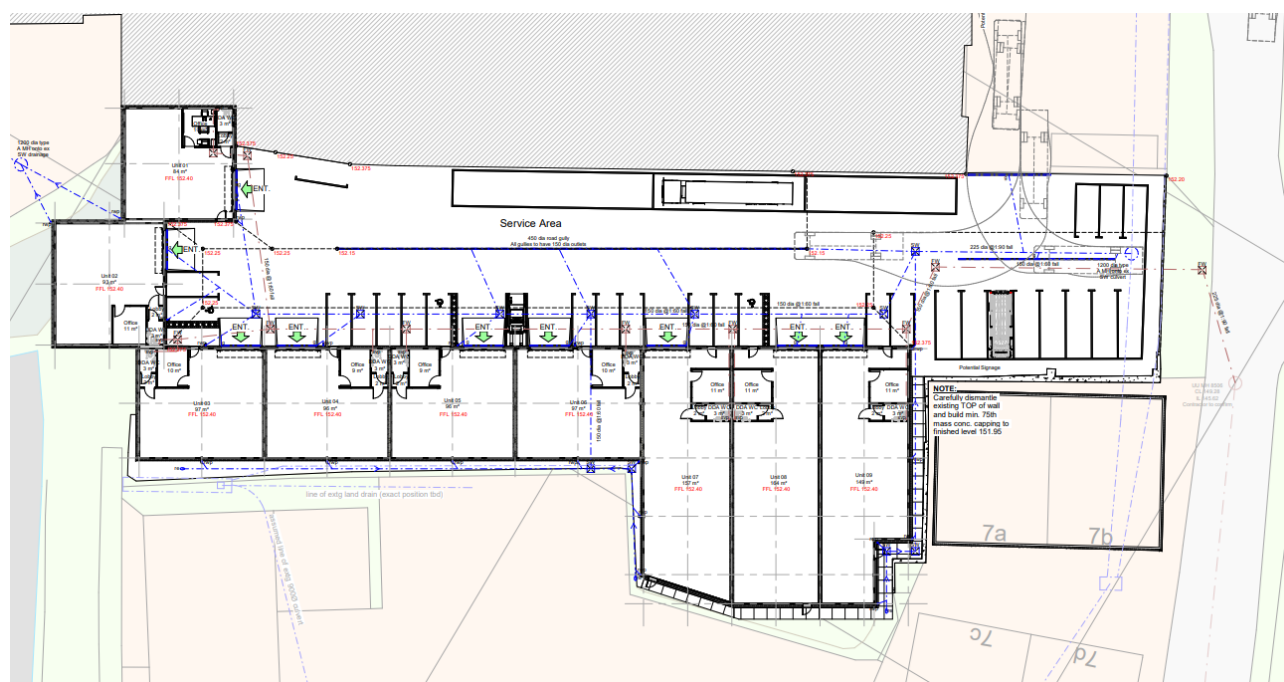


Figure 1 - Proposed site plan (courtesy of IQ Mouldings Ltd, 2023)



3 Elevation 03
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Figure 2 - Proposed North Elevation (courtesy of IQ Mouldings Ltd, 2023)

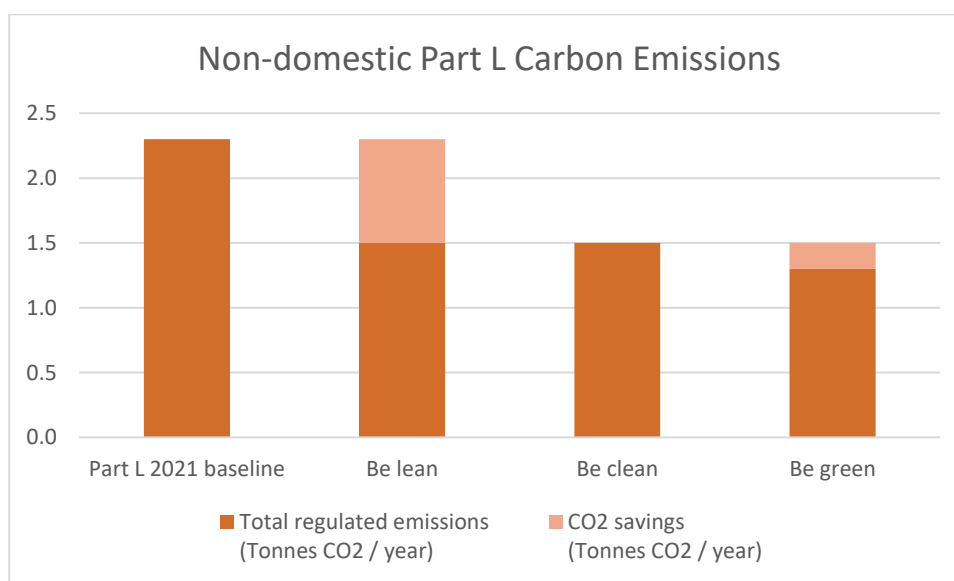
Key measures and CO₂ reductions

The report demonstrates that the given design and specification achieves a reduction of **46%** in on-site regulated emissions. This can be achieved by following the Energy Hierarchy:

- Demand reduction measures have been investigated including improved U-values, construction methods for the avoidance of thermal bridging and the improvement of air tightness.
- The energy systems for use at the development have been considered and selected in accordance with the order of preference described by the local plan, no fossil fuels will be used.
- After full consideration of the suitability of renewable generation, air source heat pump technology has been incorporated into the design. In addition, solar PV panels are proposed.

All results and strategies are directly affected by the inputs listed in this document; any deviation from these is certain to output different results. Enforcement bodies must ensure that they are satisfied that the below inputs are an accurate reflection of the final building before using this reporting to demonstrate compliance.

The carbon savings achieved by the proposed development are shown at each stage of the Energy Hierarchy in the figures below. These have been calculated and presented in accordance with the guidance set by the GLA.



Next Steps

Please contact Build Energy prior to RIBA Stage 4 or after planning permission is granted for advice on securing compliance with Building Regulations Part L & O at Design Stage and Post Construction. You can reach Ceris at ceris@buildenergy.co.uk or on 0330 055 34 05.

Summary of Targets

The following reduction targets for regulated operational carbon emissions are applicable to the proposed development at Caldershaw Centre, Ings Lane, Rochdale.

Targets set Nationally

Part L of the Building Regulations sets requirements for the conservation of fuel and power in buildings within England and Wales. Among other requirements, new buildings are expected to meet or exceed a TER (Target Emission Rate), a maximum level of regulated emissions expressed in kg of CO₂ per m² per year. There is no TER for buildings created from refurbishment or change of use.

Targets set by Stafford Borough under its Local Plan

The Local Authority Stafford Borough under its Local Plan Policy 4 sets out the targets and requirements for new residential and non-residential developments.

Proposals must demonstrate that all resources are used efficiently, as part of the construction and operation of a building. All major development should set out how embodied emissions have been taken into consideration through the production of an embodied carbon assessment.

Net zero operational energy: non residential

To demonstrate net zero carbon operational energy, all new major non-residential development must demonstrate through an energy statement, that the following have been achieved:

1. No on-site fossil fuel combustion;
2. Energy use is minimised appropriate to the end use;
3. On-site renewable energy generation is maximised, equivalent to the on-site energy demand; and Alternatively, compliance can be demonstrated by using BREEAM Excellent level accreditation, with outstanding level for energy use (Credit Ene01) or through an alternative compliance route with prior agreement.

Residual energy demand for new residential and non-residential buildings should be met through onsite renewable energy schemes, but if this is not. Technically feasible, the requirement may be met elsewhere by means of offsite renewable energy generation. Where this is the case, the development proposal must demonstrate how additional renewable energy. generation is procured to make up the on-site shortfall in generation. The offset mechanism will require agreement with the council.

Other requirements

Development must also:

1. Incorporate water efficient features and equipment into all new residential development to achieve a maximum water usage of 110 litres per person per day;
2. Follow the principles of the energy hierarchy; and
3. Demonstrate through the energy statement and/or design and access statement (where applicable) that opportunities to incorporate sustainable design features where feasible (such as rainwater harvesting and greywater recycling, green roofs, maximising use of recycled materials, orientating buildings to optimise solar gain) have been maximised.

Targets Applicable to the 9 commercial unit

The proposed 9 commercial unit scheme is defined as a non-residential development under the criteria described above, and so targets set by the Stafford Borough under its Local Plan apply. As such there is a **46.15 %** target reduction in CO₂ emissions over Part L of the Building Regulations through on-site solutions following the Energy Hierarchy.

	DER/BER	TER	Percent
	<i>kg CO₂ / m²</i>		Reduction
Caldershaw Centre	0.91	1.69	46.15%

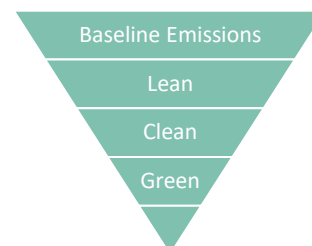
Of these, **12%** can be found using renewable technology in accordance with the policies of Stafford Borough under its Local Plan.

Establishing CO₂ Emissions

This assessment seeks to identify the carbon footprint of the development after each stage of the Energy Hierarchy. This includes regulated emissions and, separately, those emissions associated with uses not covered by Building Regulations i.e. unregulated emissions. The methodologies for calculating emissions in this report have been taken from the relevant guidance on preparing energy assessments.

The Energy Hierarchy can be described as follows:

- Baseline Emissions: Compliance with the relevant Part L 2013 Building Regulations only
- Be Lean: Use less energy
- Be Clean: Supply energy efficiently
- Be Green: Use renewable energy



The carbon footprint of 9 commercial unit at each stage of the Energy Hierarchy is demonstrated in the tables below:

Carbon dioxide emissions after each stage of the Energy Hierarchy for new build non-domestic buildings

Baseline: Part L 2021 of the Building Regulations compliant development
After energy demand reduction
After heat network / CHP
After renewable energy

Carbon dioxide emissions for domestic buildings (tonnes CO₂ / annum)

Regulated	Unregulated
2.30	21.95
1.50	21.95
0	0
1.30	21.95

Regulated carbon dioxide savings from each stage of the Energy Hierarchy for new build non-domestic buildings

Be lean: Savings from energy demand reduction
Be clean: Savings from heat network
Be green: Savings from renewable energy
Cumulative on-site savings

Regulated carbon dioxide savings

(Tonnes CO ₂ / annum)	(%)
0.80	34%
0.00	0%
0.30	12%
1.10	46%

Carbon Offsetting

This report demonstrates that it is possible to reduce the regulated on-site carbon dioxide emissions of the proposed 9 commercial unit development by 46% over Part L of the Building Regulations with the specification described, based on the modelling undertaken.

This reduction achieves a 46% reduction in carbon emissions from the notional baseline. The development will solely run on electric systems, and with improved fabric and energy efficient systems, energy use will be minimised. The flat roof has a potential for renewables we have assumed a solar PV output of 20 kWp. The proposed BRUKL document shows that at this stage energy production from the renewables could potentially offset the heating requirement at 11.44 kWh/m².

Calculating Regulated CO₂ Emissions

At each stage of the assessment, regulated emissions have been calculated using Building Regulations approved compliance software. This is SBEM / Dynamic Simulation Modelling for non-domestic buildings.

The energy assessment has established the regulated CO₂ emissions baseline by modelling the development as compliant with Part L 2021 of the Building Regulations alone. This is the TER of the final specification, i.e. the 'be green' stage. A heat pump was also used within the notional calculations however with reduced efficiencies to determine a baseline.

Reporting from approved software presents CO₂ emissions as kg/m²/year. The methodology for converting these figures into tonnes of CO₂ per annum for comparisons is as follows:

- For each representative dwelling, the related Dwelling or Target Emission Rate (DER/TER) has been multiplied by the cumulative floor area for that dwelling type to establish the related regulated CO₂ emissions.
- For each non-domestic building, the Building or Target Emissions Rate (BER/TER) has been multiplied by its floor area to provide the related regulated CO₂ emissions.
- The CO₂ emissions for each non-domestic building and dwelling type are then summed to give the total regulated emissions for the development.

The entire non-domestic space has also been modelled. The appendix of the energy assessment includes the summary output sheets from the modelling work of the baseline and each stage of the hierarchy.

The baseline emissions for the project are shown below:

Baseline emissions

	(Tonnes CO ₂ / year)			
	Baseline	Be lean	Be clean	Be green
Non-domestic new build	2.30	-	-	-

Unregulated CO₂ Emissions

Unregulated operation emissions are those which are not assessed under Part L of the Building Regulations. In dwellings, these typically result from cooking or use of appliances. Non-domestic sources are more varied but include uses such as catering, computing, etc.

For non-domestic spaces, unregulated emissions are established from the “equipment” figures shown within the BRUKL document. These have been converted from kWh/m²/year to tonnes per year for comparison with the regulated emissions presented above. Unregulated emissions are not included in methods for calculating baseline emissions, targets or reductions, but instead presented separately as follows:

Unregulated emissions

Type	Total (tonnes CO ₂ / year)
Non-domestic new build	21.95

Demand Reduction (Be Lean)

The following section of the report outlines measures which have been taken to reduce the energy demand of the proposal. This includes both architectural and building fabric measures (passive design) and energy efficient services (active design), considered at the earliest design stage.

Demonstrating CO₂ Savings from Demand Reduction Measures

According to the guidance from the GLA, passive design measures, including optimising orientation and site layout, natural ventilation and lighting, thermal mass and solar shading must be set out in the Design and Access statement. The impact of these factors is also accounted for within the energy calculations.

Active design measures to reduce energy can include high efficiency lighting and ventilation. Other possible measures include enhanced U-values, air tightness improvement and the development's approach to limiting thermal bridges. The specification for these items as proposed for the project is outlined below:

Specification at 'Be Lean' Stage

Demand Reduction Measures	Specification
<i>Building Fabric - U-Values (W/m²K)</i>	
Walls	0.20
Floors	0.12
Roofs	0.16
External opaque doors (whole frame)	1.60
Vehicle Access Door	1.30
Glazing (glazed doors, windows & rooflights (whole frame)	1.6 g-value 0.4
<i>Building Fabric - Other</i>	
Air Permeability (m ³ /hm ²)	5.0
Thermal Bridging	Accredited Construction Details
<i>Services</i>	
Ventilation	Natural Ventilation
Low Energy Lighting	100% of fittings

For the purposes of demonstrating CO₂ emission improvements in the 'be lean' stage of the energy hierarchy, the notional building system type and performance values are specified in the Part L 2021 baseline as determined by the final proposed building specification. In this way CO₂ emission improvements from the proposed space heating and hot water demand reduction measures can be compared against the Part L 2021 baseline, for example through improvements in performance of building fabric, heat recovery or water efficient fittings.

For example, under Part L 2021 for a non-residential building proposing heat pumps, the TER for the Part L 2021 baseline would include heat pumps with notional performance values of 2.86 seasonal generator efficiency for hot water and 2.64 seasonal system coefficient of performance for space heating. The CO₂ emission savings from increases in performance over the notional value would then be accounted for under the 'be green' element of the energy hierarchy.

The notional values used are as follows:

Notional specification at 'Be Lean' Stage

Item	Specification
Air Source Heat Pump	2.64 seasonal heating efficiency 4.4 seasonal cooling efficiency.
Hot Water	Direct electric instantaneous hot water 100% efficiency.
Lighting Controls*	Occupancy sensing time switch (auto on/off), photo electric dimming.
Light fittings*	100lm/cw

The carbon produced and reductions achieved by the project when the above specification is applied are shown below.

Cumulative savings after 'be lean'

	(Tonnes CO ₂ / year)				Cumulative Improvement (%)
	Baseline	Be lean	Be clean	Be green	
Non-domestic new build	2.30	1.50	-	-	34%

Heating Infrastructure (Be Clean)

The Heating Hierarchy

The energy systems for use at the development have been considered and selected in accordance with the order of preference within guidance on preparing energy assessments as part of planning applications. The hierarchy is as follows:

- **Connection to an area wide heat network.** Where proposed developments are located near to existing or planned networks, connection must be prioritised.
- **Communal heating system**
 - **Site-wide heat network.** Where proposed developments are in areas of decentralised energy potential, but no heat networks currently exist or are planned, developers should provide a site-wide heat network served by a single energy centre to future proof the development for easy connection to a wider heat network in the future.
 - **Building-level heating system.** Appropriate for single building applications or low-density developments with domestic blocks, where no district heating networks are planned or feasible.
- **Individual heating system.** Appropriate for low density individual housing, where no district heating networks are planned or feasible, and where evidence is provided that a site-wide heat network is uneconomic.

Connection to Area Wide Low Carbon Heat Distribution Networks

There are no existing or planned heat networks near the development.

Proposed Heating and Cooling Specification

The proposed system is an individual ASHP (air source heat pump) providing heating. This is considered a renewable technology and modelled under “Be Green”. The “Be Clean” model retains the previous HVAC assumptions.

The carbon produced by the project when this specification is applied is shown below.

Cumulative savings after 'be clean'

	(Tonnes CO ₂ / year)				Cumulative Improvement (%)
	Baseline	Be lean	Be clean	Be green	
Non-domestic new build	2.30	1.50	0	-	0%

Renewable Energy (Be Green)

The use of renewable technology in the proposed design of the development has been fully considered as outlined in Appendix A.

Photovoltaic solar panels have been identified as a suitable technology for incorporation into the design. The proposal is for a 20kWp, facing south at a c.a. 30° pitch. This system is equivalent to an area of approximately 80m², depending upon the array and configuration chosen. The south facing roof space has been identified as suitable for this purpose during BRUKL modelling. Drawings of the proposed array will be available when finalised by the design team.

Due to limited roof space, solar hot water cannot be used effectively alongside photovoltaic arrays, instantaneous hot water has also been opted for. Accordingly, it is considered preferable to install photovoltaic arrays in the available space identified, as these represent a greater carbon saving. Due to the size of the proposed project, biomass energy has not been considered as an economically suitable technology for this development.

An estimated PV system output of 20 kWp, equating to around 50 panels at 400 watts, which would require around 80m² of the roof area that could be used to install photovoltaic modules. An estimated 11.44kWh/m² of electricity could be generated by the photovoltaic modules. Battery storage cannot currently be modelled within the simulation, this could provide further savings and offset further electricity demand.

Air Source Heat Pump technology has been modelled to provide heating along with instantaneous electric hot water as follows:

Specification at 'Be Green' Stage

Element	Specification
<i>Heating System</i>	
Type	ASHP
Efficiency	SCOP (seasonal) – 3.10
Controls	Time and temperature zone controls Delayed Start Thermostats
<i>Hot Water</i>	
Type	Direct instantaneous hot water
<i>Cooling</i>	
Efficiency	SEER (seasonal) – 5.00
SFP	2.00

The carbon produced by the project when this specification is applied is shown below. The results of these improvements show a **46%** reduction in emissions over the Part L compliant base case, with the on-site renewables minimising the on-site energy demand as much as possible.

Cumulative savings after 'be clean'

		(Tonnes CO ₂ / year)			Cumulative Improvement (%)
	Baseline	Be lean	Be clean	Be green	
Non-domestic new build	2.30	1.50	0	1.30	12%

Carbon dioxide emissions after each stage of the Energy Hierarchy for new build non-domestic buildings

Carbon dioxide emissions for domestic buildings (tonnes CO₂ / annum)

	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations compliant development	2.30	21.95
After energy demand reduction	1.50	21.95
After heat network / CHP	0	0
After renewable energy	1.30	21.95

Regulated carbon dioxide savings from each stage of the Energy Hierarchy for new build non-domestic buildings

Regulated carbon dioxide savings

	(Tonnes CO ₂ / annum)	(%)
Be lean: Savings from energy demand reduction	0.80	34%
Be clean: Savings from heat network	0.00	0%
Be green: Savings from renewable energy	0.30	12%
Cumulative on-site savings	1.10	46%

Internal Water Use

It is the intention of the applicant to reduce the consumption of potable water within the proposed unit from all sources, using efficient fittings and flow restrictors where required. Performance in domestic properties is assessed under the methodologies set out in Part G of the Building Regulations. Although a variety of specifications are available to meet this target, the proposed flow rate criteria for dwellings at the development is outlined in Appendix B. This achieves an internal water use of **110 L/p/d** (litres per person per day) by design. This is compliant with Policy 4 (Water Use and Supplies) of the Stafford Local Plan, which states that developers should minimise the use of mains water by incorporating water saving measures and equipment.

Biodiversity

The presence of any significant ecological features as defined using guidance from BRE will be noted, and the appropriate measures for protection and conservation undertaken before works begin. Features to promote biodiversity, such as bird and bat boxes, will be incorporated into the design wherever feasible.

Due to the nature of the development (being a brownfield site), there will be minimal loss of biodiversity. Additional planting will be carried out to ensure a net gain in vegetation.

Conclusion

This report outlines how a variety of sustainability criteria have been considered alongside the proposed design. Based on the modelling undertaken, it has been demonstrated that it is possible to reduce regulated on-site carbon dioxide emissions of the proposed 9 commercial unit development by **46%** beyond the requirements of Part L of the Building Regulations, where the building and services specification described in this report is implemented. The design of the building has prioritised energy reduction through energy efficient fabric measures, lighting, ventilation, and orientation. The energy demand of the building has been minimised and efficiency design measures are in place, renewable energy technologies will be used to offset electricity demand.

In addition, any further operational emissions could be met through offset payments, the price of which is to be determined by the local authority. To assist in this, the predicted tonnes of CO₂ produced by the development over a thirty-year period have been provided as required in the tables above.

Appendices

Appendix A – Consideration of Renewable and Alternative Technology

Photovoltaic Solar Panels

Photovoltaic panel systems convert energy from the sun into electricity through semi-conductor cells mounted in collector panels. The panels are connected to an inverter to turn the DC output into AC for use in the building to which they are attached and to be fed back into the grid when not required. Photovoltaic arrays provide a quiet and effective renewable energy source with a relatively low aesthetic impact. The major benefit of PV systems is the significant reductions they can achieve in comparison to other technologies, in terms of CO₂ and energy use.

The PV panels should ideally be orientated between southeast and southwest (optimally south). The optimal tilt angle (inclination of panel from horizontal) should be calculated to ensure the best possible output of the system during the year. In the UK, the angles of most pitched roofs are suitable for mounting PV panels. Panels can also be mounted on A-frames on flat roofed buildings. PV technology comes in a range of forms: PV panels that can be retrofitted to the roof of an existing building or equally, sunk to fit flush with the roof line; PV cells that are 'laminated' between sheets of glass to provide shading in a glazed area, and PV cladding. PV systems are low maintenance as they have no moving parts and panels generally have 25 year warranties, although the lifetime of the panel can be expected to be beyond this time. The PV systems should not be shaded. Shading caused by other buildings, greenery and roof 'furniture' such as chimneys or satellite dishes, even over a small area of the panel, can significantly reduce performance. Excess energy can be exported to the grid. Although the Feed-in Tariffs are generally not high, exporters can negotiate with their utility company. Future consideration may be given to the benefits of battery storage. Payback times for this technology are usually approximately twenty years; but this is reducing year on year as the technology matures and are set to reduce further as fuel prices increase. Integrating PV into a building and replacing other building materials can further offset the cost.

Solar Hot Water Systems

Solar water heating systems use the energy from the sun to heat water stored in a hot water cylinder inside the building. A solar collector comprises a housing that contains piping, through which the carrier fluid circulates, and a glass panel to retain the radiation from the sun. The temperature inside the collector increases and this heat is then transferred to a carrier fluid. In an open loop system, the hot water is heated directly. Solar thermal panels are generally black in appearance for maximising energy absorption and the glass panels have a special coating in order to retain as much heat as possible. Two types of collector exist: flat plate and evacuated tube. Flat plate collectors can be mounted on or flush with the roof. The air in the collection tubes can be evacuated to reduce heat losses within the frame by convection. Evacuated tube collectors need to be re-evacuated every few years. They are more difficult to install but are more efficient and allow higher temperature heating.

Solar thermal collectors offer a good price-performance ratio. Solar hot water systems are best suited to developments with high hot water requirements, such as hotels, care homes and leisure centres. Many systems have been installed in the UK and they work well, even without direct sunlight. Solar thermal systems should be sized to the hot water requirements of the user since any excess heat that is generated cannot be exported elsewhere. The optimal angle for mounting depends on when the water demand is greatest. Ideally, the collectors should be mounted onto a non-shaded, south-facing roof. Solar thermal technology is a cost effective way to reduce carbon emissions, especially if it is replacing electric water heating. Due to limited roof space, solar hot water cannot be used effectively alongside photovoltaic arrays. Accordingly, it is considered preferable to install photovoltaic panels as these represent a greater carbon saving.

Biomass Heating

With the long term availability of fossil fuels such as oil and gas, and the persistent number of price rises of oil and natural gas a growing concern in the UK, alternative heating methods such as wood burning boilers are becoming more popular. Due to technical advances in wood burning technology, and improvements in the preparation of wood fuels, efficiencies of new wood pellet burning boilers have increased to around 90%, with carbon monoxide emissions dropping dramatically. There are three types of wood burning boiler - logs, woodchips and wood pellets. Wood logs are the most readily available, generally produced as a by-product from forestry and woodland from sawmills, tree surgery and wind damage. Wood chips have a high moisture content which tends to restrict their efficiency to only 50% and they tend to suffer from blockages hence we would be cautious about their use on this site. Storage space requirements are also high due to the irregularity of the chips. Wood pellets are made from dry waste wood, such as used pallets and off-cuts/sawdust from furniture manufacturers. The waste wood is compressed into uniform, high density pellets that are easier to transport, handle and store than other forms of wood fuel.

Biomass combustion systems (BCS) are generally more mechanically complex than conventional boiler heating systems, especially when it comes to fuel delivery, storage, handling and combustion. The complexity is necessary because of the different combustion characteristics of biomass as compared to conventional fossil fuels. The increased complexity means higher capital costs than for conventional systems. BCSs typically require more frequent maintenance and greater operator attention than conventional systems. As a result, the degree of operator dedication to the system is critical to its success. They often require special attention to fire insurance premiums, air quality standards, ash disposal options and general safety issues. Domestic scale boilers such as Woodchip-fed systems remain very costly and the requirements for siting both the boiler and the fuel source were considered impractical for this development. There are also some concerns on current availability of suitable fuel within a reasonable distance of the development as well as the additional traffic that would be associated with it. The use of efficient heat pumps is considered more suitable.

Biomass can be burnt directly to provide heat in buildings using wood from forests, urban tree pruning, and farmed coppices or as liquid biofuel, such as bio diesel. In non-domestic applications, biomass boilers replace conventional fossil fuel boilers and come with automated features to enable reduced user intervention. Due to the size of the proposed project, biomass energy has not been considered as an economically suitable technology for this development.

Heat Pumps

Heat pumps transfer heat from a lower temperature source to one of a higher temperature. These are split into three main categories:

- Air source heat pumps operate by converting the energy of the outside air into heat, creating a comfortable temperature inside the building as well as supplying energy for the hot water system. Air-to-water systems provide hot water for direct use or to supply 'wet' heating through underfloor heating or radiators. Air-to-air systems provide hot air, either directly into an internal space, or to be distributed by fans.
- Ground source heat pumps apply the same principle to heat energy stored underground. In this case a circuit of piping is buried horizontally or via a bore hole.
- Water source heat pumps absorb heat from a local water source, such as a lake, river, well, or borehole.

The most prevalent system is an air source heat pump. As with all heat pumps, air source models are most efficient when supplying low temperature systems such as underfloor heating.

An air source heat pump extracts heat from the outside air in the same way that a fridge extracts heat from its inside. It can extract heat from the air even when the outside temperature is as low as minus 15°C. Cold water or another fluid is circulated through pipes, picking up the ambient temperature and then passing through the heat exchanger (the evaporator) in the heat pump unit. The heat exchanger extracts heat from the fluid, using a refrigerant compression cycle to upgrade the heat to a usable temperature (+55°C). This heat is then transferred to the heating system via another heat exchanger, the condenser of the heat pump.

Accordingly, ASHP heating systems generally run at a lower temperature than conventional heating systems. There are two main types of air source heat pumps. An air-to-water system uses the heat to warm water. Heat pumps heat water to a lower temperature than a standard boiler system would, so they are better suited to underfloor heating systems than radiator systems. An air-to-air system produces warm air, which is circulated by fans to heat the building. Whilst heat pumps are not a wholly renewable energy source due to use of electricity, the renewable component is considered as the heat is extracted from the air. It is measured as the difference between heat outputs, less the primary electrical energy input. Using this heat, for every Watt of electrical energy supplied to the system, 4 Watts or more of heating energy can be supplied to a heating system. This 'Coefficient of Performance' (CoP) of 4 is effectively an 'efficiency' of 400% for the system and compares very favourably with even the best gas condensing boiler's efficiency of around 85%. The smaller the temperature difference between the source and the output temperature of the heat pump (i.e. the temperature of the distribution system) the higher the heat pump's CoP. Unlike boilers, there is no pollution on-site and as the mix of power stations used to supply the electricity grid gets 'cleaner', with more renewable electricity generation being brought on line, so the carbon emissions from the heat pumps system will decrease even further. The key operational benefit of air source heat pumps for the user is the reduction in fuel bills. In addition, space savings can be made over other plant types as an air source heat pump unit is compact, and requires no storage space for fuel.

Since air source heat pumps produce less heat than traditional boilers, it is essential that the building where the air source heat pump is proposed is well insulated and draught proofed for the heating system to be effective. Fans and compressors integral to the air source heat pump unit generate some noise, but this is generally acceptable especially where outdoor units can be located away from windows and adjacent buildings. By selecting a heat pump with an outdoor sound rating of 7.6 dB or lower and mounting the unit on a noise-absorbing base these issues can be resolved for the site. Costs for installing a typical system vary but they are considerably more economical to install than an equivalent capacity ground source heat system and can produce similar levels of energy and carbon savings. Actual running costs and savings for space heating will vary depending on several factors - including the size and use pattern of the building and how well insulated it is.

Combined Heat and Power (CHP)

A Combined Heat and Power system (CHP) or cogeneration is the simultaneous generation of both heat and power (thermal energy and electricity). This is achieved through recovering heat generated in the production of electricity, which can be utilised in providing space heating and hot water. The most common fuel used in the UK to power a CHP engine is natural gas although LPG, biogas, ethanol, methane, hydrogen, biofuel, oil or any fuel that can drive an engine can be used. A CHP operating on fossil fuels, e.g. gas, diesel, is not considered a renewable technology. A biomass CHP, however, is considered to be a renewable energy technology but it is only suitable for developments with larger heat and electricity demands.

A CHP system uses on average 35% less primary energy compared to conventional heat-only boilers and power stations approaching efficiencies as high as 75%. Although not a renewable technology, except if biomass is being used, CHP is considered very efficient, reducing carbon emissions related to a site's energy consumption while providing electricity and heat to occupiers.

The GLA does not recommend CHP for use in developments consisting of 500 units or less, as 'at this scale it is generally not economical'. CHP has also been removed from the GLAs hierarchy for selecting energy systems with the publication of 'Energy Assessment Guidance Greater London Authority guidance on preparing energy assessments as part of planning applications - October 2018'.

CHP installed at the development to meet the base heat load would require the export of electricity to the national grid as it would likely exceed demand. The GLA continues to state that '...the administrative burden of managing CHP electricity sales at this small scale where energy service companies (ESCOs) are generally not active, and the low unit price available for small volumes of exported CHP electricity, means it is generally uneconomic for developers to pursue'.

CHP requires significant infrastructure and a substantial heat demand. In order to obtain maximum efficiency, it is necessary to have an energy demand profile which is evenly spread throughout the day and night. A CHP unit will operate efficiently when running continuously and so requires its energy to be used continuously to avoid wastage.

Appendix B – Water Calculations

Summary of Requirements

This appendix addresses water consumption for the proposed development. The approved document Part G gives two options to demonstrate compliance. These are as follows:

- **Fittings Approach.** Within the approved document, tables 2.1 and 2.2 describe the maximum rates for fittings to achieve 125/p/d or the 'optional' 110 l/p/d. The specifier may choose fittings which do not exceed these limits in order to attain compliance.
- **The Water Efficiency Calculator.** If any fittings exceed the amounts described within tables 2.1 or 2.2, then the water efficiency calculator must be completed to demonstrate compliance. Similarly, where a shower is not to be provided or where a waste disposal unit, a water softener or water re-use is to be provided the water efficiency calculator must be completed.

The standard required by default is **125 litres/person/day**. The 2015 edition of Approved Document G includes an 'optional' standard of **110 litres/person/day** which may be required by planning permission. This is intended to supersede the ability of planning authorities to require the Code for Sustainable Homes. The optional standard is equivalent to the minimum water use permitted under CSH Level 4.

By following the Government's national calculation methodology for assessing water efficiency in new dwellings for the project as designed, it is possible to achieve a water consumption of less than 110 litres per person per day using the fittings approach. Compliance with Building Regulation 36(1) can therefore be demonstrated.

This is compliant with Policy 5.15 B (Water Use and Supplies) of the London Plan, which states that developers should minimise the use of mains water by:

- A. Incorporating water saving measures and equipment.
- B. Designing domestic development so that mains water consumption would meet a target of 105 litres or less per head per day (excluding an allowance of 5 litres or less per head per day for external water consumption).

Compliant Design Specification

The fittings approach can be adopted to demonstrate compliance as follows. Fittings must not exceed the given the rates during design and construction:

Fitting	Maximum Consumption
WC flush	4/2.6 litres dual flush
Basin taps (in WCs and bathrooms)	5 l/min
Sink taps (kitchen and utility)	6 l/min
Showers	8 l/min
Baths	170 litres to overflow
Dishwasher	1.25 l/place setting
Washing machine	8.17 l/kilogram
Waste disposal unit	None fitted
Water softener	None fitted
Total consumption:	110 litres/person/day (105 internal)

Further Guidance for Specifiers on Achieving the Required Flowrates

Taps and showers will **require flow limiters** to meet these values. Please ensure these are installed along with the tap and shower fittings as these must be checked by Building Control prior to sign off.

Some taps and showers may already have built in limiters. Flow limiters are almost needed to meet the shower and tap values. You could alternatively check the flow rate with the manufacturer. For high pressure water systems (above 1 bar) it's the flow rates measured at 3 bar that is required. If it's a low-pressure water system (less than 0.3 bar), the flow rate at 0.1 bar is required. Tap values should be the maximum flow rate and showers should be the cold flow rate.

What if a waste disposal unit or water softener system is being used? These use additional water so may need to be compensated with lower values elsewhere. Please provide details of the waste disposal and softener systems being used. This report assumes that no such system is present.

What if any values are exceeded? It may be possible to compensate for them by further reducing values elsewhere. If you'd like us to look at this, please let us know. Grey water recycling or rainwater harvesting for internal use can also compensate for exceeding values.

WC Flush and Baths. The flush volume and capacity to overflow is often displayed on the manufacturer website or can be requested from them.

Dishwashers must achieve a water use of 1.25 l/place setting. This can be found by dividing the water consumption of a standard cycle by the number of place settings. If only the annual water consumption is given, divide this by 280 to get the water consumption of a single cycle. Where a dishwasher is not being fitted, 1.25 l/place setting is used as a default.

Washing machines need to achieve a water use of 8.17 l/kg dry load. This can be found by dividing the water consumption of a standard cycle by the dry load capacity in kg. If only the annual water consumption is given, divide this by 220 to get the water consumption of a single cycle. Where a washing machine is not being fitted, 8.17 l/place setting is used as a default.

External Water Use. Both the 125l and 110l target include a 5l allowance for external water use, e.g. to water a garden. This is not influenced by the building specification or fittings. It is common to see these targets described as 120l or 105 targets for internal water use. For example, the Greater London Authority require "mains water consumption would meet a target of 105 litres or less per head per day (excluding an allowance of 5 litres or less per head per day for external water consumption)".

Appendix C – Energy Model Output Documents

Project name

Caldershaw Centre_V1**As designed****Date:** Tue May 07 12:37:14 2024

Administrative information

Building Details

Address: Caldershaw Centre, Ings Lane, Rochdale, L2 7LQ

Certifier details

Name: Build Energy**Telephone number:** 0330 055 34 05**Address:** Unit A37 Aerodrome Studios, 2 8 Airfield Way,
Christchurch, BH23 3TS

Certification tool

Calculation engine: SBEM**Calculation engine version:** v6.1.e.1**Interface to calculation engine:** Virtual Environment**Interface to calculation engine version:** v7.0.26**BRUKL compliance module version:** v6.1.e.1**Foundation area [m²]:** 130.69The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	1.69
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	0.91
Target primary energy rate (TPER), kWh _{PE} /m ² annum	17.48
Building primary energy rate (BPER), kWh _{PE} /m ² annum	8.87
Do the building's emission and primary energy rates exceed the targets?	BER ≤ TER BPER ≤ TPER

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

Fabric element	U _a -Limit	U _a -Calc	U _i -Calc	First surface with maximum value
Walls*	0.26	0.2	0.31	SP000002_W4_A1
Floors	0.18	0.14	0.14	SP000002_F
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.16	0.16	SP000002_C_A0
Windows** and roof windows	1.6	-	-	No external windows/roof-windows
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

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]

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

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

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

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

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

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

Building services

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

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

1- ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.1	5	-	2	-
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

1- SYST0002-DHW

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

Zone-level mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1			
Unit 01 - Office	-	-	-	-	-	-	-	0.3	-	-	-	N/A
Unit 01 - DDA WC	0.3	-	-	-	-	-	-	0.3	-	-	-	N/A
Unit 02 - Office	-	-	-	-	-	-	-	0.3	-	-	-	N/A
Unit 02 - DDA WC	0.3	-	-	-	-	-	-	0.3	-	-	-	N/A
Unit 04 - Office	-	-	-	-	-	-	-	0.3	-	-	-	N/A
Unit 04 - DDA WC	0.3	-	-	-	-	-	-	0.3	-	-	-	N/A
Unit 05 - Office	-	-	-	-	-	-	-	0.3	-	-	-	N/A
Unit 05 - DDA WC	0.3	-	-	-	-	-	-	0.3	-	-	-	N/A
Unit 06 - Office	-	-	-	-	-	-	-	0.3	-	-	-	N/A
Unit 06 - DDA WC	0.3	-	-	-	-	-	-	0.3	-	-	-	N/A
Unit 03 - Office	-	-	-	-	-	-	-	0.3	-	-	-	N/A
Unit 03 - DDA WC	0.3	-	-	-	-	-	-	0.3	-	-	-	N/A
Unit 09 - Office	-	-	-	-	-	-	-	0.3	-	-	-	N/A

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
Unit 09 - DDA WC	0.3	-	-	-	-	-	-	0.3	-	-	N/A
Unit 08 - Office	-	-	-	-	-	-	-	0.3	-	-	N/A
Unit 08 - DDA WC	0.3	-	-	-	-	-	-	0.3	-	-	N/A
Unit 07 - Office	-	-	-	-	-	-	-	0.3	-	-	N/A
Unit 07 - DDA WC	0.3	-	-	-	-	-	-	0.3	-	-	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
Unit 01 - Office		110	-	-
Unit 01 - DDA WC		110	-	-
Unit 02 - Office		110	-	-
Unit 02 - DDA WC		110	-	-
Unit 04 - Office		110	-	-
Unit 04 - DDA WC		110	-	-
Unit 05 - Office		110	-	-
Unit 05 - DDA WC		110	-	-
Unit 06 - Office		110	-	-
Unit 06 - DDA WC		110	-	-
Unit 03 - Office		110	-	-
Unit 03 - DDA WC		110	-	-
Unit 09 - Office		110	-	-
Unit 09 - DDA WC		110	-	-
Unit 08 - Office		110	-	-
Unit 08 - DDA WC		110	-	-
Unit 07 - Office		110	-	-
Unit 07 - DDA WC		110	-	-
Unit 01 - Lobby		110	-	-
Unit 01 - Warehouse		150	80	1.875
Unit 02 - Lobby		110	-	-
Unit 02 - Warehouse		150	80	1.875
Unit 04 - Lobby		110	-	-
Unit 05 - Lobby		110	-	-
Unit 06 - Lobby		110	-	-
Unit 06 - Warehouse		150	80	1.875
Unit 05 - Warehouse		150	80	1.875
Unit 04 - Warehouse		150	80	1.875
Unit 03 - Lobby		110	-	-
Unit 03 - Warehouse		150	80	1.875
Unit 09 - Lobby		110	-	-
Unit 08 - Lobby		110	-	-
Unit 07 - Lobby		110	-	-
Unit 07 - Warehouse		150	80	1.875

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m ²]
	Standard value	95	80	0.3
Unit 08 - Warehouse		150	80	1.875
Unit 09 - Warehouse		150	80	1.875

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?
Unit 01 - Office	N/A	N/A
Unit 01 - DDA WC	N/A	N/A
Unit 02 - Office	N/A	N/A
Unit 02 - DDA WC	N/A	N/A
Unit 04 - Office	N/A	N/A
Unit 04 - DDA WC	N/A	N/A
Unit 05 - Office	N/A	N/A
Unit 05 - DDA WC	N/A	N/A
Unit 06 - Office	N/A	N/A
Unit 06 - DDA WC	N/A	N/A
Unit 03 - Office	N/A	N/A
Unit 03 - DDA WC	N/A	N/A
Unit 09 - Office	N/A	N/A
Unit 09 - DDA WC	N/A	N/A
Unit 08 - Office	N/A	N/A
Unit 08 - DDA WC	N/A	N/A
Unit 07 - Office	N/A	N/A
Unit 07 - DDA WC	N/A	N/A
Unit 01 - Warehouse	YES (+117.1%)	NO
Unit 02 - Warehouse	YES (+93.3%)	NO
Unit 06 - Warehouse	YES (+82.7%)	NO
Unit 05 - Warehouse	YES (+86.7%)	NO
Unit 04 - Warehouse	YES (+86.7%)	NO
Unit 03 - Warehouse	YES (+88.3%)	NO
Unit 07 - Warehouse	YES (+33.5%)	NO
Unit 08 - Warehouse	YES (+95.3%)	NO
Unit 09 - Warehouse	YES (+60.4%)	NO

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]	1376.9	1376.9
External area [m ²]	5455.5	5455.5
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	5	5
Average conductance [W/K]	1723.6	1837.36
Average U-value [W/m ² K]	0.32	0.34
Alpha value* [%]	13.8	46.65

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

Building Use

% Area	Building Type
89	Retail/Financial and Professional Services Restaurants and Cafes/Drinking Establishments/Takeaways Offices and Workshop Businesses General Industrial and Special Industrial Groups
11	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 Terminals Others: Emergency Services Others: Miscellaneous 24hr Activities Others: Car Parks 24 hrs Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	2.05	3.1
Cooling	0.29	0.38
Auxiliary	2.49	1.55
Lighting	10.22	9.95
Hot water	1.84	1.84
Equipment*	21.95	21.95
TOTAL **	16.89	16.83

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

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	11.44	5.19
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>11.44</i>	<i>5.19</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	303.72	345.59
Primary energy [kWh _{PE} /m ²]	8.87	17.48
Total emissions [kg/m ²]	0.91	1.69

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] Fan coil systems, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	211.2	39.5	21.6	3	26.2	2.71	3.62	3.1	5
	Notional	310	64.1	32.6	4	16.4	2.64	4.4	----	----
[ST] No Heating or Cooling										
	Actual	214.7	94.6	0	0	0	0	0	0	0
	Notional	277.1	65.5	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