



ENERGY STATEMENT

FOR



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AT

ASHBOURNE ROAD
BUXTON

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EXECUTIVE SUMMARY

This document forms the Sustainable Energy Strategy for the proposed Aldi foodstore associated access and landscaping works on development land at Ashbourne Road, Buxton. This document has been compiled by SEM Technology Ltd on the behalf of the applicant, Aldi Stores Ltd.

The proposed development includes a new 1,805m² ALDI retail store with approximately 153 car parking spaces and associated landscaping.

In addition to the utilisation of Air Source Heat pump heating scheme the building will incorporate significant photovoltaic arrays for the purposes of additional renewable energy generation.

The assessment and subsequent strategy has been prepared such that it is aligned with the Energy Hierarchy (see Section 2.1), with particular focus on sustainable building design (reduction of energy consumption at source), provision of energy efficiency measures and installation of building-integrated low and zero carbon (LZC) technologies.

The strategy has been derived in order to demonstrate, meet and exceed compliance with current energy planning policy requirements. Table E1 below provides an overview of the provisional energy strategy & sustainability statement, based on the objectives detailed throughout this report.

Table E1: Energy Strategy Overview			
Area	Objective Ref	Section	Description
Passive Solar Design	A (1)	2.2.2 (Box 2.1)	Minimising overshadowing
	B (1 – 4)	2.2.2 (Box 2.2)	Passive design principles
	C (1 – 4)	2.2.2 (Box 2.3)	Limiting excessive solar gain
Energy Management & Efficiency	D (1 – 5)	2.2.2 (Box 2.4)	Building energy efficiency measures
Renewable Technologies	E (1 – 2)	2.3.4 (Box 2.11)	Integration of LZC technologies

The conclusion of the energy strategy is that the development achieves a significant reduction in CO₂ emission compared to 2013 Building Regulation compliant development through the incorporation of the principles of the Energy Hierarchy and the combination of passive measures, including building fabric design improvements and the utilisation of zero and low carbon technologies.

The extent of onsite renewable or low carbon technologies, including Air Source Heat Pumps and a 50kWp roof mounted solar photovoltaic array, produces sufficient energy to ensure the reduction in CO₂ emissions significantly exceeds the mandated requirements stipulated by local planning policy.

Specific detail relating to the predicted reductions in annual CO₂ emissions is detailed within the table below.

ALDI Store: Energy Strategy Summary				
Scenario	Energy Demand (kWh / year)	Energy saving achieved (%)	Regulated CO ₂ Emissions (kgCO ₂ / year)	Saving achieved in CO ₂ emissions (%)
2013 Part L Compliant Benchmark Building	80,054	-	35,120	-
Enhanced Scenario (improved building fabric and M&E services)	75,318	6%	34,219	2.6%
Enhanced Scenario + ASHP + 50kWp Solar Array	63,377	16%	24,944	27.1%
Total Savings in Energy and Emissions	16,677	20.8%	10,176	29.7%

The above Table details a 29.7% reduction in CO₂ emissions through installation of LZC technologies (including the Air Source Heat Pumps and 50 kWp solar photovoltaic array) when compared to the benchmark building scenario (comprising BRUKL 2013 compliant gas-fired condensing boiler and electric heating and insulation values).

A graphical representation of the cumulative reduction in CO₂ emissions through implementation of various stages of the Energy Hierarchy is provided below.

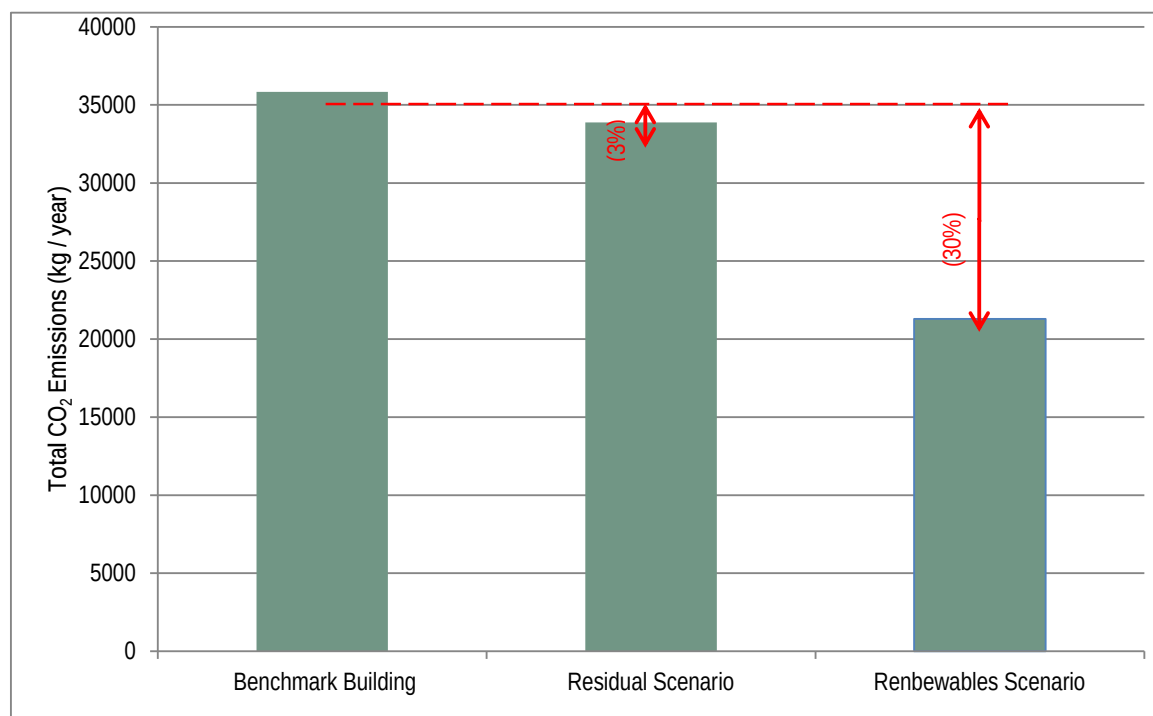


Figure E1: Implementation of the Energy Hierarchy for proposed Aldi development at Buxton

Specific detail relating to the predicted reductions in annual CO₂ emissions of the development is detailed within Table E2 overleaf.

1. INTRODUCTION

1.1 Background

SEM Technology Ltd was engaged by Aldi Stores Ltd. ('the applicant' hereafter) to undertake an assessment of energy use and production of an energy strategy for the proposed Aldi Stores Ltd. development at Ashbourne Road, Buxton.

This report has been prepared by SEM Technology Ltd in cooperation with the applicant and in accordance with the requirements of High Peak Borough Council.

1.2 Proposed Development

The proposed retail development shall incorporate the construction of a new ALDI food store with associated car parking, and landscaping. The development will comprise of the following elements;

- A new ALDI food store with a proposed sales floor area of 1,315m² and a gross internal area of 1,805m²;
- Car parking of approximately 153 spaces (Inc. 10 accessible bays; 11 Parent & Child Spaces and 6 EVCP spaces);
- Associated landscaping.

This Energy Statement was informed by correspondence with the design team in addition to the following documentary sources;

- Latest site / design drawings, prepared by The Harris Partnership Ltd;
- Mechanical and Electrical Engineering Specifications provided by SEM Technology Ltd.
- Plant and equipment specifications provided by Aldi Stores Ltd.

The development will endeavor to achieve a significant reduction in CO₂ emissions through the installation of renewable and low carbon technologies.

1.3 Local Planning Criteria

The following planning condition relates to energy statement.

"Condition 35 - No phase of development hereby approved shall be commenced, other than those works included within the enabling works phase as approved through condition 03, until a detailed design and associated management and maintenance plan of the Sustainable Design and Construction for that phase of development has been submitted to and approved in writing by the Local Planning Authority in accordance with the principles outlined within Sustainability Statement Ref. Z46347 Rev. 1. All works relevant to that phase of development shall be carried out in accordance with the approved details prior to first occupation of the phase of development and thereafter maintained for the lifetime of the scheme."

The condition will aim to be satisfied via this report.

2. ENERGY ASSESSMENT

2.1 The Energy Hierarchy

The Energy Hierarchy adopts a set of principles to guide design development and decisions regarding energy, balanced with the need to optimise environmental and economic benefits. The Hierarchy, which is a widely accepted approach amongst many Local & County Councils, seeks to ensure that developments incorporate energy efficiency through the approach detailed in Figure 2.1.

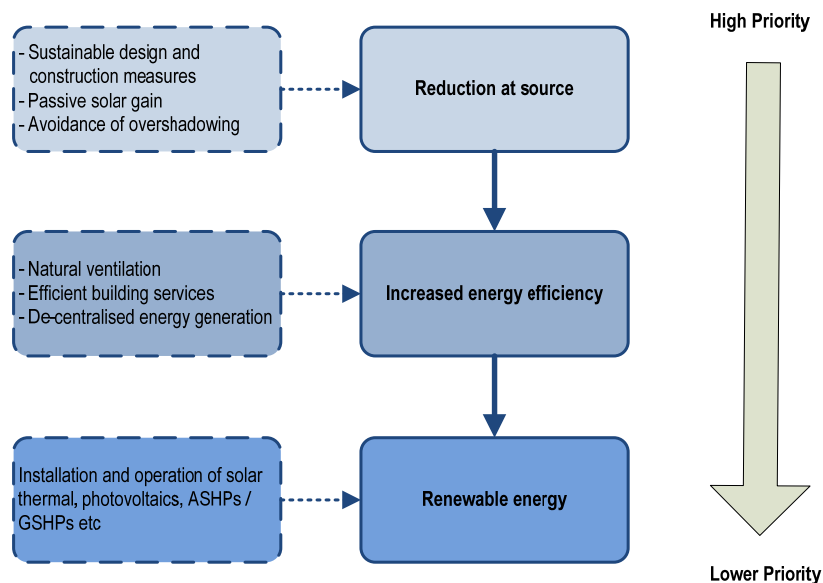


Figure 2.1: The Energy Hierarchy

It is considered that the above principles for carbon reduction form the most appropriate approach from both a practical and financial perspective. The industry is broadly in agreement that energy efficiency and low carbon technologies have the greatest impact in offsetting CO₂ emissions. Therefore, it is logical to encourage enhanced mitigation through energy efficiency and low carbon technologies in the first instance, as opposed to applying renewables as a first option at a significantly greater cost.

Consequently, as a result of the above principles, the first stage in the energy strategy for the proposed development is the consideration of energy efficiency measures to ensure that the base energy demand is minimised.

2.2 Site Layout & Building Design

2.2.1 Overview

It is stated within the Part L of the 2013 Building Regulations that *'measures to make the building energy efficient must be incorporated within the scheme design.'*

Typically, passive energy efficient design measures can bring about an improvement upon the Building Emission Rate ('BER') by typically 30% in new built projects, as a result of energy efficiency measures alone.

2.2.2 Passive Solar Design

Passive design measures manage internal heating through solar gain and as such reduce the need for heating/cooling. Buildings that are aligned in a north-south orientation are observed to maximise daylight and sunlight (i.e. solar gain), subsequently reducing energy consumption associated with excessive heating and lighting requirements.

Although the large width and general geometry of the building is pre-determined due to the use, a benefit of the design is the high levels of natural light afforded by the large amount of glazing around the entry.

The predetermined orientation of the building has led to some minor benefits in relation to the solar orientation of internal facilities. The more long term occupied building areas, such as the staff room, are located on the southern side of the building with some glazing assisting solar gain. All areas of the site subject to refrigeration are inset, so as to avoid unwanted (and detrimental) solar heating.

It is therefore considered that where possible, and taking into consideration the site and building use constraints, the internal layout has been optimised to ensure that additional energy consumption due to overshadowing has been minimised. The specific objectives related to this area are referenced in Box 2.1 below.

Box 2.1: Objective A – Minimising Overshadowing

A1 – *Where no restrictions apply due to internal site layout, areas that do not require conditioning / mechanical heating shall be located to the north of the building. Therefore maximising the utilisation of solar gain for the staff, office and working spaces, with minimal overshadowing and subsequently lower residual energy consumption.*

The development shall be designed (wherever possible) to further maximise the benefits provided by solar orientation. Subsequently, the building shall be constructed to specified design briefs and the principles detailed in Box 2.2 overleaf.

Box 2.2: Objective B – Building Design Principles

B1 – Where orientation provides favourable conditions and no physical restrictions are provided by surrounding buildings, the glazing ratios within the development shall be designed such that potential for solar gain is maximised.

B2 – Consideration will be given to the design of the internal envelopes of the proposed development, which will seek to utilise materials that not only provide high insulation values, but also have a high thermal mass.

B3 – Consideration will be given to the selection of insulation materials for the building, ensuring the following heat loss parameters (U-Values) as a minimum:

Component	U-value
Walls	0.31
Roof	0.25
Floor	0.25
Doors	2.2
Windows	2.2
High Use Entrance Doors	1.6

B4 – The new elements of the building shall endeavour not to exceed a maximum **air permeability of $8\text{m}^3 / (\text{hr.m}^2)$** . This can be achieved through the following measures:

- Adequate sealing between openings / windows and panels;
- Adequate sealing of ceiling-to-wall joints;
- Provision of a continuous air barrier over ceiling areas and adequate sealing of service ducts (where appropriate);
- High specification openings (see Objective B3);
- Brick / block construction will be mitigated against through application of wet plastering / parging / dry lining.

The provision of a large awning over the main entry glazing and the orientation of the building (i.e. entry facing north) minimises the impact of solar gain and subsequent building overheating thus reducing the reliance on mechanical cooling systems in the summer months.

The retail space is being serviced by low temperature hot water (LTHW) provided by air source heat pumps. The LTHW is delivered to the retail space via zoned underfloor heating pipes. Refer to section 2.3.3 for further detail.

The office, WCs and other staff facilities to be supported by mechanical extract ventilation system with Part L2A 2013 compliant efficiencies, flow rates and fan powers.

Box 2.3: Objective C – Limiting Excessive Solar Gain

C1 – Where mechanical ventilation and extract is required, Part L2A 2013 compliant efficiencies, flow rates and fan powers shall be installed.

C2 – When cooling is required the proposed Air source heating system has the capability to change modes and provide chilled water through the underfloor pipework network.

C3 – The shopfront glazing is protected from excessive solar gain by a large fixed canopy around the shop entry.

In addition to regulated emissions (heating, cooling and ventilation), energy consumed by ancillary activities (primarily electricity consumption derived from the use of lighting and electrical appliances) is anticipated to account for approximately 40% of the overall CO₂ emissions from the development.

Significant energy efficiency measures shall be installed such that unnecessary energy consumption is reduced at source (in accordance with the Energy Hierarchy).

Box 2.4: Objective D – Energy Efficiency Measures

D1 – Lighting shall achieve an initial efficiency averaging over the whole building of not less than 60 lumens/circuit watt. Display lighting shall be on a separate circuit which may be on automatic timing devices. Any display lighting must have an efficiency of at least 22 lamp lumens per circuit watt.

D2 – The building management system shall be fitted and integrated with AMR energy display devices for the provision of half hourly energy consumption data.

D3 – Majority of the heat (all heating to the sales area) will be supplied via the underfloor heating system available from the air source heat pumps.

D4 – All electric fans, motors and pumps will be specified with high efficiency motors and inverter drive controls;

D5 – The buildings have been designed with low building permeability and high levels of building fabric insulation to ensure high levels of building thermal performance;

2.3 Low-Zero Carbon Technologies Appraisal

2.3.1 Overview

This report forms a high level feasibility study, to ascertain the predicted energy consumption (and associated carbon dioxide emissions) for the site and select appropriate technologies. The report is provided to assess compliance with the stipulated local planning policy, and that the reduction in CO₂ emissions can be achieved through the inclusion of LZC technologies.

The proposed scheme is to include the Air Source Heat Pumps (ASHP's) and the building has been fitted with a 236m² roof mounted solar photovoltaic array. This system has been specified to produce 50kWe_{peak}.

2.3.2 Baseline Energy Assessment

In order to determine the type and size of proposed LZC technology and reduction in CO₂ emissions, a detailed baseline modelling and assessment exercise was undertaken.

Proprietary energy demand calculations for the proposed development (completed by SEM Technology) have been undertaken using SBEM modelling software. Subsequently, Part L of the current Building Regulations (2013) will be used as the minimum benchmark and will form the benchmark standard for the assessment for regulated emissions (heating, lighting and ventilation). Pursuant to this, initial energy demand calculations for the building have been undertaken to provide a 'benchmark' building from which further calculations based on energy measures, efficient supply and renewable energy systems can be progressed.

Upon calculation of a baseline SBEM outputs, the building was then remodelled in order to account for the various stages of the Energy Hierarchy and subsequently demonstrate the reduction in CO₂ emissions for the development. Further modelling will then be undertaken to ensure that the proposed development will achieve a CO₂ emissions reductions of ≥30%.

Tables 2.5 (overleaf) provide a summary of the results for each scenario.

Table 2.5: Summary of Modelled Scenarios				
Parameter		Scenario		
		Baseline	Enhanced	After LZC Energy
Building Emission Rate (kgCO₂/m²/year)		19.5	19.0	13.8
U-Values (W/m ² .K)	Walls	0.35	0.31	0.31
	Roofs	0.25	0.25	0.25
	Floors	0.25	0.25	0.25
	Doors	2.2	2.2	2.2
	Windows	2.2	2.2	2.2
	High Use Entrance Doors	3.5	1.6	1.6
Y-Values		0.15	0.15	0.15
Air permeability (m ³ /(hr.m ²) @ 50 Pa)		10.0	8.0	8.0
Heating / Domestic Hot Water (DHW)	Type	Notional Gas Boiler	ASHP (LTHW) Underfloor heating	ASHP (LTHW) Underfloor heating
	Efficiency	95%	>400%	>400%
	Fuel	Gas	Electricity	Electricity
	Controls	Zoned and fitted with independent time and temperature controls	Zoned and fitted with independent time and temperature controls	Zoned and fitted with independent time and temperature controls
	DHW	Electric Instantaneous Hot Water	Electric Instantaneous Hot Water	Electric Instantaneous Hot Water
Cooling		-	-	-
Internal Lighting		50% non-dedicated low energy	100% LED Lighting	100% LED Lighting
Renewable Technologies		-	-	PV

The benchmark emissions for the building is 2013 Part L2A compliant scenario to demonstrate the buildings CO₂ savings.

Based on the provisional figures detailed above the development shall significantly exceed the minimum 15% of predicted energy use to be generated from the installation of Air Source Heat Pumps and a photovoltaic array (see Section 2.3.4) as required by the Core Strategy.

All space heating requirements within the sales area will be provided by the LTHW produced from the Air Source Heat Pump heating system.

Table 2.6 below details the 'baseline case' scenarios for the development regarding CO₂ emissions.

Scenario	Energy Demand (kWh / year)	Energy saving achieved (%)	Regulated CO₂ Emissions (kgCO₂ / year)	Saving achieved in CO₂ emissions (%)
2013 Part L Compliant Benchmark Building	80,054	-	35,120	-
Enhanced Scenario (improved building fabric and M&E services)	75,318	6%	34,219	2.6%
Enhanced Scenario + Arctic Circle 'Freeheat' + 50kWp Solar Array	63,377	16%	24,944	27.1%
Total Savings in Energy and Emissions	16,677	20.8%	10,176	29.7%

Table 2.6 demonstrates a total of 29.7% reduction in CO₂ emissions through the installation of LZC technologies, including a 2.6% reduction in CO₂ emissions through improved building fabric and M&E services, with a further 27.1% reduction with the solar array (when compared to the 'Enhanced' scenario).

A graphical representation of the cumulative reduction in CO₂ emissions through implementation of various scenarios is provided in Figure 2.2 below.

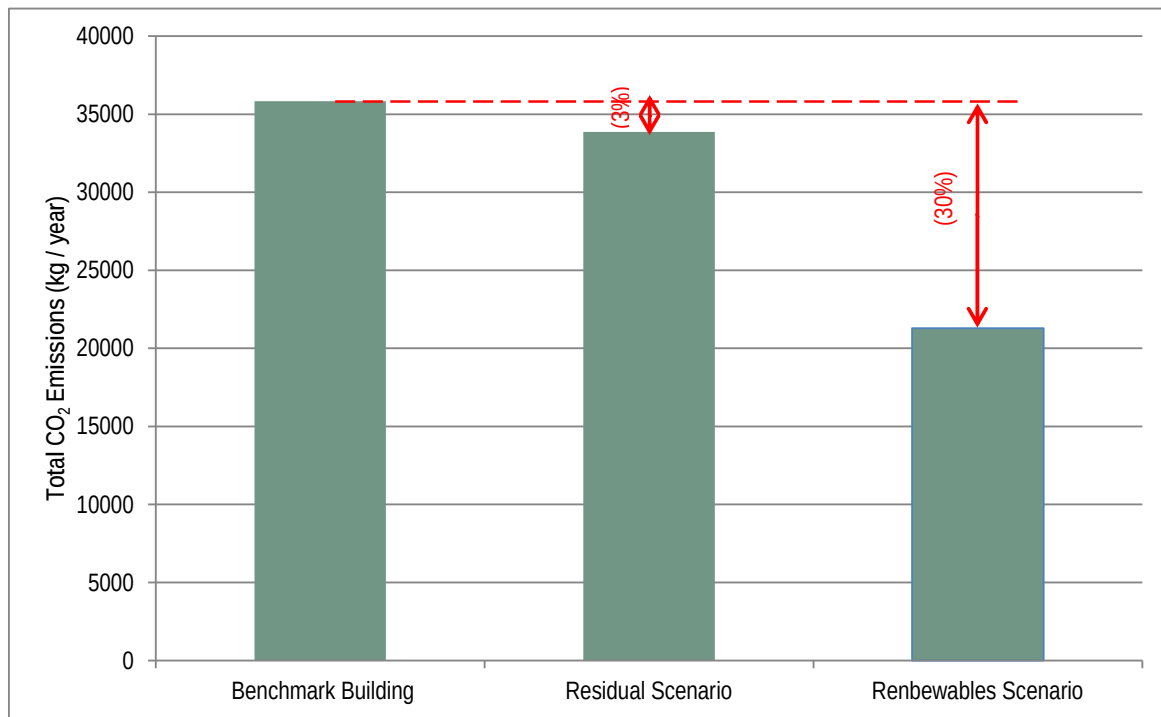


Figure 2.2: Implementation of the Energy Hierarchy for proposed Aldi development at Buxton

2.3.3 High-Level Feasibility Review

Combined Heat & Power

CHP comprises combination of the generation of electricity for general consumption, with the recovery of exhausted heat energy (otherwise emitted from power stations / generators as waste heat) which can be used to provide heating for domestic and industrial processes.

Although not considered a renewable source (excepting biofuel-fired plants), CHP plants (typically 75% - 80% efficient) are significantly more efficient than a typical oil / gas fired power station (35% - 45% efficient), even when it is used in combination with fossil fuels such as gas and diesel. Therefore it is more efficient than obtaining energy from the National Grid ('the grid').

In addition, transmission losses (typically 5% when consuming electricity from the grid) are minimised by on-site generation and, as such, a gas-fired CHP can be seen as a relatively carbon efficient means of energy supply.

A comparative flow diagram of CHP and a typical gas-fired power station is shown in Figure 2.3 below;

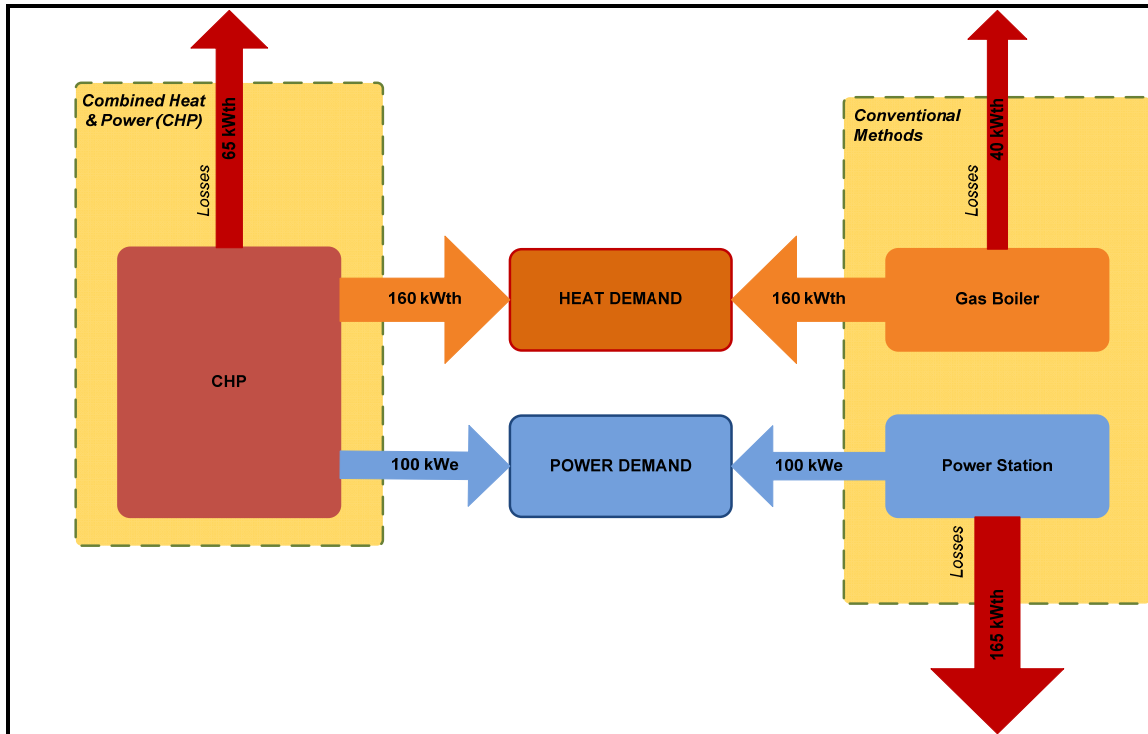


Figure 2.3; Flow Diagram of Gas fired CHP versus Grid Electricity and Gas Fired Heating

Major mixed use and residential developments often install dedicated ‘energy centres’ as part of the development. These effectively comprise a localised, small scale power station (typically 1 – 3 MW) which provides the development with both electricity and heat (usually with zero to minimal supplementation from the grid).

Given the size and nature of the energy profile of the development, using a CHP plant for the entire development was not considered appropriate.

Box 2.5: Feasibility Summary – CHP

The design team do not consider the installation of a CHP system as a viable option for the site due to the nature of the building use and subsequent heating demand. The baseload heating requirements for the development are not considered sufficient to warrant the installation of a CHP unit.

Solar Thermal Heating / Hot Water

Solar thermal panels are typically used in order to provide supplementary heat for the purposes of space heating or domestic hot water (DHW). These systems consist of solar collectors, a pump, a control unit, connecting pipes, hot water tank and a conventional heat source (gas / oil fired boiler). The collectors are usually mounted on the roof and provide heat to a fluid circulated between the collectors and a water tank.

The efficiency of solar collector panels depends on a number of factors, including the type of collector, correct installation, location and orientation.

Installing solar thermal heating panels could reduce energy consumption and carbon impacts through significant reductions in gas / oil supply.

Typically, solar collectors would produce approximately 5-600 kWh/m² of hot water. Evacuated tube systems are about 30% more efficient but have a corresponding increased capital outlay. A collector

area of 4–5 m² will normally save approximately 230kg of CO₂ emissions per year. A well designed system should satisfy 70-80% of the hot water demand in the summer and 20-30% in the winter.

Box 2.6: Feasibility Summary – Solar Thermal

The provision of the supplementary DHW heating via installation of solar thermal is neither considered suitable nor necessary due to the very limited requirement for domestic hot water.

Ground Source Heat Pumps

Ground Source Heat Pumps (GSHPs) operate by the removal of residual heat from the ground by using various 'loops' containing a water and glycol fluid mix, heat from the ground is absorbed into this fluid and is pumped through a heat exchanger in the heat pump. Low grade heat passes through a compressor and is concentrated into a higher temperature gas capable of heating water for DHW and central heating systems.

There are a number of configurations for GSHP systems. A vertical collector system is considered to be the most appropriate in the context of the proposed development given the large scale of the system and limited area available for horizontal collectors. Vertical collectors can be between 15 – 180m deep and minimum spacing between adjacent boreholes should be maintained at 5 - 15m to prevent thermal interference.

The heat yielded from GSHPs is relatively small (collecting approximately 14 - 20Wth per metre of collector loop), therefore the adequacy of the accompanying heat exchanger is vital in ensuring greater heat transfer (although more efficient exchangers have a significantly larger capital cost).

The performance of a GSHP system is entirely dependent on the appropriateness of the ground conditions (i.e. depth of soil cover, the type of soil or rock, ground temperature and thermal conductivity), which would be established subject to a ground survey.

'Reversible' heat pumps systems are also available that give the potential for provision of space cooling, if required. Groundwater can also be used to cool buildings where a suitable source exists, abstraction and discharge permissions can be obtained from the Environment Agency and test bores are favourable.

Box 2.7: Feasibility Summary – Ground Source Heat Pumps

Installation of GSHPs as a supplementary heating system for the building is not considered to be feasible due the significant amount of electrical energy that would be required from the pumps in order to satisfy the proposed building heating and cooling load.

All selling floor space heating requirements are considered to be able to be met through the utilisation of Air Source Heat Pumps and therefore additional GSHP is not required.

Air Source Heat Pumps

Air Source Heat Pumps (ASHPs) absorb heat from ambient air in order to provide heat for the purposes of space heating and domestic hot water. ASHPs work on a similar principle to a fridge, which extracts heat from its inside. An evaporator coil, mounted outside absorbs the heat; a compressor unit then drives refrigerant through the heat pump and compresses it to the right level to suit the heat distribution system.

Finally, a heat exchanger transfers the heat from the refrigerant for use, depending on which of the two main types of systems (identified below) is installed:

- Air to air system - produces warm air which is circulated by fans to heat a home; and

- Air to water system - uses heat to warm water. Heat pumps heat water to a lower temperature than a standard boiler system; therefore, these systems are more suitable for underfloor heating systems than radiator systems, requiring less space to incorporate, compared with an air to air system.

The efficiency of ASHPs is measured by a coefficient of performance (CoP) i.e. the amount of heat produced compared to the amount of electricity needed for them to operate. This methodology is also used with GSHPs, although the use of air as a heat source instead of the earth results in ASHPs having a lower CoP than GSHPs, with subsequently less carbon savings for a similar sized heat pump. ASHPs have a relatively low heat yield when compared traditional boilers, therefore buildings must be well insulated and draught-proofed to ensure that the heating system is effective.

Due to the required electrical load of ASHPs, consideration must be given to the source of grid electricity when considering the potential carbon savings of ASHPs. Therefore, the purchase of 'cleaner' grid electricity (i.e. renewable or CHP tariffs) result in increased carbon savings from ASHPs. As the store will benefit from the onsite generation of electricity via the solar PV, this option is considered feasible.

ASHPs are often a more popular (and technically / financially viable) alternative to GSHPs due to lack of requirement for extensive excavation, requiring far less space and easier installation.

The use of ASHP technology at the proposed development is considered feasible on a number of grounds:

- The systems are reversible and can provide both heating and cooling duty; and
- The pump units can be located on the available roof space, within a louvered enclosure such that visual impact is minimised.

Box 2.8: Feasibility Summary –Air Source Heat Pumps

Based on the requirement for low water temperatures to be utilised with the sales floor underfloor heating, Air Source Heat Pumps are considered to be **feasible**.

The subsequent on site generation of electricity via the solar panels offsets the negative factor of the inherent electric loads. A further benefit is Aldi's framework agreement with a reputable ASHP manufacturer to ensure a reduced price on capital outlay.

Biomass Heating

Biomass boilers replace conventionally powered boilers with an almost carbon neutral fuel (such as wood pellets). In addition, the installation and operation of a biomass boiler in new-build developments could yield significant revenue from the forthcoming Renewable Heat Incentive, a government funded clean energy cashback scheme.

Although many biomass burners will meet Clean Air Act requirements, combustion of woody biomass releases higher quantities of NO_x compared to a comparable system fuelled by natural gas. As a consequence, many Local Authorities, particularly in urban areas have concerns about the potential impact on air quality that the widespread uptake of biomass boilers would have.

Therefore, a large number of Councils generally approve of the specification of biomass when linked to a large-scale biomass CHP as opposed to being used for individual boilers.

Box 2.9: Feasibility Summary – Biomass Boilers

The use of biomass heating is not considered feasible due to both air quality issues and need.

All selling floor space heating requirements are considered to be able to be met through the utilisation of Air Source Heat Pumps

Photovoltaic Cells

Solar Photovoltaics (PVs) are solar panels which generate electricity through photon-to-electron energy transfer, which takes place in the dielectric materials that make up the cells. The cells comprise layers of semi-conducting silicon material which, when illuminated by the sun, produces an electrical field which generates an electrical current. PVs can generate electricity even on overcast days, requiring daylight, rather than direct sunlight. This makes them viable even in the UK, although peak output is obtained at midday on a sunny summer's day. PVs offer a simple, proven solution to generating renewable electricity.

Box 2.10: Feasibility Summary – Photovoltaic Cells

Based on the orientation of the building and available roofspace, the provision of supplementary electricity via installation of photovoltaic cells is considered to be **feasible**.

A system with the total capacity of c. 50kWp (c. 236m²) is proposed for the development

Micro Wind Turbines

Large wind turbines are an established means of capturing wind energy and converting it into usable electricity. Wind turbines come in various sizes depending on the location and electrical load of a particular site. A wind turbine usually consists of a nacelle containing a generator connected, sometimes via a gearbox, to a rotor consisting of three blades.

Box 2.12: Feasibility Summary – Micro Wind Turbines

Owing to site-constraints, micro-wind turbines have not been considered as part of this feasibility study. Constraints also include relatively low wind speeds in this area, averaging <4.65 ms⁻¹.

Wind turbines are also likely to have a significant visual impact on local environment, as well as health and safety implications for occupiers or users on-site and on adjacent areas as a result of noise and light flicker

2.3.4 Proposed LZC Strategy

The ALDI Store has been formally assessed and considered against all potential options regarding the use and incorporation of integrated low carbon technologies.

The store will be designed to utilise Air Source Heat Pumps with LTHW pumped through underfloor pipework meet all space heating needs for the selling floor area of the development. Furthermore, given the opportunity to utilise the south west facing aspects of the roof space on site, a significant photovoltaic array has been provided across the building. The extent of ASHP's and photovoltaic arrays within the development is considered sufficient to offset 27% of regulated emissions requirements.

The development will provide a realistic total carbon equivalent emission saving of approximately 14.6 tonnes per annum.

A summary of the proposed technologies are provided in Box 2.12 below.

Box 2.13: Objective E – Site-integrated renewable technologies

E1 – The retail floor space heating by underfloor LTHW pipes will be supplied from the Air Source Heat Pumps located externally.

E2 - The developer will install a system of roof-mounted photovoltaic array to the main roof within the development for the provision of supplementary electricity.

The Photovoltaic array will comprise the following guideline specification;

Parameter	Value
Capacity	c. 236m ² (c. 50 kWp)
Orientation	South West (where possible)
Pitch	c. 30°
Coefficient of Performance (CoP)	c. 4.0
ECA List	Yes
Approximated electricity production	c. 39,400 kWh / year

The development has been estimated to provide a realistic total carbon equivalent emission saving of 14.6 tonnes per annum.

Project name

Ald Buxton - Enhanced Scenario**As designed****Date:** Tue Mar 21 12:57:20 2023**Administrative information****Building Details****Address:** Ashbourne Road, Buxton, Derbyshire, SK17 9RZ**Owner Details****Name:** Aldi Foodstores Ltd**Telephone number:** +44 (161) 655-1299**Certification tool****Calculation engine:** SBEM**Calculation engine version:** v5.6.a.0**Interface to calculation engine:** iSBEM**Interface to calculation engine version:** v5.6.a**BRUKL compliance check version:** v5.6.a.0**Address:** Logistics North, Bridgewater Avenue, Bolton, BL5 1EE**Certifier details****Name:** SEM Technology Ltd.**Telephone number:** 0161 523 2926**Address:** 20 Hospital Road, Swinton, M27 4EY**Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target**

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	19.5
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	19.5
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	19
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.31	0.35	Sales Floor/s
Floor	0.25	0.25	0.25	Sales Floor/f
Roof	0.25	0.25	0.25	Sales Floor/c
Windows***, roof windows, and rooflights	2.2	2.2	2.2	Sales Floor/s/g
Personnel doors	2.2	2.2	2.2	Sales Fire Escape
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	1.6	1.6	Main Doors
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs. ** 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. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	8

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

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 to 0.95

1- Boiler

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	-	-	-
Standard value	0.91*	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 gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- Basic HWS

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

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
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 supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard	
Cash Office	0.1	-	-	-	-	-	-	-	-	-	N/A	
Staff Room & Lockers	0.2	-	-	-	-	-	-	-	-	-	N/A	
Toilets	0.2	-	-	-	-	-	-	-	-	-	N/A	
Meeting Room	0.2	-	-	-	-	-	-	-	-	-	N/A	
Sales Floor	-	-	-	0.8	-	-	-	-	-	0.65	0.5	

General lighting and display lighting

		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
Standard value	60	60	22		
Warehouse	-	485	-		720
Plantroom	141	-	-		108
Cash Office	136	-	-		124
Staff Room & Lockers	-	157	154		186
Toilets	-	193	-		93
Circulation Area	-	240	-		124

General lighting and display lighting		Luminous efficacy [lm/W]		
Zone name		Luminaire	Lamp	Display lamp
	Standard value	60	60	22
Meeting Room		126	-	-
Sales Floor		-	214	151
				General lighting [W]
				12000

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Cash Office	N/A	N/A
Staff Room & Lockers	NO (-67.4%)	NO
Meeting Room	N/A	N/A
Sales Floor	NO (-29.2%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	1801.4	1801.4
External area [m ²]	5389.2	5389.2
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	8	6
Average conductance [W/K]	1677.8	1714.2
Average U-value [W/m ² K]	0.31	0.32
Alpha value* [%]	41.21	35.19

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

Building Use

% Area	Building Type
100	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 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	8.23	7.78
Cooling	0	0
Auxiliary	4.54	3.09
Lighting	25.78	29.78
Hot water	3.28	3.79
Equipment*	166.41	166.41
TOTAL **	41.82	44.45

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

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	597.48	609.13
Primary energy* [kWh/m ²]	112.14	112.06
Total emissions [kg/m ²]	19	19.5

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

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] No Heating or Cooling										
	Actual	353.6	15.7	0	0	0.5	0	0	0	0
	Notional	223.1	63.7	0	0	1.2	0	0	----	----
[ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	36.2	645.7	11.3	0	6	0.89	0	0.95	0
	Notional	33	695.3	10.7	0	3.8	0.82	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

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.27	Sales Floor/ni
Floor	0.2	0.25	Sales Floor/f
Roof	0.15	0.25	Sales Floor/c
Windows, roof windows, and rooflights	1.5	2.2	Sales Floor/s/g
Personnel doors	1.5	2.2	Sales Fire Escape
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	1.6	Main Doors
U _{i-Typ} = Typical individual element U-values [W/(m²K)]			U _{i-Min} = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	8

Project name

Aldi Buxton - ASHP & PV

As designed

Date: Tue Mar 21 13:00:49 2023

Administrative information

Building Details

Address: Ashbourne Road, Buxton, Derbyshire, SK17 9RZ

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.0

Interface to calculation engine: iSBEM

Interface to calculation engine version: v5.6.a

BRUKL compliance check version: v5.6.a.0

Owner Details

Name: Aldi Foodstores Ltd

Telephone number: +44 (161) 655-1299

Address: Logistics North, Bridgewater Avenue, Bolton, BL5 1EE

Certifier details

Name: SEM Technology Ltd.

Telephone number: 0161 523 2926

Address: 20 Hospital Road, Swinton, M27 4EY

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	19.7
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	19.7
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	13.8
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.31	0.35	Sales Floor/s
Floor	0.25	0.25	0.25	Sales Floor/f
Roof	0.25	0.25	0.25	Sales Floor/c
Windows***, roof windows, and rooflights	2.2	2.2	2.2	Sales Floor/s/g
Personnel doors	2.2	2.2	2.2	Sales Fire Escape
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	1.6	1.6	Main Doors
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs. ** 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. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	8

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

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 to 0.95

1- ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.88	-	-	-	-
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. For types ≤12 kW output, refer to EN 14825 for limiting standards.					

1- Basic HWS

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

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
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 supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

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	1.9	1.6	0.5	1.1	0.5	1			
Cash Office	0.1	-	-	-	-	-	-	-	-	-	-	N/A
Staff Room & Lockers	0.2	-	-	-	-	-	-	-	-	-	-	N/A
Toilets	0.2	-	-	-	-	-	-	-	-	-	-	N/A
Meeting Room	0.2	-	-	-	-	-	-	-	-	-	-	N/A
Sales Floor	-	-	-	0.8	-	-	-	-	-	-	0.65	0.5

General lighting and display lighting

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
Standard value	60	60	22		
Warehouse	-	485	-		720
Plantroom	141	-	-		108
Cash Office	136	-	-		124
Staff Room & Lockers	-	157	154		186
Toilets	-	193	-		93
Circulation Area	-	240	-		124

General lighting and display lighting		Luminous efficacy [lm/W]		
Zone name		Luminaire	Lamp	Display lamp
	Standard value	60	60	22
Meeting Room		126	-	-
Sales Floor		-	214	151
				General lighting [W]
				12000

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Cash Office	N/A	N/A
Staff Room & Lockers	NO (-67.4%)	NO
Meeting Room	N/A	N/A
Sales Floor	NO (-29.2%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	1801.4	1801.4
External area [m ²]	5389.2	5389.2
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	8	6
Average conductance [W/K]	1677.8	1714.2
Average U-value [W/m ² K]	0.31	0.32
Alpha value* [%]	41.21	35.19

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

Building Use

% Area Building Type

100	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 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	1.6	2.87
Cooling	0	0
Auxiliary	4.54	3.92
Lighting	25.78	29.78
Hot water	3.28	3.79
Equipment*	166.41	166.41
TOTAL **	35.19	40.37

* 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	8.16	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	597.48	610.14
Primary energy* [kWh/m ²]	106.96	113.65
Total emissions [kg/m ²]	13.8	19.7

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

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] No Heating or Cooling										
	Actual	353.6	15.7	0	0	0.5	0	0	0	0
	Notional	223.1	63.7	0	0	1.2	0	0	----	----
[ST] Central heating using water: floor heating, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	36.2	645.7	2.2	0	6	4.58	0	4.88	0
	Notional	34.4	695.3	3.9	0	4.9	2.43	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

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.27	Sales Floor/ni
Floor	0.2	0.25	Sales Floor/f
Roof	0.15	0.25	Sales Floor/c
Windows, roof windows, and rooflights	1.5	2.2	Sales Floor/s/g
Personnel doors	1.5	2.2	Sales Fire Escape
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	1.6	Main Doors
U _{i-Typ} = Typical individual element U-values [W/(m²K)]			U _{i-Min} = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	8