

Energy Strategy

Atlas Park

2628

Rev 02

05.06.2023

Revision Record

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01	Initial issue	16/12/22	ER	MS	NBE
02	Amended Layout Incorporated	05/06/23	MS	NBE	NBE

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1 Executive Summary

The developer, Hale Architects, has instructed Yonder Limited to produce an energy strategy for the proposed development at Atlas Park, henceforth referred to as the 'Development'. This report will set out the energy strategy.

In summary, the recommendations for the development, as the most technically and economically viable options, are as follows:

- Passive design measures in the form of improved U-values, solar controlled glazing and reduced air permeability have been applied to reduce the base energy demand of the building.
- Roof lights to 12% of warehouse floor area to enhance natural light, reducing the need for artificial light.
- Energy efficiency measures in the form of low energy fans, high efficiency LED lighting, etc. have been applied to reduce the energy consumption of the building.
- Air source heat pumps supplying the office heating & cooling.
- The building roofs are to be designed with a structural integrity capable of mounting PV to offset the proposed developments operational carbon.

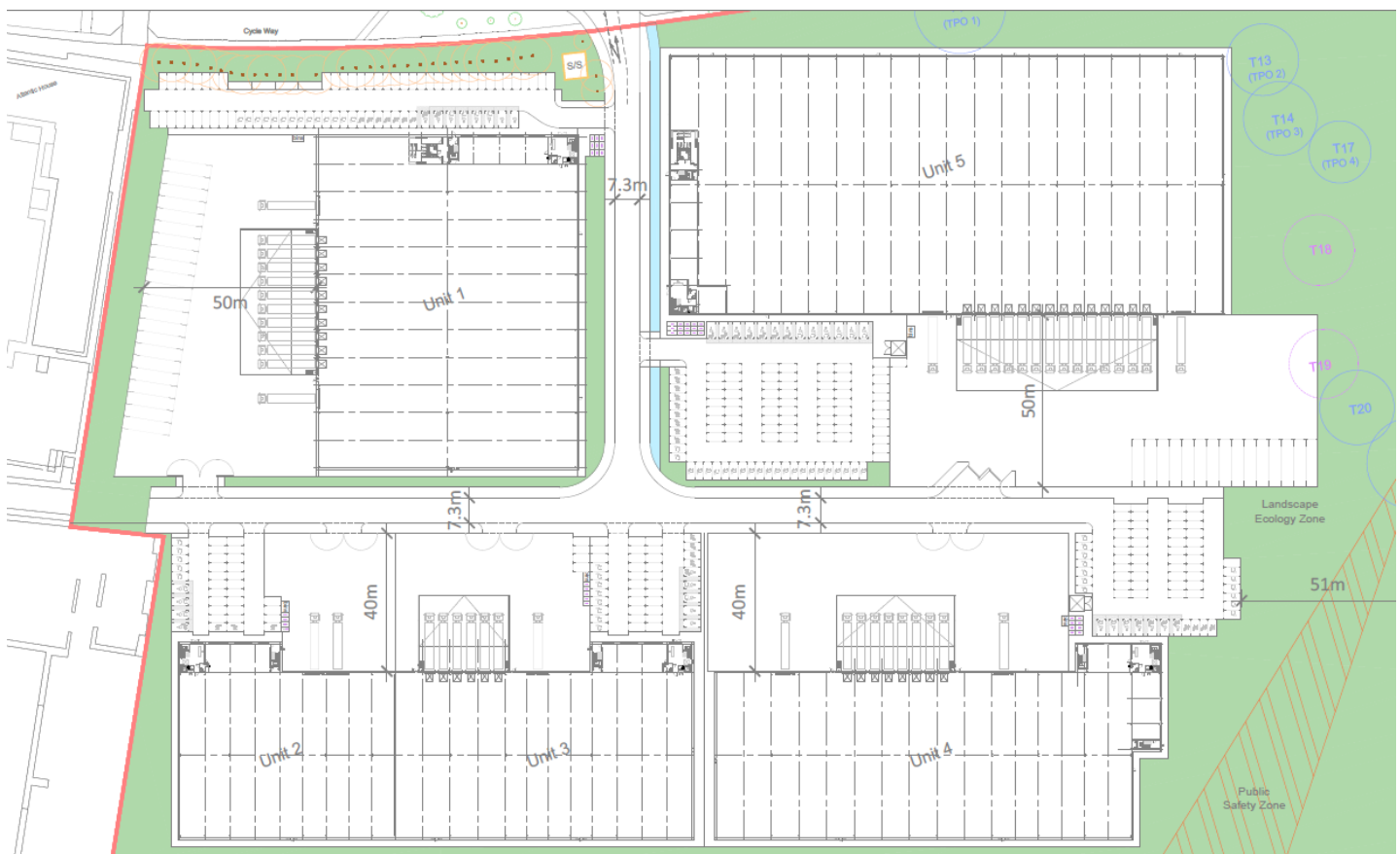


Figure 1.1. Proposed development at Atlas Park

1.1 Project Specific Requirements

Table 1.1- Summary of development requirements addressed in this report

Requirement	Description
Local Planning Policy	Prepared in line with the Manchester City Council <i>Core Strategy Development Plan 2012-27, aligning with Policies EN 4 & 6</i>
Energy Strategy	The report will follow the nationally accepted hierarchy of 'Be Lean', 'Be Clean' and 'Be Green' as set out within the London Plan [section 2.1.3]
BREEAM	2018 Excellent

1.2 Predicted CO₂ Emissions

Using Part L 2013 methods, with IES software version 2022.1.2.0, the following energy emissions have been estimated. They are summarised in the table and figure below.

Table 1.2: CO₂ emissions for the development using the energy hierarchy

		Emission Rate (kgCO ₂ /m ²)	Total Regulated CO ₂ Emissions (tCO ₂ /annum)	CO ₂ Savings (tCO ₂ /annum)	Percentage Improvements [%] <i>compared to baseline</i>
Unit 1	Baseline	20.4	168.28	-	
	Be Lean	12.6	103.94	64.34	38%
	Be Clean	12.6	103.94	64.34	38%
	Be Green	11.5	94.86	73.42	44%
Unit 2	Baseline	21.4	75.83	-	
	Be Lean	13.0	46.07	29.76	39%
	Be Clean	13.0	46.07	29.76	39%
	Be Green	10.4	36.50	39.33	52%
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	Be Clean	12.3	57.25	39.56	41%
	Be Green	10.4	48.40	48.41	50%
Unit 4	Baseline	20.6	143.07	-	
	Be Lean	12.6	87.51	55.56	39%
	Be Clean	12.6	87.51	55.56	39%
	Be Green	11.4	79.18	64.52	45%

		Emission Rate (kgCO ₂ /m ²)	Total Regulated CO ₂ Emissions (tCO ₂ /annum)	CO ₂ Savings (tCO ₂ /annum)	Percentage Improvements (%) <i>compared to baseline</i>
Unit 5	Baseline	19.6	313.27	-	
	Be Lean	11.7	187.00	126.27	40%
	Be Clean	11.7	187.00	126.27	40%
	Be Green	11.3	180.61	132.66	42%

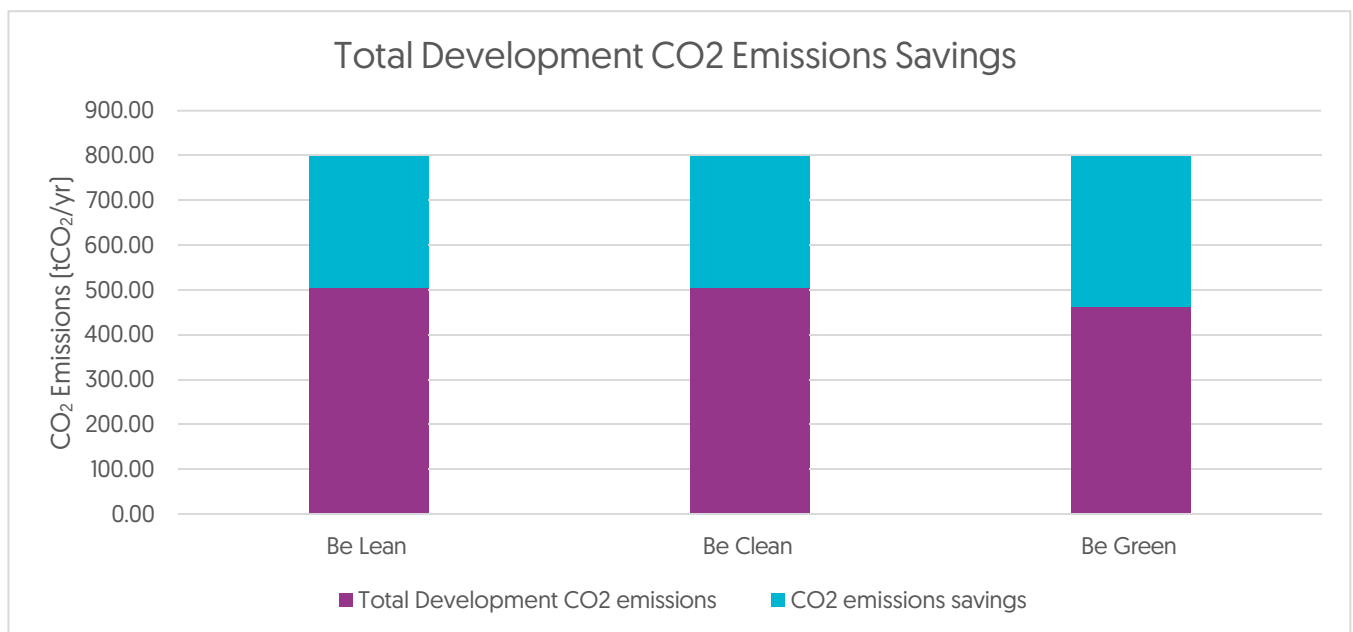


Figure 1.2 - CO₂ emissions graph

2 Introduction

2.1 Planning Policy

2.1.1 Local Planning Policy

The Manchester City Council have outlined qualitative planning conditions to reduce carbon emissions by enabling low and zero carbon development, under Policy EN4. It focuses on applying passive design features, improved insulation and low or zero carbon energy generating technologies.

The Local Development Plan *The Thurrock Local Development Framework 2011-2026 (as amended in 2015)* requires all new buildings to follow Policies EN4 & 6 pertaining to renewable or low carbon energy generation. This policy is detailed below.

Policy EN 4

Reducing CO₂ Emissions by Enabling Low and Zero Carbon Development

The Council will seek to reduce fuel poverty and decouple growth in the economy, growth in CO₂ emissions, and rising fossil fuel prices, through the following actions:

- All development must follow the principle of the Energy Hierarchy, being designed:
 - to reduce the need for energy through design features that provide passive heating, natural lighting and cooling
 - to reduce the need for energy through energy efficient features such as improved insulation and glazing
 - to meet residual energy requirements through the use of low or zero carbon energy generating technologies
- Wherever possible new development and retrofit projects, including energy generation plant, must be located and designed in a manner that allows advantage to be taken of opportunities for low and zero carbon energy supplies.
- Where possible new development and retrofit projects will be used as a mechanism to help improve energy efficiency and provide low and zero carbon energy supplies to existing buildings.
- Where appropriate new development and retrofit projects will be required to connect to and/or make contributions to low or zero carbon energy schemes and/or to incorporate provision to enable future connection to any existing / potential decentralised energy schemes.
- The use of building materials with low embodied carbon in new development and refurbishment schemes.

Policy EN 6

Target Framework for CO₂ reductions from low or zero carbon energy supplies

Applications for residential development of 10 or more units and all other development over 1,000 sq m will be expected as a minimum to meet the target shown in Tables 12.1 or 12.2, unless this can be shown not to be viable. This should be demonstrated through an energy statement, submitted as part of the Design and Access Statement. Such a statement will be expected to set out the projected regulated energy demand and associated CO₂ emissions for all phases of the development.

Developments smaller than the above threshold, but involving the erection of a building or substantial improvement to an existing building will also be expected to meet the minimum target, where viable, but will not be expected to submit an energy statement.

The target framework relates to three broad development locations and their potential for low and zero carbon, decentralised energy. The areas are defined as follows

- Target 1 Network development areas: Locations where the proximity of new and existing buildings, the mix of uses and density of development provide the right conditions to support district heating (and cooling).
- Target 2 Electricity intense areas: Locations where the predominant building type has an all electric fit-out such as retail units and leisure complexes.
- Target 3 Micro-generation areas: Locations where lower densities and a fragmented mix of uses tend to mean that only building scale solutions are practical.

Domestic CO₂ emissions reduction targets

Table 12.1

Target	% Minimum requirement
Target 1: Network development area	CHP/district heating anchor or connection or where not feasible a 15% increase on Part L 2010
Target 2: Electricity intense buildings	+15% increase on Part L 2010
Target 3: Micro generation area	+15% increase on Part L 2010

Non-domestic CO₂ emissions reduction targets

Table 12.2

Target	% Minimum requirement
Target 1: Network development area	CHP/district heating anchor or connection or where not feasible, a 15% increase on Part L 2010
Target 2: Electricity intense buildings (Applies to commercial uses with a high proportion of emissions from electricity use (>45 kg CO ₂ /m ²)	+10% increase on Part L 2010
Target 3: Micro generation area	+15% increase on Part L 2010

The Manchester City Council Core Strategy Development Plan (2012-2027) has been reviewed for this energy strategy; however, in the absence of quantitative energy saving policies, the 2021 update of the National Planning Policy Framework has been used as a guide.

2.1.2 National Planning Policy Framework (NPPF)

The NPPF (2021 update) sets out the government's planning policies for England, with paragraphs 152 – 173 relating specifically to the challenges of climate change.

Within this framework it is stated that new building developments should “take a proactive approach to mitigating and adapting to climate change” [1].

Paragraph 154(a) relates to the reduction of greenhouse gas emissions through location, orientation, and design. Reference is also made to the “supply of renewable and low carbon energy and heat” in paragraph 155.

2.1.3 Nationwide Energy Hierarchy

Chapter 5 of the London Plan 2021 [2] sets out an energy hierarchy, used both in London and nationwide as a framework to reduce energy requirements, thus meeting local and national planning policy.

POLICY SI 2 - Minimising greenhouse gas emissions

Major development should be net zero-carbon.¹⁵¹ This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy:

- 1. Be Lean: use less energy and manage demand during operation*
- 2. Be Clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly*
- 3. Be Green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site*
- 4. Be Seen: monitor, verify and report on energy performance.*

This energy strategy will follow the hierarchy as detailed above, with CO₂ emission reductions reported for stages 1-3.

2.2 BREEAM Requirements

The developments will be designed to meet the requirements of BREEAM NC Industrial 2018 and achieve a rating of Excellent.

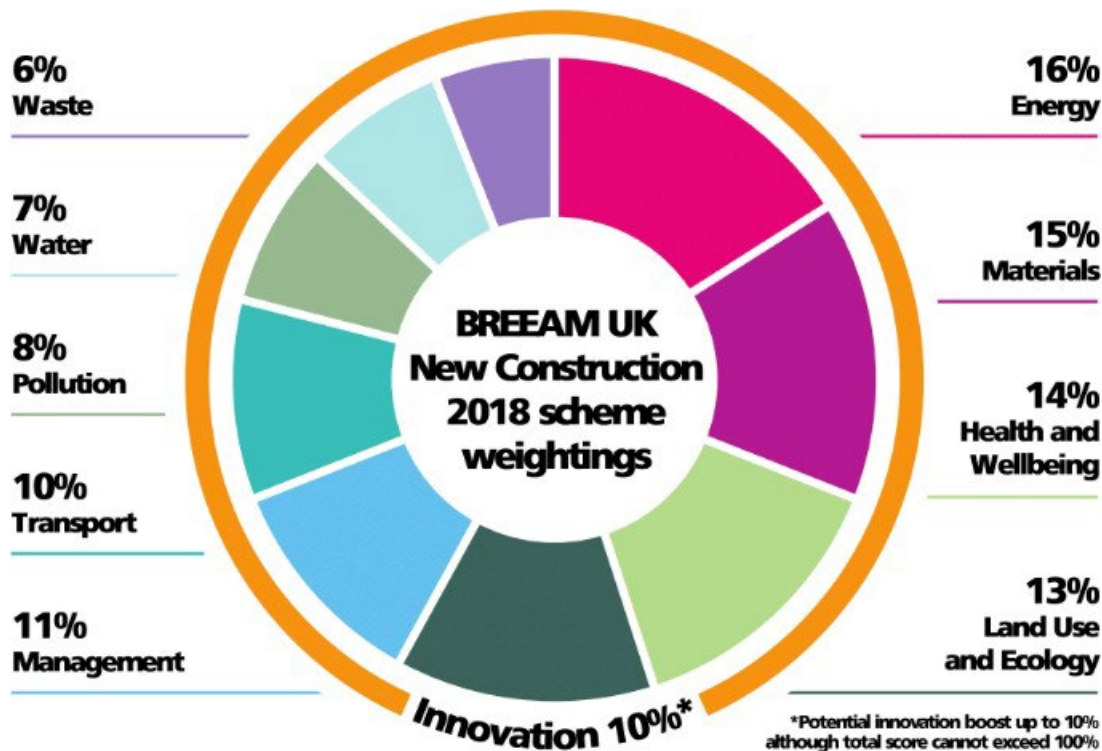


Figure 2.1. BREEAM Scheme Weightings

The advantages of employing formal assessment methods, such as BREEAM, are threefold:

1. Recognition: A BREEAM certification is the most widely recognised measure of environmental performance in the UK building industry, as well as around much of Europe and beyond.
2. Formalisation / Contractual Obligations: A BREEAM requirement within formal, contractual documentation is an easily understood, and easily monitored, method of ensuring project tendering, and delivery, is carried out in accordance with the client's sustainability objectives.
3. Standardisation: BREEAM requirements are based on a tried and tested methodology, which encompasses well thought out, broad-reaching academic, and evidence-based measures, addressing all areas of environmental performance in buildings.

3 Modelling CO₂ Emissions

3.1 Energy Hierarchy



Figure 3.1. Energy Hierarchy

The energy strategy for the development follows the energy hierarchy of 'Be Lean', 'Be Clean', 'Be Green' and 'Be Seen', as set out within the London Plan and referred to previously in section 2.1.3. Design improvements will be detailed for each stage of the hierarchy, with absolute and relative reductions in CO₂ emission for each stage reported in the final results table.

3.2 Methodology

IES Virtual Environment dynamic thermal simulation software version 2022.1.2.0 has been used to carry out the calculations and simulations required to predict development CO₂ emissions in line with Building Regulations Part L DSM methodology.

The CO₂ emission rate calculations consider the building's regulated energy use due to lighting, heating, cooling, hot water, and auxiliary uses. An estimate of unregulated energy can be found in the 'equipment' load; however, this figure is not accounted for in CO₂ emission figures. National Calculation Methodology (NCM) standard activity templates are assigned to each activity zone.

3.3 CO₂ Emissions Factors

The carbon emissions factors used in this report [Table 3.1] are based on Building Regulations Part L 2021 guidelines, which references tables 29 and 30 of the NCM guide. These factors changed with the Part L update on 15th June 2022, in order to reflect the increased efficiency of the UK electric grid more accurately. An indication of how these factors have changed is given in the table below.

Table 3.1 - CO₂ Emission Factors

	Part L 2013 factor [kgCO ₂ /kWh]	Part L 2021 update [kgCO ₂ /kWh]
Natural Gas	0.216	0.210
Grid Supplied Electricity	0.519	0.139*

*Annual average taken as the carbon factor of grid supplied electricity varies month by month

3.3.1 BEIS Grid Predictions

The UK National Grid is continually reducing its carbon factor, due to the increased supply of electricity by low/zero carbon technologies, with carbon neutrality targeted by 2050 latest. Figure 5 below demonstrates how the carbon factor of grid electric will reduce well below that of gas over the next 30 years.

As such the proposed development has been designed to operate without the need for fossil fuels, opting for a grid supplied electric solution.

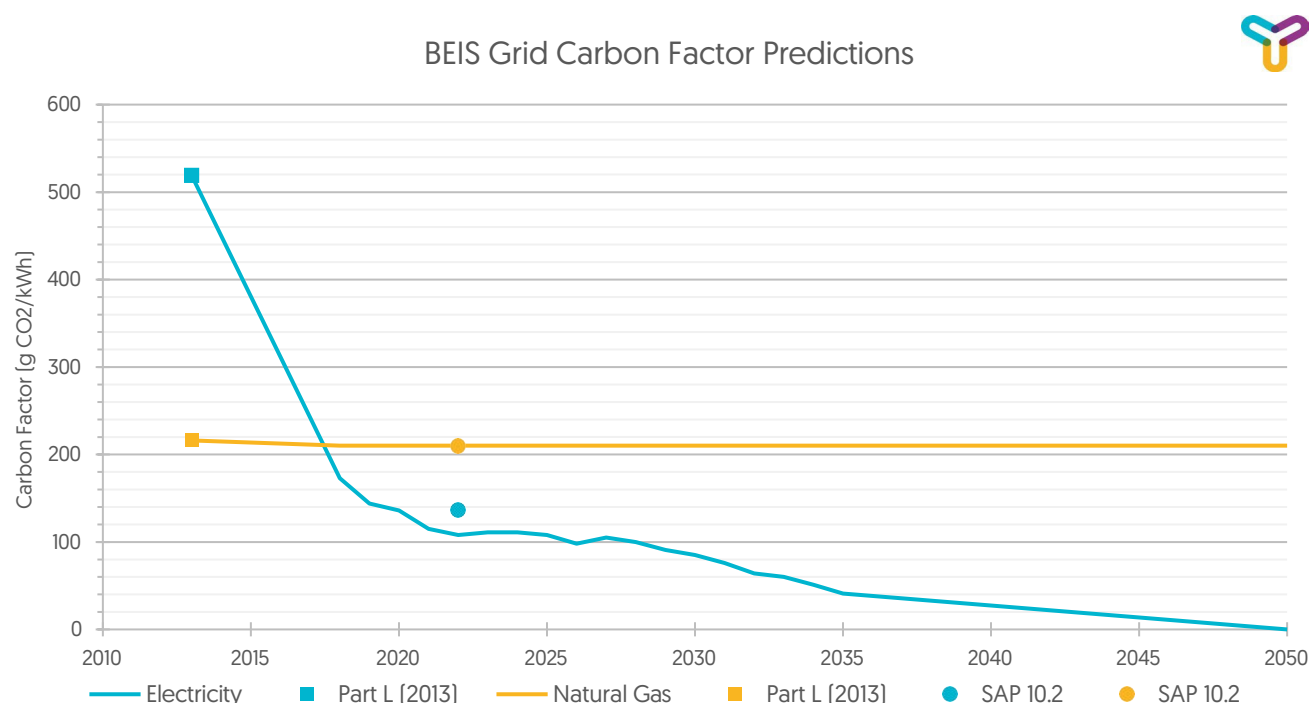


Figure 3.2. Predicted Grid vs Gas Carbon Factor

3.4 Baseline Building

The 'baseline' building is a theoretical model of the development, in which minimum requirements for CO₂ emissions are met. This is based on the Target Emissions Rate (TER) calculated in line with Building Regulations Part L 2013. Table 3.2 details the emissions associated with this baseline building.

Table 3.2 – Sitewide Baseline Total Regulated CO₂ Emissions

		Total floor area [m ²]	TER [kgCO ₂ /m ²]	Total Regulated CO ₂ Emissions [tCO ₂ /annum]
Baseline	Unit 1	8248.9	20.4	168.28
	Unit 2	3543.6	21.4	75.83
	Unit 3	4654.3	20.8	96.81
	Unit 4	6945.3	20.6	143.07
	Unit 5	13983.4	19.8	276.87

The input data and BRUKL report used for the baseline building can be found in the appendix. Floor area is based on thermal modelling and may vary from architectural schedules.

4 'Be Lean'

4.1 Introduction

Aiming to maximise energy efficiency of the development, these following measures meet the 'Be Lean' stage of the energy hierarchy.

Energy demand can be dramatically reduced through passive and active measures. These measures must be considered early on in the design, and will incur an economic, as well as time, cost, if not implemented at initial design stages.

All energy efficient measures outlined hereon are suggestions, and it is accepted that future design iterations may see them change. Yonder takes no responsibility for changes in design schemes and the resulting impact on CO₂ emissions.

A sitewide Be Lean BRUKL can be found in the appendix.

4.2 Passive Design

Passive design aims to reduce the energy demand of a building through carefully informed design decisions about built form, internal layout, daylight, solar shading, ventilation, thermal mass, and thermal insulation.

The benefit of passive principles is seen not just in reductions in CO₂ emissions, but also in improvements to the internal environment for the building user, with a comfortable, healthy internal environment sustained with lower energy requirements.

4.2.1 Daylighting

Natural daylight is crucial for an efficient design, with a carefully considered daylight strategy resulting in reduced lighting, heating, and cooling load. The following measures are taken to ensure natural light, solar gain and glare are optimised:

- Solar control glazing with lower g-value and LT value, reducing solar gain and thus cooling requirements.
- Clear glazing with high g-value and LT value, improving natural light and solar gain, thus reducing lighting and heating load.
- Solar shading in the form of brise soleil/recesses/overhangs, reducing peak season solar gain.
- Rooflights to 12% of warehouse roof, reducing the daytime lighting load.

4.2.2 Building Fabric

Building fabric insulation is imperative in maintaining a comfortable internal environment within a building, with the fabric required to be insulated enough to reduce winter heating load, but not over insulated as to result in high summer cooling loads.

The air permeability of a building is the rate at which air moves through the building envelope to the outside, measured in m³/hr/m², this must also be optimised with consideration to the seasonal temperature changes experienced in this country,

Improvements to the fabric insulation, compared to minimum standards defined in Building Regulations Part L 2013, can be seen in table 4.1 below. These values do not reflect coordinated construction details and may vary as the stages of construction evolve.

Table 4.1 - Fabric Improvement Summary

Parameter	Part L2A maximum	Actual
Fabric U values [W/m ² K]		
External Wall	0.35	0.35
Floor	0.25	0.25
Roof	0.25	0.25
Window (including frame)	2.00	1.50
Personnel Door	2.20	-
Vehicle Door	1.50	1.50
Rooflights	2.00	1.50
Air Tightness [m ³ /hr/m ²]	10.0	3

4.3 Active Design

4.3.1 Mechanical Ventilation

Office areas are mechanically ventilated from a central air handling plant with a minimum efficiency heat recovery of 75% and low energy fans (SFP=1.6W/l/s). All heat recovery units are to be speed controlled based on CO₂ levels.

Toilet and store areas operate an extract system with low energy fans (SFP=0.5W/l/s).

4.3.2 Heating & Cooling

For the purpose of 'Be Lean' analysis, heating to all ancillary areas is assumed to be provided by electric panel heaters. Local cooling units operate in office space and meet L2A minimum efficiency requirements, as per Table 6.6 of the L2A guide. This system works in conjunction with the MVHR unit.

The warehouse has been assumed to be unheated.

4.3.3 Low Energy Lighting and Smart Controls

Low energy LED lighting is proposed throughout the development, with a minimum efficacy of 100lm/W. All occupied zones will have occupancy sensing controls, preventing lights remaining on when a space is out of use. Photoelectric options, in the form of daylight dimming, are proposed for use in externally facing office areas, and throughout the warehouse.

4.4 'Be Lean' Results

Table 4.2 - Sitewide 'Be Lean' CO₂ Emissions

		Emission Rate (kgCO ₂ /m ²)	Total Regulated CO ₂ Emissions (tCO ₂ /annum)	CO ₂ Savings (tCO ₂ /annum)	Percentage Improvements (%)
Unit 1	Baseline	20.4	168.28	-	
	Be Lean	12.6	103.94	64.34	38%
Unit 2	Baseline	21.4	75.83	-	
	Be Lean	13.0	46.07	29.76	39%
Unit 3	Baseline	20.8	96.81	-	
	Be Lean	12.3	57.25	39.56	41%
Unit 4	Baseline	20.6	143.07	-	
	Be Lean	12.6	87.51	55.56	39%
Unit 5	Baseline	19.8	276.87	-	
	Be Lean	11.9	166.40	110.47	40%

5 'Be Clean'

5.1 Introduction

'Be Clean' measures refer to district heating systems and local energy generation technologies [CHP]. The local planning policy places emphasis on these schemes in particular.

5.2 Existing District Heating Networks

Initial research has suggested that the development does not sit within any of the existing decentralised energy/district heating networks.

5.3 Combined Heat and Power

It has been deemed that an on-site heating network with a central boiler and CHP plant, is not appropriate for this development, given the all-electric scheme that is being proposed.

6 'Be Green'

6.1 Introduction

'Be Green' refers to the use of low or zero carbon energy production technologies on the development site. In order to suggest appropriate renewable energy technologies, a high-level options appraisal has been undertaken to assess the viability of the technologies. A sitewide Be Green BRUKL can be found in the appendix.

6.2 Feasibility Study

An in-depth description of each LZC technology can be found in the appendix [Section 9].

Table 6.1 - LZC Feasibility Study

Technology	Brief Description	Considerations	Selected?
Biomass	Biomass fuel is burnt and used to fire a boiler	No noise issues but high maintenance and operational costs. Localised exhaust issues in urban locations.	NO
Ground Source Heat Pump (GSHP)	Energy stored in the earth's crust from solar radiation is used as part of a heat pump system	Suitable for all buildings where heating is required, but it requires large amounts of land use and there can be planning issues	NO
Air Source Heat Pump (ASHP)	Work on the same basis as a GSHP but using outside air as an energy source	Low land use, can be used for heating and cooling, if properly enclosed noise can be reduced to acceptable levels	YES
Solar Hot Water	Fluid within pipes, typically on a roof, is heated up and then, in turn, used to heat water in a separate cylinder	Low land use as can be roof mounted, no noise issues but this system is not normally used in conjunction with the electric hot water system proposed for this development	NO
Photovoltaics (PV)	PV systems convert energy from the sun into electricity	Can mount on the roof to save land, are easily incorporated to a building, offering high CO ₂ savings as well as scope to sell excess electricity back to the grid	YES
Wind Turbines	Turbines harvest energy from the wind and use it to generate electricity, these can be roof mounted or stand alone	The ground works and planning issues associated with wind turbines make them unfeasible for smaller scale production	NO

6.3 Summary of Selected LZC Technologies

6.3.1 ASHP (VRF)

An Air Source Heat Pump is proposed as a viable technology for the development, in the form of a VRF system. This system can provide high efficiency heating and cooling to office spaces in the development. External condensers can be located in an external room.

Heating and cooling to office areas is provided by a high efficiency VRF system, with a minimum SCOP of 3.5 and minimum SEER of 4.0. This VRF system works in conjunction with the MVHR unit.

Heating to ancillary spaces is provided by electric panel heaters.

6.3.2 Photovoltaic Panels

Photovoltaic panels are proposed as a feasible way of providing a portion of the development's energy demand. Ensure the building's metering system allows export of energy if needed. The government offers Feed in Tariffs for the export of electricity into to the grid.

The development's roof shall be designed to hold PV for future installation. 100sqm of PV has been included in the initial 'Be Green' model, but the savings could increase to up to 100% of regulated energy load, once PV has been installed.

6.4 'Be Green' Results

Table 6.2 - Sitewide 'Be Green' Regulated CO₂ emissions Part L 2021

		Emission Rate (kgCO ₂ /m ²)	Total Regulated CO ₂ Emissions (tCO ₂ /annum)	CO ₂ Savings (tCO ₂ /annum)	Percentage Improvements [%] <i>compared to baseline</i>
Unit 1	Baseline	20.4	168.28	-	
	Be Lean	12.6	103.94	64.34	38%
	Be Clean	12.6	103.94	64.34	38%
	Be Green	11.5	94.86	73.42	44%
Unit 2	Baseline	21.4	75.83	-	
	Be Lean	13.0	46.07	29.76	39%
	Be Clean	13.0	46.07	29.76	39%
	Be Green	10.4	36.50	39.33	52%
Unit 3	Baseline	20.8	96.81	-	
	Be Lean	12.3	57.25	39.56	41%
	Be Clean	12.3	57.25	39.56	41%
	Be Green	10.4	48.40	48.41	50%

		Emission Rate [kgCO ₂ /m ²]	Total Regulated CO ₂ Emissions [tCO ₂ /annum]	CO ₂ Savings [tCO ₂ /annum]	Percentage Improvements [%] <i>compared to baseline</i>
Unit 4	Baseline	20.6	143.07	-	
	Be Lean	12.6	87.51	55.56	39%
	Be Clean	12.6	87.51	55.56	39%
	Be Green	11.4	79.18	64.52	45%
Unit 5	Baseline	19.8	276.87	-	-
	Be Lean	11.9	166.40	110.47	40%
	Be Clean	11.9	166.40	110.47	40%
	Be Green	11.3	158.01	118.86	43%

7 'Be Seen'

As per policy SI 2 of the GLA, a building is required to 'Be Seen' through the monitoring, verification, and reporting of energy performance.

It is proposed that the development at Atlas Park is fitted with a building management system (BMS). Building users should be educated in how to read and respond to this management system, ensuring that the building is operated optimally. Out of range alarms associated with HVAC or lighting systems can warn occupants when systems aren't achieving expected efficiencies, enabling early diagnosis of faulty building services.

An in-use operational energy assessment can be undertaken on the development post construction, enabling the verification and reporting of building energy performance compared to the initial modelling.

8 Ene 01 – Reduction of energy use and carbon emissions

8.1 Introduction

BREEAM Issue Ene 01 aims to minimise energy demand, primary energy consumption and CO₂ emissions. In order to achieve an Excellent rating this development must achieve 6 credits under the energy performance section of Ene 01. An Energy Performance Ratio for New Construction (EPR_{NC}) is used to determine the credits awarded.

Table 7.1 - ENE 01 EPR_{NC} benchmark scale

		Minimum standards	
BREEAM credits	EPR _{NC}	Rating	Minimum requirements
1	0.1		Requires a performance improvement progressively better than the relevant national building regulations compliant standard.
2	0.2		
3	0.3		
4	0.4	Excellent	Requires 4 credits to be achieved (equivalent to an EPR _{NC} of at least 0.4) or 4 credits for Prediction of operational energy consumption (where operational energy performance has been substantially improved).
5	0.5		
6	0.6	Outstanding	Requires 6 credits to be achieved (equivalent to an EPR _{NC} of at least 0.6) and 4 credits for prediction of operational energy consumption.
7	0.7		
8	0.8		
9	0.9 AND zero net regulated CO ₂ -eq emissions.		

This building, under current assumptions made in the energy model, will achieve the following EPR_{NC} and Ene 01 credits:

	EPR _{NC}	BREEAM ENE 01 credits
Proposed development	0.454	4

9 Conclusion

9.1 Recommendations

- Passive design measures in the form of improved U-values, solar controlled glazing, and reduced air permeability have been applied to reduce the base energy demand of the building
- Roof lights between 12% of warehouse floor area to enhance natural light, reducing the need for artificial light.
- Energy efficiency measures in the form of low energy fans, high efficiency LED lighting, etc. have been applied to reduce the energy consumption of the building
- Air source heat pumps supplying the office heating & cooling
- The building roofs are to be designed with a structural integrity capable of mounting PV to offset the proposed developments operational carbon.

9.2 Results

Table 7.1 - CO₂ emissions using energy hierarchy.

		Emission Rate [kgCO ₂ /m ²]	Total Regulated CO ₂ Emissions [tCO ₂ /annum]	CO ₂ Savings [tCO ₂ /annum]	Percentage Improvements (%) <i>compared to baseline</i>
Unit 1	Baseline	20.4	168.28	-	
	Be Lean	12.6	103.94	64.34	38%
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	Be Clean	11.9	166.40	110.47	40%
	Be Green	11.3	158.01	118.86	43%

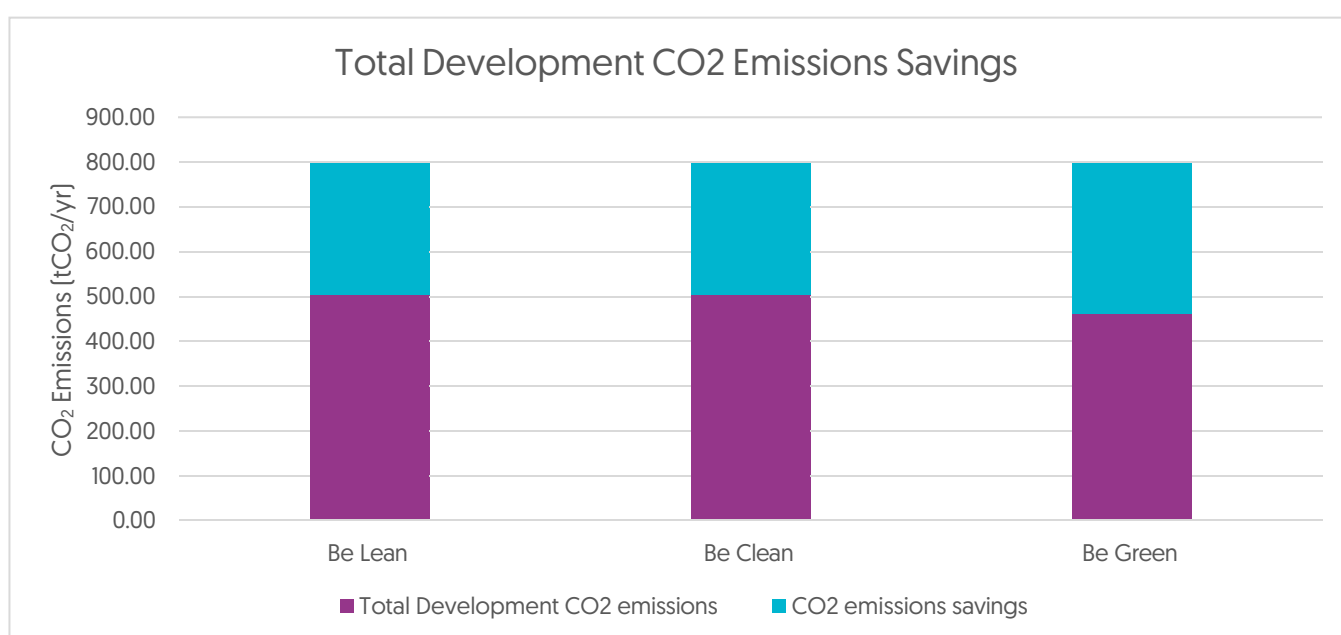


Figure 7.1 - CO₂ emissions graph

10 References

1. Ministry of Housing, Communities & Local Government. National Planning Policy Framework. GOV.UK. [Online] 20 July 2021. <https://www.gov.uk/government/publications/national-planning-policy-framework--2>.
2. Greater London Authority. The Spatial Development Strategy for Greater London. London.Gov.Uk. [Online] March 2021. https://www.london.gov.uk/sites/default/files/the_london_plan_2021.pdf.
3. BRE. *The Government's Standard Assessment Procedure for Energy Rating of Dwellings (Version 10.2)*. Watford : BRE Garston, 2022.

11 Appendices

11.1 Be Lean Model Inputs

11.2 Baseline & Be Lean BRUKL Report

11.3 Be Green LZC technology descriptions

11.4 Be Green Model Inputs

11.5 Be Green Model BRUKL Report

Be Lean Model Inputs

Project Name:	Atlas Park
Project Nr:	2628
Project Engineer:	Max Stephenson

Site Details

CIBSE Weather File:	Manchester
Orientation [North angle from vertical]:	341
Building Type:	B8: Warehouse/storage [Warehouse]
Name:	Units 1 - 5 Atlas Park
Address Line 1	
Address Line 2	
Address Line 3	
Address Line 4	
City:	
Postcode:	
UPRN:	

Building Owner

Name:	
Telephone:	
Street Address:	
City:	
Postcode:	

Building Details

PFC equipment installed?:	No
Electric power factor:	<0.90
Lighting systems metered?:	Yes
Warns for out-of-range values?:	No
Project Complexity:	Level 5

Simulation Settings

Calculation Method:	Apache
Time Step:	10 minutes
Reporting Interval:	30 minutes
Preconditioning:	20 days

Notes

Cells shaded in light grey have drop down boxes for selections
Cells shaded in light purple are automatically copied or calculated
Cells shaded in Yellow are assumptions made at this stage of the assessment

Project Name:	Atlas Park
Project Nr:	2628
Project Engineer:	Max Stephenson

Ref.	Zone Name	NCM Activity
1	Circulation	NCM Ware: Circulation Area
2	Office	NCM Ware: Office [Warehouse: Open]
3	Reception	NCM Ware: Reception
4	Store	NCM Ware: Cupboard
5	Toilet	NCM Ware: Toilet
6	Warehouse	NCM Ware: 24/7 Warehouse Storage
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

Notes

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Cells shaded in Yellow are assumptions made at this stage of the assessment

Project Name:	Atlas Park
Project Nr:	2628
Project Engineer:	Max Stephenson

Element	Description	Proposed area-weighted u-value [W/m ² .K]	Area-weighted average [Table 3, AD L2A [a]]
External Walls - Warehouse		0.35	0.35
External Walls - Office		0.35	0.35
Internal Walls - Warehouse		0.35	n/a
Internal Walls - Office		0.67	n/a
Ground-Contact Floors - Warehouse		0.25	0.25
Ground-Contact Floors - Office		0.25	0.25
Internal Floors - Slab		2.54	n/a
Roof		0.25	0.25
Windows		1.50	2.20
Rooflights		1.80	2.20
Pedestrian doors		2.20	2.20
Vehicle access and similar large doors		1.50	n/a

Element	Description	g-value [BS EN 410]	Light transmittance [LT]
General Glazing		0.40	0.68
Rooflights		0.55	0.58

Air Permeability	Description	This building [Design Value]	Worst acceptable standard
m ³ /[h.m ²] @ 50 Pa		3	10

Notes

Cells shaded in light grey have drop down boxes for selections

Cells shaded in light purple are automatically copied or calculated

Cells shaded in Yellow are assumptions made at this stage of the assessment

Project Name:	Atlas Park	
Project Nr:	2628	
Project Engineer:	Max Stephenson	

HVAC System Details	HVAC system name	HVAC 01: EPH NV	HVAC 02: EPH EV	HVAC 03: VRF MVHR	DHW 01: ASHP
	NCM System Type	Other local room heater -	Other local room heater -	Split or multi- split system	Other local room heater -
Heating	Heat source	Room Heater	Room Heater	Heat pump (electric): air source	Heat pump (electric): air source
	Fuel	Electricity	Electricity	Electricity	Electricity
	Does system use CHP?	No	No	No	No
	Heat Gen. SEER	1	1	3.5	3.2
Cooling	Pack chiller type	-	-	Heat pump	-
	Pack chiller power	-	-	Up to 100kW	-
	SEER	-	-	4	-
	EER	-	-	3.5	-
	Mixed Mode	-	-	-	-
System Adjustment	Ductwork Leakage Tested	Class worse than A, or not	Class worse than A, or not	Class worse than A, or not	-
	AHU Leakage Tested	Class worse than 3, or not compliant	Class worse than 3, or not compliant	Class worse than 3, or not compliant	-
	SFP (W/l/s)	-	0.5	1.6	-
	Variable Speed Pumps	Variable speed differential sensor across	Variable speed differential sensor across	-	-
Metering Provision	Yes	-	-	Yes	-
Ventilation	Alarm for out of range	-	-	No	-
	Cooling/vent. Mechanism	-	-	Air conditioning	-
	Air Supply Mechanism	-	-	Central	-
	Heat Recovery Method	-	-	Plate heat exchanger	-
	Heat Recovery Efficiency	-	-	75.0%	-
Zonal Ventilation & Extract (Entered at Zone Level)	Mechanical supply?	No	No	Yes	No
	Specific fan power (W/l/s)	-	-	1.6	-
	Local mechanical exhaust?	No	Yes	No	No
	Specific fan power (W/l/s)	-	0.5	-	-
	Extract flow rate	-	10ACH	-	-
	Extract remote from room?	-	Yes	-	-
	Demand controlled ventilation type	-	N/A	Speed / CO2	-

Notes

Cells shaded in light grey have drop down boxes for selection

Cells shaded in light purple are automatically copied or calculated

Cells shaded in Yellow are assumptions made at this stage of the assessment

Project Name:	Atlas Park
Project Nr:	2628
Project Engineer:	Max Stephenson

Apache System Title:

DHW 1: ASHP

Associated Room Type:

Room/Zone

System	Parameter		
Domestic Hot Water	DHW Delivery Efficiency	95.0%	
	Generator Type	Water Heater	
	Fuel Type	Natural Gas	
	Does the system have storage?	Yes	Secondary
	Storage Volume [litres]	500	circulation
	Storage Losses [kWh/l day]	0.005	included in DHW
	Does the system have secondary circulation?	Yes	delivery
	Circulation Losses [W/m]	-	efficiency at this
	Pump Power [kW]	-	stage
	Loop Length [m]	-	
Solar Water Heating	Time Switch?	-	
	Panel		
	Area [m ²]		
	Azimuth [° clockwise from North]		
	Tilt [° from horizontal]		
	Shading Factor		
	Degradation Factor		
	Conversion Efficiency at Ambient Temperature		
	First Order Heat Loss Coefficient		
	[W/m ² K]		
	Second Order Heat Loss Coefficient [W/m ² K]		
	Flow Rate [l/h.m ²]		
	Pump Power [kW]		
	Heat Exchanger Effectiveness		
	Cylinder		
	Volume [Litres]		
	Storage Loss at max. temperature [kWh/l.day]		

Notes

Cells shaded in light grey have drop down boxes for selections

Cells shaded in light purple are automatically copied or calculated

Cells shaded in Yellow are assumptions made at this stage of the assessment

Baseline & Be Lean Model BRUKL Report

Project name

Shell and Core

Unit 1 - Atlas Park (Be Lean)

As designed

Date: Mon Jun 05 12:29:10 2023

Administrative information

Building Details

Address: Unit 1 - Atlas Park, ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.21

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.21

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

Certifier details

Name: Max Stephenson

Telephone number: Phone

Address: Street Address, City, Postcode

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	20.4
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	20.4
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	12.6
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	0.35	0.35	01000000:Surf[14]
Floor	0.25	0.25	0.25	01000001:Surf[0]
Roof	0.25	0.25	0.25	01000000:Surf[89]
Windows***, roof windows, and rooflights	2.2	1.5	1.5	01000000:Surf[88]
Personnel doors	2.2	-	-	No personnel doors in building
Vehicle access & similar large doors	1.5	1.5	1.5	01000000:Surf[69]
High usage entrance doors	3.5	-	-	No high usage entrance doors in building
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	3

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- HVAC 02: EPH EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- HVAC 01: EPH NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

3- HVAC 03: VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	3.5	0	-	0.75
Standard value	2.5*	2.6	N/A	N/A	0.5
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. For types ≤12 kW output, refer to EN 14825 for limiting standards.

1- DHW 01: ASHP

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3.2	0.005
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

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		
01.00.01 WC		-	-	0.5	-	-	-	-	-	-	-	N/A
01.00.02 WC		-	-	0.5	-	-	-	-	-	-	-	N/A
01.00.03 Dis WC		-	-	0.5	-	-	-	-	-	-	-	N/A

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		
01.00.09 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
01.00.10 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A
01.00.11 Reception	-	-	-	1.6	-	-	-	-	-	-	N/A
01.01.02 Open Plan Office	-	-	-	1.6	-	-	-	-	-	-	N/A
01.01.03 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
01.01.04 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
01.01.05 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
01.01.08 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A
01.02.02 Open Plan Office	-	-	-	1.6	-	-	-	-	-	-	N/A
01.02.03 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
01.02.04 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
01.02.05 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
01.02.08 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
01.00.00 Unit 1 Warehouse	NO
01.00.01 WC	NO
01.00.02 WC	NO
01.00.03 Dis WC	NO
01.00.04 Circulation	NO
01.00.05 Stairs	NO
01.00.06 Store	NO
01.00.07 Warehouse Undercroft	NO
01.00.08 Cleaners	NO
01.00.09 WC	NO
01.00.10 Dis WC	NO
01.00.11 Reception	NO
01.01.00 Stairs	NO
01.01.01 Store	NO
01.01.02 Open Plan Office	NO
01.01.03 WC	NO
01.01.04 WC	NO
01.01.05 WC	NO
01.01.06 Lobby	NO
01.01.07 Circulation	NO
01.01.08 Dis WC	NO
01.02.00 Stairs	NO
01.02.01 Store	NO
01.02.02 Open Plan Office	NO
01.02.03 WC	NO
01.02.04 WC	NO
01.02.05 WC	NO
01.02.06 Lobby	NO
01.02.07 Circulation	NO

Shell and core configuration

Zone	Assumed shell?
01.02.08 Dis WC	NO

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
01.00.00 Unit 1 Warehouse		100	-	-	32160
01.00.01 WC		-	100	-	126
01.00.02 WC		-	100	-	130
01.00.03 Dis WC		-	100	-	40
01.00.04 Circulation		-	100	-	46
01.00.05 Stairs		-	100	-	40
01.00.06 Store		100	-	-	9
01.00.07 Warehouse Undercroft		100	-	-	981
01.00.08 Cleaners		100	-	-	3
01.00.09 WC		-	100	-	27
01.00.10 Dis WC		-	100	-	41
01.00.11 Reception		-	100	22	0
01.01.00 Stairs		-	100	-	40
01.01.01 Store		100	-	-	9
01.01.02 Open Plan Office		100	-	-	1453
01.01.03 WC		-	100	-	29
01.01.04 WC		-	100	-	29
01.01.05 WC		-	100	-	31
01.01.06 Lobby		-	100	-	26
01.01.07 Circulation		-	100	-	49
01.01.08 Dis WC		-	100	-	33
01.02.00 Stairs		-	100	-	40
01.02.01 Store		100	-	-	9
01.02.02 Open Plan Office		100	-	-	1453
01.02.03 WC		-	100	-	29
01.02.04 WC		-	100	-	29
01.02.05 WC		-	100	-	31
01.02.06 Lobby		-	100	-	26
01.02.07 Circulation		-	100	-	49
01.02.08 Dis WC		-	100	-	33

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?
01.00.00 Unit 1 Warehouse	YES (+12.6%)	NO
01.00.07 Warehouse Undercroft	NO (-40.9%)	NO
01.00.11 Reception	YES (+0%)	NO
01.01.02 Open Plan Office	NO (-48.3%)	NO
01.02.02 Open Plan Office	NO (-52.8%)	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?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	8248.9	8248.9
External area [m ²]	20354.5	20354.5
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	3	5
Average conductance [W/K]	8037.07	6476.23
Average U-value [W/m ² K]	0.39	0.32
Alpha value* [%]	10	10

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

Building Use

% Area Building Type

	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
100	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	2.4	1.61
Cooling	0.79	0.67
Auxiliary	0.74	0.58
Lighting	18.87	36.3
Hot water	1.51	1.66
Equipment*	42.78	42.78
TOTAL **	24.31	40.82

* 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]	21.13	16.08
Primary energy* [kWh/m ²]	74.63	119.74
Total emissions [kg/m ²]	12.6	20.4

* 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 SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
Actual	245.8	0	68.3	0	0	1	0	1	0	
Notional	147.2	0	47.4	0	0	0.86	0	----	----	
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
Actual	187.4	0	52.1	0	22.5	1	0	1	0	
Notional	111.5	0	35.9	0	25.7	0.86	0	----	----	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
Actual	100.1	126.8	8.5	12.4	6.8	3.26	2.84	3.5	4	
Notional	46.4	143.6	5	10.5	3.6	2.56	3.79	----	----	
[ST] No Heating or Cooling										
Actual	0	0	0	0	0	0	0	0	0	
Notional	0	0	0	0	0	0	0	----	----	

Key to terms

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

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	0.35	01000001:Surf[1]
Floor	0.2	0.25	01000000:Surf[0]
Roof	0.15	0.25	01000000:Surf[89]
Windows, roof windows, and rooflights	1.5	1.5	01000000:Surf[1]
Personnel doors	1.5	-	No personnel doors in building
Vehicle access & similar large doors	1.5	1.5	01000000:Surf[69]
High usage entrance doors	1.5	-	No high usage entrance doors in building
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	3

Project name

Shell and Core

Unit 2 - Atlas Park (Be Lean)

As designed

Date: Mon Jun 05 12:31:54 2023

Administrative information

Building Details

Address: Unit 2 - Atlas Park, ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.21

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.21

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

Certifier details

Name: Max Stephenson

Telephone number: Phone

Address: Street Address, City, Postcode

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	21.4
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	21.4
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	13
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	0.35	0.35	02000005:Surf[35]
Floor	0.25	0.25	0.25	02000000:Surf[0]
Roof	0.25	0.25	0.25	0200000D:Surf[33]
Windows***, roof windows, and rooflights	2.2	1.5	1.5	0200000D:Surf[32]
Personnel doors	2.2	-	-	No personnel doors in building
Vehicle access & similar large doors	1.5	1.5	1.5	02000006:Surf[2]
High usage entrance doors	3.5	-	-	No high usage entrance doors in building
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	3

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- HVAC 03: VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	3.5	0	-	0.75
Standard value	2.5*	2.6	N/A	N/A	0.5
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. For types ≤12 kW output, refer to EN 14825 for limiting standards.					

2- HVAC 02: EPH EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

3- HVAC 01: EPH NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

1- DHW 01: ASHP

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3.2	0.005
Standard value	2*	N/A
* Standard shown is for all types except absorption and gas engine heat pumps.		

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			
02.00.00 Reception	-	-	-	1.6	-	-	-	-	-	-	-	N/A
02.00.02 Dis WC	-	-	0.5	-	-	-	-	-	-	-	-	N/A
02.00.03 WC	-	-	0.5	-	-	-	-	-	-	-	-	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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
02.01.02 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
02.01.03 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A
02.01.04 Open Plan Office	-	-	-	1.6	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
02.00.00 Reception	NO
02.00.02 Dis WC	NO
02.00.03 WC	NO
02.00.04 Cleaners	NO
02.00.05 Warehouse Undercroft	NO
02.00.06 Stairs	NO
02.00.07 Unit 2 Warehouse	NO
02.01.00 Circulation	NO
02.01.02 WC	NO
02.01.03 Dis WC	NO
02.01.04 Open Plan Office	NO
02.01.05 Stairs	NO

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
02.00.00 Reception		-	100	22	0
02.00.02 Dis WC		-	100	-	41
02.00.03 WC		-	100	-	29
02.00.04 Cleaners		100	-	-	3
02.00.05 Warehouse Undercroft		100	-	-	792
02.00.06 Stairs		-	100	-	40
02.00.07 Unit 2 Warehouse		100	-	-	13609
02.01.00 Circulation		-	100	-	78
02.01.02 WC		-	100	-	28
02.01.03 Dis WC		-	100	-	44
02.01.04 Open Plan Office		100	-	-	1367
02.01.05 Stairs		-	100	-	58

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?
02.00.00 Reception	NO (-62.2%)	NO
02.00.05 Warehouse Undercroft	NO (-8%)	NO
02.00.07 Unit 2 Warehouse	YES (+11.4%)	NO
02.01.04 Open Plan Office	NO (-45%)	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?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	3543.6	3543.6
External area [m ²]	9145.2	9145.2
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	3	5
Average conductance [W/K]	3497.21	2894.35
Average U-value [W/m ² K]	0.38	0.32
Alpha value* [%]	10.01	10

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

Building Use

% Area Building Type

	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
100	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	2.24	2.22
Cooling	0.67	0.64
Auxiliary	0.65	0.44
Lighting	19.87	37.9
Hot water	1.56	1.67
Equipment*	42.78	42.78
TOTAL **	24.98	42.87

* 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]	20.28	18.73
Primary energy* [kWh/m ²]	76.68	125.07
Total emissions [kg/m ²]	13	21.4

* 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 SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	274.1	0	76.1	0	0	1	0	1	0
	Notional	273.9	0	88.2	0	0	0.86	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	131.8	0	36.6	0	28.2	1	0	1	0
	Notional	70.9	0	22.8	0	32.1	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	107.7	94.2	9.2	9.2	6.9	3.26	2.84	3.5	4
	Notional	63.3	121.4	6.9	8.9	3.7	2.56	3.79	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

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

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	0.35	02000000:Surf[10]
Floor	0.2	0.25	02000005:Surf[0]
Roof	0.15	0.25	0200000D:Surf[33]
Windows, roof windows, and rooflights	1.5	1.5	02000000:Surf[1]
Personnel doors	1.5	-	No personnel doors in building
Vehicle access & similar large doors	1.5	1.5	02000006:Surf[2]
High usage entrance doors	1.5	-	No high usage entrance doors in building
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	3

Project name

Shell and Core

Unit 3 - Atlas Park (Be Lean)

As designed

Date: Mon Jun 05 12:47:11 2023

Administrative information

Building Details

Address: Unit 3 - Atlas Park, ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.21

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.21

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

Certifier details

Name: Max Stephenson

Telephone number: Phone

Address: Street Address, City, Postcode

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	20.8
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	20.8
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	12.3
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	0.35	0.35	0300000E:Surf[9]
Floor	0.25	0.25	0.25	03000001:Surf[0]
Roof	0.25	0.25	0.25	0300000E:Surf[48]
Windows***, roof windows, and rooflights	2.2	1.5	1.5	0300000E:Surf[47]
Personnel doors	2.2	-	-	No personnel doors in building
Vehicle access & similar large doors	1.5	1.5	1.5	0300000E:Surf[1]
High usage entrance doors	3.5	-	-	No high usage entrance doors in building
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	3

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- HVAC 01: EPH NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- HVAC 03: VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	3.5	0	-	0.75
Standard value	2.5*	2.6	N/A	N/A	0.5
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. For types <=12 kW output, refer to EN 14825 for limiting standards.

3- HVAC 02: EPH EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

1- DHW 01: ASHP

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3.2	0.005
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

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			
03.00.03 Reception	-	-	-	1.6	-	-	-	-	-	-	-	N/A
03.00.04 WC	-	-	0.5	-	-	-	-	-	-	-	-	N/A
03.00.06 Dis WC	-	-	0.5	-	-	-	-	-	-	-	-	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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
03.01.01 Open Plan Office	-	-	-	1.6	-	-	-	-	-	-	N/A
03.01.03 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A
03.01.04 WC	-	-	0.5	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
03.00.00 Unit 3 Warehouse	NO
03.00.01 Stairs	NO
03.00.02 Warehouse Undercroft	NO
03.00.03 Reception	NO
03.00.04 WC	NO
03.00.05 Cleaners	NO
03.00.06 Dis WC	NO
03.01.00 Stairs	NO
03.01.01 Open Plan Office	NO
03.01.02 Circulation	NO
03.01.03 Dis WC	NO
03.01.04 WC	NO

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
Standard value	60	60	22		
03.00.00 Unit 3 Warehouse	100	-	-		18502
03.00.01 Stairs	-	100	-		39
03.00.02 Warehouse Undercroft	100	-	-		782
03.00.03 Reception	-	100	22		0
03.00.04 WC	-	100	-		31
03.00.05 Cleaners	100	-	-		3
03.00.06 Dis WC	-	100	-		41
03.01.00 Stairs	-	100	-		57
03.01.01 Open Plan Office	100	-	-		1354
03.01.02 Circulation	-	100	-		77
03.01.03 Dis WC	-	100	-		44
03.01.04 WC	-	100	-		30

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?
03.00.00 Unit 3 Warehouse	YES (+11.1%)	NO
03.00.02 Warehouse Undercroft	NO (-27.5%)	NO
03.00.03 Reception	NO (-68.3%)	NO
03.01.01 Open Plan Office	NO (-48.4%)	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?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	4654.3	4654.3
External area [m ²]	11999.7	11999.7
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	3	5
Average conductance [W/K]	4577.98	3767.26
Average U-value [W/m ² K]	0.38	0.31
Alpha value* [%]	10	10

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

Building Use

% Area Building Type

	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
100	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	1.7	1.66
Cooling	0.46	0.47
Auxiliary	0.49	0.33
Lighting	19.53	37.41
Hot water	1.55	1.68
Equipment*	43.04	43.04
TOTAL **	23.74	41.56

* 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]	14.98	13.94
Primary energy* [kWh/m ²]	72.87	121.98
Total emissions [kg/m ²]	12.3	20.8

* 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 SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
Actual	282.2	0	78.4	0	0	1	0	1	0	
Notional	276.6	0	89.1	0	0	0.86	0	----	----	
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
Actual	133.1	0	37	0	28.2	1	0	1	0	
Notional	72.8	0	23.5	0	32.2	0.86	0	----	----	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
Actual	109.8	86.6	9.3	8.5	6.9	3.26	2.84	3.5	4	
Notional	64.5	118.6	7	8.7	3.7	2.56	3.79	----	----	
[ST] No Heating or Cooling										
Actual	0	0	0	0	0	0	0	0	0	
Notional	0	0	0	0	0	0	0	----	----	

Key to terms

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

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	0.35	03000001:Surf[2]
Floor	0.2	0.25	0300000E:Surf[0]
Roof	0.15	0.25	0300000E:Surf[48]
Windows, roof windows, and rooflights	1.5	1.5	0300000E:Surf[12]
Personnel doors	1.5	-	No personnel doors in building
Vehicle access & similar large doors	1.5	1.5	0300000E:Surf[1]
High usage entrance doors	1.5	-	No high usage entrance doors in building
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	3

Project name

Shell and Core

Unit 4 - Atlas Park (Be Lean)

As designed

Date: Mon Jun 05 12:52:22 2023

Administrative information

Building Details

Address: Unit 4 - Atlas Park, ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.21

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.21

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

Certifier details

Name: Max Stephenson

Telephone number: Phone

Address: Street Address, City, Postcode

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	20.6
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	20.6
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	12.6
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	0.35	0.35	04000000:Surf[13]
Floor	0.25	0.25	0.25	04000002:Surf[0]
Roof	0.25	0.25	0.25	04000000:Surf[66]
Windows***, roof windows, and rooflights	2.2	1.5	1.5	04000000:Surf[65]
Personnel doors	2.2	-	-	No personnel doors in building
Vehicle access & similar large doors	1.5	1.5	1.5	04000000:Surf[1]
High usage entrance doors	3.5	-	-	No high usage entrance doors in building
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	3

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- HVAC 02: EPH EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- HVAC 03: VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	3.5	0	-	0.75
Standard value	2.5*	2.6	N/A	N/A	0.5
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. For types ≤12 kW output, refer to EN 14825 for limiting standards.

3- HVAC 01: EPH NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

1- DHW 01: ASHP

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3.2	0.005
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

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			
04.00.03 WC	-	-	0.5	-	-	-	-	-	-	-	-	N/A
04.00.04 Dis WC	-	-	0.5	-	-	-	-	-	-	-	-	N/A
04.00.05 Reception	-	-	-	1.6	-	-	-	-	-	-	-	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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
04.01.00 Open Plan Office	-	-	-	1.6	-	-	-	-	-	-	N/A
04.01.02 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
04.01.03 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
04.01.04 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
04.01.05 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A
04.02.00 Open Plan Office	-	-	-	1.6	-	-	-	-	-	-	N/A
04.02.02 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
04.02.03 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
04.02.04 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
04.02.05 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
04.00.00 Unit 4 Warehouse	NO
04.00.01 Warehouse Undercroft	NO
04.00.03 WC	NO
04.00.04 Dis WC	NO
04.00.05 Reception	NO
04.00.07 Store	NO
04.00.08 Stairs	NO
04.01.00 Open Plan Office	NO
04.01.01 Circulation	NO
04.01.02 WC	NO
04.01.03 WC	NO
04.01.04 WC	NO
04.01.05 Dis WC	NO
04.01.07 Store	NO
04.01.08 Stairs	NO
04.02.00 Open Plan Office	NO
04.02.01 Circulation	NO
04.02.02 WC	NO
04.02.03 WC	NO
04.02.04 WC	NO
04.02.05 Dis WC	NO
04.02.07 Store	NO
04.02.08 Stairs	NO

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
Standard value		60	60	22	
04.00.00 Unit 4 Warehouse		100	-	-	25560
04.00.01 Warehouse Undercroft		100	-	-	1416
04.00.03 WC		-	100	-	30

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
04.00.04 Dis WC		-	100	-	41
04.00.05 Reception		-	100	22	0
04.00.07 Store		100	-	-	9
04.00.08 Stairs		-	100	-	43
04.01.00 Open Plan Office		100	-	-	1945
04.01.01 Circulation		-	100	-	86
04.01.02 WC		-	100	-	27
04.01.03 WC		-	100	-	27
04.01.04 WC		-	100	-	27
04.01.05 Dis WC		-	100	-	32
04.01.07 Store		100	-	-	9
04.01.08 Stairs		-	100	-	43
04.02.00 Open Plan Office		100	-	-	2042
04.02.01 Circulation		-	100	-	111
04.02.02 WC		-	100	-	27
04.02.03 WC		-	100	-	27
04.02.04 WC		-	100	-	27
04.02.05 Dis WC		-	100	-	33
04.02.07 Store		100	-	-	10
04.02.08 Stairs		-	100	-	55

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?
04.00.00 Unit 4 Warehouse	YES (+11.3%)	NO
04.00.01 Warehouse Undercroft	NO (-15.8%)	NO
04.00.05 Reception	NO (-34.8%)	NO
04.01.00 Open Plan Office	NO (-29.1%)	NO
04.02.00 Open Plan Office	NO (-26.6%)	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?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	6945.3	6945.3
External area [m ²]	17430.9	17430.9
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	3	5
Average conductance [W/K]	6800.53	5570.25
Average U-value [W/m ² K]	0.39	0.32
Alpha value* [%]	10.01	10

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

Building Use

% Area Building Type

	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
100	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	2.33	2.06
Cooling	0.93	0.83
Auxiliary	0.79	0.5
Lighting	18.8	36.25
Hot water	1.52	1.67
Equipment*	42.95	42.95
TOTAL **	24.36	41.31

* 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]	23.02	20.49
Primary energy* [kWh/m ²]	74.78	120.6
Total emissions [kg/m ²]	12.6	20.6

* 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 SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	271.7	0	75.5	0	0	1	0	1	0
	Notional	229.4	0	73.9	0	0	0.86	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	66.7	0	18.5	0	25.8	1	0	1	0
	Notional	26.3	0	8.5	0	29.4	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	76.6	96.8	6.5	9.5	6.7	3.26	2.84	3.5	4
	Notional	42.9	115.8	4.7	8.5	3.6	2.56	3.79	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

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

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	0.35	04000005:Surf[13]
Floor	0.2	0.25	04000000:Surf[0]
Roof	0.15	0.25	04000000:Surf[66]
Windows, roof windows, and rooflights	1.5	1.5	04000000:Surf[20]
Personnel doors	1.5	-	No personnel doors in building
Vehicle access & similar large doors	1.5	1.5	04000000:Surf[1]
High usage entrance doors	1.5	-	No high usage entrance doors in building
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	3

Project name

Shell and Core

Unit 5 - Atlas Park (Be Lean)

As designed

Date: Mon Jun 05 12:18:34 2023

Administrative information**Building Details**

Address: Unit 5 - Atlas Park, ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.21

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.21

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

Certifier details

Name: Max Stephenson

Telephone number: Phone

Address: Street Address, City, Postcode

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	19.8
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	19.8
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	11.9
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	0.35	0.35	0500000D:Surf[26]
Floor	0.25	0.25	0.25	05000001:Surf[0]
Roof	0.25	0.25	0.25	05000001:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.5	1.5	0500000D:Surf[98]
Personnel doors	2.2	-	-	No personnel doors in building
Vehicle access & similar large doors	1.5	1.5	1.5	05000005:Surf[1]
High usage entrance doors	3.5	-	-	No high usage entrance doors in building
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	3

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- HVAC 02: EPH EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- HVAC 01: EPH NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

3- HVAC 03: VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	3.5	0	-	0.75
Standard value	2.5*	2.6	N/A	N/A	0.5
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. For types ≤12 kW output, refer to EN 14825 for limiting standards.

1- DHW 01: ASHP

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3.2	0.005
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

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		
05.00.01 Male WC		-	-	0.5	-	-	-	-	-	-	-	N/A
05.00.02 Female WC		-	-	0.5	-	-	-	-	-	-	-	N/A
05.00.03 Dis WC		-	-	0.5	-	-	-	-	-	-	-	N/A

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		
05.00.08 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
05.00.09 Reception	-	-	-	1.6	-	-	-	-	-	-	N/A
05.00.11 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A
05.01.02 Open Plan Office	-	-	-	1.6	-	-	-	-	-	-	N/A
05.01.05 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A
05.01.06 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
05.01.08 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
05.01.09 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
05.02.02 Open Plan Office	-	-	-	1.6	-	-	-	-	-	-	N/A
05.02.05 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A
05.02.06 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
05.02.08 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
05.02.09 WC	-	-	0.5	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
05.00.01 Male WC	NO
05.00.02 Female WC	NO
05.00.03 Dis WC	NO
05.00.04 Circulation	NO
05.00.05 Stairs	NO
05.00.06 Store	NO
05.00.07 Cleaners	NO
05.00.08 WC	NO
05.00.09 Reception	NO
05.00.11 Dis WC	NO
05.01.00 Stairs	NO
05.01.01 Store	NO
05.01.02 Open Plan Office	NO
05.01.03 Circulation	NO
05.01.05 Dis WC	NO
05.01.06 WC	NO
05.01.07 Circulation	NO
05.01.08 WC	NO
05.01.09 WC	NO
05.02.00 Stairs	NO
05.02.01 Store	NO
05.02.02 Open Plan Office	NO
05.02.03 Circulation	NO
05.02.05 Dis WC	NO
05.02.06 WC	NO
05.02.07 Circulation	NO
05.02.08 WC	NO
05.02.09 WC	NO
05.00.00 Unit 5 Warehouse	NO

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
05.00.01 Male WC		-	100	-	130
05.00.02 Female WC		-	100	-	129
05.00.03 Dis WC		-	100	-	41
05.00.04 Circulation		-	100	-	44
05.00.05 Stairs		-	100	-	41
05.00.06 Store		100	-	-	9
05.00.07 Cleaners		100	-	-	4
05.00.08 WC		-	100	-	29
05.00.09 Reception		-	100	22	0
05.00.11 Dis WC		-	100	-	41
05.01.00 Stairs		-	100	-	41
05.01.01 Store		100	-	-	9
05.01.02 Open Plan Office		100	-	-	1989
05.01.03 Circulation		-	100	-	64
05.01.05 Dis WC		-	100	-	32
05.01.06 WC		-	100	-	28
05.01.07 Circulation		-	100	-	20
05.01.08 WC		-	100	-	28
05.01.09 WC		-	100	-	28
05.02.00 Stairs		-	100	-	41
05.02.01 Store		100	-	-	9
05.02.02 Open Plan Office		100	-	-	1989
05.02.03 Circulation		-	100	-	64
05.02.05 Dis WC		-	100	-	32
05.02.06 WC		-	100	-	28
05.02.07 Circulation		-	100	-	20
05.02.08 WC		-	100	-	28
05.02.09 WC		-	100	-	28
05.00.00 Unit 5 Warehouse		100	-	-	57367

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?
05.00.09 Reception	NO (-16.2%)	NO
05.01.02 Open Plan Office	NO (-54.2%)	NO
05.02.02 Open Plan Office	NO (-50.8%)	NO
05.00.00 Unit 5 Warehouse	YES (+22.5%)	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?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	13983.4	13983.4
External area [m ²]	34257.5	34257.5
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	3	3
Average conductance [W/K]	13616	11022.5
Average U-value [W/m ² K]	0.4	0.32
Alpha value* [%]	10	10

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

Building Use

% Area Building Type

	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
100	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	1.83	1.23
Cooling	0.7	0.55
Auxiliary	0.52	0.39
Lighting	18.43	35.55
Hot water	1.51	1.68
Equipment*	43.2	43.2
TOTAL **	23	39.41

* 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]	17.58	13.18
Primary energy* [kWh/m ²]	70.6	116.17
Total emissions [kg/m ²]	11.9	19.8

* 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 SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	269.2	0	74.8	0	0	1	0	1	0
	Notional	156.9	0	50.5	0	0	0.86	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	233.3	0	64.8	0	22.5	1	0	1	0
	Notional	142.8	0	46	0	25.7	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	109.9	144.1	9.4	14.1	6.7	3.26	2.84	3.5	4
	Notional	54	151.9	5.9	11.1	3.6	2.56	3.79	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

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

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	0.35	05000001:Surf[2]
Floor	0.2	0.25	0500000D:Surf[0]
Roof	0.15	0.25	05000001:Surf[1]
Windows, roof windows, and rooflights	1.5	1.5	05000009:Surf[1]
Personnel doors	1.5	-	No personnel doors in building
Vehicle access & similar large doors	1.5	1.5	05000005:Surf[1]
High usage entrance doors	1.5	-	No high usage entrance doors in building
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	3

Be Green LZC technology descriptions

Each of the technologies was considered individually for its application to the proposed development. The site has been assumed to be positioned within an urban area and is assumed to be exposed.

1. Solar Thermal

Solar water heating systems use energy from the sun to heat water, most commonly for hot water needs in the UK. Fluid is heated by the sun in a series of panels, generally mounted on a south-facing roof. This fluid is circulated by a pump to heat up water that is stored in either a separate hot water cylinder or in a twin coil hot water cylinder inside the building. The systems work effectively in all parts of the UK if placed in an unshaded position, as they can work in diffuse light conditions.

There are two main types of collectors:

- Flat plate – simple matt black collector usually with a selective coating to increase efficiency
- Evacuated tube – more complicated manufacturing process, more efficient (about 15%) as heat losses through convection or conduction are minimised due to the presence of the vacuum but at higher cost than flat plate collectors.



This would be used to pre-heat the domestic hot water for use at sinks and wash basins. Whilst the energy generation is modest, it can be used for pre-heat in the low temperature application. The equipment is generally of a lower capital cost than other LZC technologies.

Given that the building can utilise a low-pitched roof it is ideally suited to the application of solar hot water panels. Assuming the hot water demand for the building is available, this technology could be considered viable.

Considerations: -

- Payback – Solar thermal could generate a high payback period, but an even larger system could reduce this, particularly if it is subsidised.
- Land Use – there will be no direct or indirect issues relating to land use as the solar collectors could be mounted on the roof structure.
- Local Planning Requirements – there are unlikely to be any planning issues as it should be possible to align these relatively closely to the slope of the roof.
- Noise – None, silent in operation.
- Export feasibility – this is low grade heat and therefore only suitable for local consumption. Any attempt to transport it any distance will produce unacceptable losses.
- Impact on carbon emissions – this will depend on whether it displaces an electric or gas-based system, and the demand for hot water. Either way, it is likely to have a modest impact on the building's carbon emissions.
- System Performance – The payback period will be medium term, assuming typical prevailing energy costs.

2. Photovoltaics

PV systems convert energy from the sun into electricity through semi-conductor cells, most commonly made of silicon. PV panels are usually connected to an inverter to turn the direct current (DC) produced into alternating current (AC), which is usable in buildings or when the building demand is exceeded, electricity can be exported to the electricity grid.



There are several types of PV cell with varying efficiencies and costs, available in a range of formats including roof tiles, shingles, bolt-on modules, rain screen cladding, integrated into standing seam roofs, and integrated into glass laminate for facades, walkway canopies or atrium roofs. A range of architectural looks can therefore be achieved, either blending in or making a design statement.

Once a PV system is installed, maintenance is minimal and reliability high as there are no moving parts in the system. The panels themselves usually have an electrical warranty of 20-25 years and an expected life of 30 years. Apart from occasional cleaning depending on the location, the only item needing regular checking is the inverter. Inverters are currently the weak link in the system and may need replacing every 5 – 10 years, although their reliability is continually improving.

Cost savings will be made on the electricity bill as once installed, the fuel to run the system – the sun's energy – is free. The savings will depend on the size of the system installed. Photovoltaics can be applied to the roofs or facades of the building, with individual inverters and metering arrangements set up for each as required, so that electricity savings can be monitored. If the PV generates more electricity than required by the project at any given moment [e.g., at weekends and holiday periods], the electricity can be sold and exported to the grid and therefore earn a small income.

PVs can be mounted upon the roof of the building or as an alternative they can form a solar facade as highlighted below. A solar glazing option serves the dual function of creating energy and shade at the same time. Solar Glazing can be used wherever conventional glass would be specified.

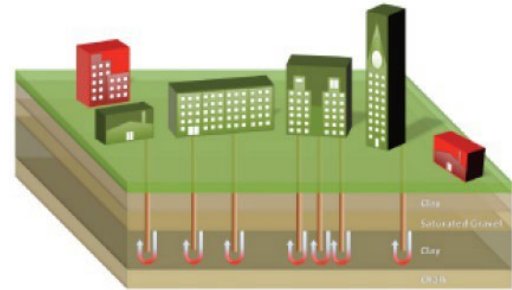
System Performance: – the cost of PV continues to come down, but current market figures are a magnitude of approx. £156/m². Assuming usual generating efficiencies and utility tariffs this could provide a quantity of saleable electricity. [N.B. all costs are approximate only; actual costs depend on type and size of system].

Considerations: -

- Payback – a long term payback can be expected from this technology, though much higher periods can accrue. There are economies to be made in having large installations, but it is not possible to achieve short payback periods.
- Land Use – there will be no direct or indirect issues relating to land use as the photovoltaics could be mounted on the roof structure.
- Local Planning Requirements – No initial planning discussed specifically.
- Noise – None, silent in operation.
- Export feasibility – electricity can be easily exported using a G40 meter.
- Impact on carbon emissions – this can have a significant effect on emissions, but most projects cannot give enough space or size to the installation, so the benefits are marginalised.

3. Ground Source Heat Pumps (GSHP)

GSHP technology makes use of the energy stored in the Earth's crust, which comes mainly from solar radiation. Essentially, heat pumps take up heat at a certain temperature and release it at a higher temperature. This is achieved by means of ground collectors (coils), in which a heat exchange fluid circulates and transfers heat via a heat exchanger to the heat pump. GSHPs are either open-loop (abstracting and discharging water to the aquifer below the site) or closed-loop (using water circulated through pipes in contact with the ground) and the circulating fluid.



Installing a ground source heat pump to meet the peak load would not be practical due to high installation costs. A more practical approach would be to install a system to meet a base LPHW load, allowing a traditional primary system to provide for the process energy.

There are three main methods of installing a ground source heat pump system:

- A closed loop horizontal system relies on installing vast lengths of 'slinky' pipework at a shallow depth. This is the most viable option because of the benefits of external ground works with the car park area allowing for inclusion of the pipework. This is a viable option depending on the selected site.
- A closed loop vertical system uses a series of boreholes to obtain greater heat exchange benefit with shorter pipework lengths.
- Finally, an open loop vertical system exchanges water with an aquifer deep beneath the site via a borehole to yield a greater heat exchange.

Ground source systems use the constant temperature of the ground (10-12°C below 2m) to provide heating and/or cooling to a building through a heat exchanger and heat pump. Water (or other fluid) is circulated through a system of pipes, either integrated into the piled foundations of a building, in vertically drilled bores, or coiled in loops in horizontal trenches to collect heat from the ground.

An "open system" can be used in which water is abstracted through a borehole and then discharged either to an above-ground body of water, or back to the underground water body through a separate well. The pipes feed into a heat exchanger and heat pump system in a standard plant room, which extracts heat and raises the temperature of the working fluid to supply hot water to the building as from a normal boiler, but at a lower temperature.

Considerations: -

- Pay back – a medium sized system with an overall coefficient of performance [COP] of 3.1 could be expected to achieve a payback of about 110 years. If the system is small this will be higher, but a better COP could counteract this (depending on actual unit selection).
- Land Use – closed loop systems require large areas of land for the buried pipe coils. Open loop systems take up less actual land but need a large separation between the wells. Either way, a building needs substantial grounds with it to install this system.
- Local Planning Requirements – No initial planning discussed specifically. Could have planning issues as the building is single storey impact and could be overlooked by other residential or commercial properties.

- Noise – Heat pumps with a high level of outbreak noise can be fitted with attenuation or acoustic enclosures and are usually installed in plant rooms.
- Export feasibility – this is a low-grade energy source and cannot therefore be transmitted any distance.
- Impact on carbon emissions – this only makes an impact on emissions when it is used in a heating and cooling application. For heating only, the benefits are marginal.
- System Performance - The installation of the ground pipes is the most expensive part of the system, whilst heat pumps can be of a comparable price to conventional boilers. No flues or condensate drains are required.

4. Air Source Heat Pumps (ASHP)

ASHP systems work on the same principle as a ground source heat pumps but use the outside air as the energy source instead of the ground, the benefit of this is that no expensive boreholes are required. The COPs given by ASHP systems are affected by the varying air temperatures.

Air-source heat pumps operate by extracting heat/coolth from the external air utilising the vapour compression cycle. Air-source heat pumps are classified as either air-to-air or air-to-water depending on whether the heat distribution system in the building uses air or water.

To suit a heating only strategy an air-to-water system could be used by way of packaged roof top units consisting of a condenser, evaporator, compressor and expansion valve. The unit produces the required heating water where required for use in the building.



To suit a heating and cooling strategy the use of packaged VRF (Variable Refrigerant Flow) systems could be feasible. This consists of air-to-air heat pumps that operate in heating and cooling mode with inherent heat recovery where simultaneous heating and cooling exist.

COPs compared with ground source systems are often inferior due to the less stable temperature of atmospheric air compared with ground temperatures. However, air source heat pumps provide a very practical solution where the building footprint is limited or use of bore holes impractical. It provides far superior efficiencies to gas/oil fired appliances. ASHPs also provide a cost-effective solution.

The outdoor VRF heat recovery ASHP units provide heating and can be augmented with traditional gas fired modulating boilers. The capital cost is lower when compared to GSHP installations with similar capacities. Although they are only available on a relatively small scale, they can be installed in a modular arrangement to greatly increase their capacity.

Considerations:

- Pay back – a medium sized system with an overall COP of 3.1 could be expected to achieve a payback in a long-term timescale. If the system is small this will be higher, but a better COP could counteract this [depending on actual unit selection].
- Land Use - The ASHP plant would be installed at roof level or in a small compound on the ground.
- Local Planning Requirements – there are unlikely to be any issues with this technology provided a suitable screen is put in place and the units do not cause the height of the building outline to rise.
- Noise – External ASHP units generally emit noise ratings at around 68dB at 1 metre. If the architectural enclosure is of suitable material the noise generation will be within the limits stipulated in the planning submission external noise survey report.
- Export feasibility – this is a low-grade energy source and cannot therefore be transmitted any distance.
- Impact on carbon emissions – this only makes an impact on emissions when it is used in a heating and cooling application. Super high efficiency units, which provide heating only, are available as small-scale options.

5. Wind Turbines

Harvesting energy from the wind seems like a sensible and straight forward solution. But there are several factors which affect their operation and selection. Depending on the final application they can be medium scale of about 100kW.

There are two main forms of wind turbine, which are referred to by the attitude of the rotating axis:

Horizontal axis – these are the traditional ‘windmill’ type with two or three blades. Although less efficient than their ‘vertical’ cousins they are generally liked for their simplicity.

Vertical axis – these are more efficient because they can accept the wind from any direction, even when it is partly changeable. Typically, their blades are set vertically and only move in plan.



Choosing a good site for any turbine is essential. Wind conditions are affected by topography, and surface roughness, as well as the typical incidence of suitable wind speeds. Winds below 5m/s are of no use, and generally anything less than 7m/s is considered poor. Turbulence on the leeward side of a hill, or around tall buildings can play havoc with the blades, and in high winds most turbines must be stopped for safety. It is necessary to understand the application site in detail before recommending a wind turbine.

Even in rural areas the presence of bluff hillsides or mature trees will need to be carefully considered. Any wind turbine will need to be raised above such obstacles to experience free running conditions. Consequently, it is not possible to make any sensible decision to include a wind turbine in the generic design solution for the proposed building.

Considerations: -

- Payback – generally the small-scale units generate only modest levels of power, which lead to extremely high payback periods. Medium sized units can generate paybacks of about 38 years depending on selection and the application site.
- Land Use – A modest amount of land will be required for any wind turbine, even on its own. Horizontal axis units tend to need more space for the sweep of the blades, whereas vertical axis units tend to be more compact.
- Local Planning Requirements – turbines usually attract planning issues and can be the subject of a separate planning application. Blade ‘flicker’ and bird strike are common issues cited, though these are less problematic with the vertical axis units.
- Noise – Contrary to their larger early counterparts, most modern turbines are quiet in operation [other than the obvious wind noise]. Small units have no need of gear boxes which removes the associated noise, and modern designers are carefully to minimise any other sources.
- Export feasibility – the electricity can be easily exported to the grid using a G40 meter.
- Impact on carbon emissions – this can have a significant impact on emissions when correctly sited in a uniformly windy location.

6. Biomass Heating

Biomass heating is seen as a zero-carbon technology because it uses the closed loop of the carbon cycle. Taking the example of trees: we grow trees, cut them down, burn them, and the carbon is re-ingested by new trees, which provides carbon lock-up until they in turn are cut down for fuel. Provided we continue to plant trees, we are just tapping into this cycle, and not making it worse. It is not quite zero carbon because of transportation costs, but overall, it is close.



Supplies of biomass are changing all the time. Previously there was thought to be a surplus in forestry commission quotas, and some parts of the UK have invested heavily in Short Rotation Coppice crops (typically of willow). Networks such as EnviroLink seek to put buyers in touch with local suppliers. But the availability is patchy, and some suppliers rely on imports from Canada which is not sustainable.

Biomass can be provided from wood in three different forms: log, chip, and pellet. Logs are difficult to handle, and can involve de-gasifiers, so these will not be considered. Chip is a good source but does not lend itself to automation as readily as pellet due to the higher moisture content causing delivery systems to become clogged, higher moisture content will also affect the calorific value meaning less thermal energy will be produced for a similar quantity of fuel. Pellets are made by pressing chippings and dust into a pellet which is held together by the natural lignins squeezed out of the wood. Pellets are small and can therefore be transported easily. They can be blown into silos by delivery lorries, and automatically conveyed into the boiler in a reliable way. Ash can be removed by hand, or an automatic chain grate – but there is relatively little of it. The by-product is pot-ash which can be used as a fertilizer. There are many different types of boilers available now with all sorts of stoking systems available. The main problem for pellet is therefore in finding a reliable local source.

Considerations: -

- Payback – Biomass systems are more expensive to install, have higher maintenance costs associated with their plant and subject to unstable fuel supply costs. It is generally accepted that there is no realistic payback as the benefits are purely their low carbon contribution.
- Land Use – relatively small amounts of land are required. The boilers are generally little different from their gas fired counterparts. Only space for the silo might be an issue: this can be in a silo above the boiler level, or an adjacent room which uses an auger feed mechanism.
- Local Planning Requirements – there should not be any significant planning issues. The boiler has a flue much like any other, but the discharge will have to be carefully considered, especially in a residential area. Many are Clean Air Act exempt.
- Noise – there should be no noise issues associated with this technology.
- Export feasibility – high grade heat can be generated which can then be distributed within the locality. Long distance transmission is not usually viable though.
- Impact on carbon emissions – this can have a significant impact on the carbon emission of the heating system, however since electricity commands the larger share of a building's overall emissions it will not make a massive reduction.

Be Green Model Inputs

To reduce repetition, only input sheets which vary from the Be Lean model have been included here. Please assume all other input data remains the same

Project Name:	Atlas Park
Project Nr:	2628
Project Engineer:	Max Stephenson

System	Parameter
PVS Generator	PV array type
	Derive performance parameters from PV array type? yes
	PV module efficiency 0.17
	Reference irradiance for NOCT (W/m ²) 1000
	Nominal cell temp. [NOCT] [°C] 44
	Temp. Coefficient for module efficiency -0.37
	Degradation factor 0.99
	Shading factor 1
	Electrical conversion efficiency 0.96
	Area [m ²] 100
	Azimuth [° clockwise from North] 180
	Inclination [° from horizontal] 45
Wind Generator	Hub height [m]
	Rated power [kW]
CHP Generator	Fuel type
	Performance at rated output:
	Heat output [kW]
	Thermal efficiency
	power efficiency
	Performance at minimum output:
	Fraction of rated heat output
	Thermal efficiency
	power efficiency
	Profile for heat matching strategy

Notes

Cells shaded in light grey have drop down boxes for selections

Cells shaded in light purple are automatically copied or calculated

Cells shaded in Yellow are assumptions made at this stage of the assessment

Be Green Model BRUKL Report

Project name

Shell and Core

Unit 1 - Atlas Park (Be Green)

As designed

Date: Mon Jun 05 13:22:51 2023

Administrative information

Building Details

Address: Unit 1 - Atlas Park, ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.21

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.21

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

Certifier details

Name: Max Stephenson

Telephone number: Phone

Address: Street Address, City, Postcode

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	20.4
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	20.4
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	11.5
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	0.35	0.35	01000000:Surf[14]
Floor	0.25	0.25	0.25	01000001:Surf[0]
Roof	0.25	0.25	0.25	01000000:Surf[89]
Windows***, roof windows, and rooflights	2.2	1.5	1.5	01000000:Surf[88]
Personnel doors	2.2	-	-	No personnel doors in building
Vehicle access & similar large doors	1.5	1.5	1.5	01000000:Surf[69]
High usage entrance doors	3.5	-	-	No high usage entrance doors in building
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	3

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- HVAC 02: EPH EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- HVAC 01: EPH NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

3- HVAC 03: VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	3.5	0	-	0.75
Standard value	2.5*	2.6	N/A	N/A	0.5
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. For types <=12 kW output, refer to EN 14825 for limiting standards.

1- DHW 01: ASHP

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3.2	0.005
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

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			
01.00.01 WC	-	-	0.5	-	-	-	-	-	-	-	-	N/A
01.00.02 WC	-	-	0.5	-	-	-	-	-	-	-	-	N/A
01.00.03 Dis WC	-	-	0.5	-	-	-	-	-	-	-	-	N/A

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		
01.00.09 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
01.00.10 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A
01.00.11 Reception	-	-	-	1.6	-	-	-	-	-	-	N/A
01.01.02 Open Plan Office	-	-	-	1.6	-	-	-	-	-	-	N/A
01.01.03 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
01.01.04 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
01.01.05 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
01.01.08 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A
01.02.02 Open Plan Office	-	-	-	1.6	-	-	-	-	-	-	N/A
01.02.03 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
01.02.04 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
01.02.05 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
01.02.08 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
01.00.00 Unit 1 Warehouse	NO
01.00.01 WC	NO
01.00.02 WC	NO
01.00.03 Dis WC	NO
01.00.04 Circulation	NO
01.00.05 Stairs	NO
01.00.06 Store	NO
01.00.07 Warehouse Undercroft	NO
01.00.08 Cleaners	NO
01.00.09 WC	NO
01.00.10 Dis WC	NO
01.00.11 Reception	NO
01.01.00 Stairs	NO
01.01.01 Store	NO
01.01.02 Open Plan Office	NO
01.01.03 WC	NO
01.01.04 WC	NO
01.01.05 WC	NO
01.01.06 Lobby	NO
01.01.07 Circulation	NO
01.01.08 Dis WC	NO
01.02.00 Stairs	NO
01.02.01 Store	NO
01.02.02 Open Plan Office	NO
01.02.03 WC	NO
01.02.04 WC	NO
01.02.05 WC	NO
01.02.06 Lobby	NO
01.02.07 Circulation	NO

Shell and core configuration

Zone	Assumed shell?
01.02.08 Dis WC	NO

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
01.00.00 Unit 1 Warehouse		100	-	-	32160
01.00.01 WC		-	100	-	126
01.00.02 WC		-	100	-	130
01.00.03 Dis WC		-	100	-	40
01.00.04 Circulation		-	100	-	46
01.00.05 Stairs		-	100	-	40
01.00.06 Store		100	-	-	9
01.00.07 Warehouse Undercroft		100	-	-	981
01.00.08 Cleaners		100	-	-	3
01.00.09 WC		-	100	-	27
01.00.10 Dis WC		-	100	-	41
01.00.11 Reception		-	100	22	0
01.01.00 Stairs		-	100	-	40
01.01.01 Store		100	-	-	9
01.01.02 Open Plan Office		100	-	-	1453
01.01.03 WC		-	100	-	29
01.01.04 WC		-	100	-	29
01.01.05 WC		-	100	-	31
01.01.06 Lobby		-	100	-	26
01.01.07 Circulation		-	100	-	49
01.01.08 Dis WC		-	100	-	33
01.02.00 Stairs		-	100	-	40
01.02.01 Store		100	-	-	9
01.02.02 Open Plan Office		100	-	-	1453
01.02.03 WC		-	100	-	29
01.02.04 WC		-	100	-	29
01.02.05 WC		-	100	-	31
01.02.06 Lobby		-	100	-	26
01.02.07 Circulation		-	100	-	49
01.02.08 Dis WC		-	100	-	33

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?
01.00.00 Unit 1 Warehouse	YES (+12.6%)	NO
01.00.07 Warehouse Undercroft	NO (-40.9%)	NO
01.00.11 Reception	YES (+0%)	NO
01.01.02 Open Plan Office	NO (-48.3%)	NO
01.02.02 Open Plan Office	NO (-52.8%)	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?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	8248.9	8248.9
External area [m ²]	20354.5	20354.5
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	3	5
Average conductance [W/K]	8037.07	6476.23
Average U-value [W/m ² K]	0.39	0.32
Alpha value* [%]	10	10

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

Building Use

% Area Building Type

	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
100	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	2.4	1.61
Cooling	0.79	0.67
Auxiliary	0.74	0.58
Lighting	18.87	36.3
Hot water	1.51	1.66
Equipment*	42.78	42.78
TOTAL **	24.31	40.82

* 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	2.08	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]	21.13	16.08
Primary energy* [kWh/m ²]	74.63	119.74
Total emissions [kg/m ²]	11.5	20.4

* 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] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
Actual	245.8	0	68.3	0	0	1	0	1	0	
Notional	147.2	0	47.4	0	0	0.86	0	----	----	
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
Actual	187.4	0	52.1	0	22.5	1	0	1	0	
Notional	111.5	0	35.9	0	25.7	0.86	0	----	----	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
Actual	100.1	126.8	8.5	12.4	6.8	3.26	2.84	3.5	4	
Notional	46.4	143.6	5	10.5	3.6	2.56	3.79	----	----	
[ST] No Heating or Cooling										
Actual	0	0	0	0	0	0	0	0	0	
Notional	0	0	0	0	0	0	0	----	----	

Key to terms

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

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	0.35	01000001:Surf[1]
Floor	0.2	0.25	01000000:Surf[0]
Roof	0.15	0.25	01000000:Surf[89]
Windows, roof windows, and rooflights	1.5	1.5	01000000:Surf[1]
Personnel doors	1.5	-	No personnel doors in building
Vehicle access & similar large doors	1.5	1.5	01000000:Surf[69]
High usage entrance doors	1.5	-	No high usage entrance doors in building
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	3

Project name

Shell and Core

Unit 2 - Atlas Park (Be Green)

As designed

Date: Mon Jun 05 13:49:32 2023

Administrative information

Building Details

Address: Unit 2 - Atlas Park, ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.21

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.21

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

Certifier details

Name: Max Stephenson

Telephone number: Phone

Address: Street Address, City, Postcode

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	21.4
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	21.4
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	10.4
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	0.35	0.35	02000005:Surf[35]
Floor	0.25	0.25	0.25	02000000:Surf[0]
Roof	0.25	0.25	0.25	0200000D:Surf[33]
Windows***, roof windows, and rooflights	2.2	1.5	1.5	0200000D:Surf[32]
Personnel doors	2.2	-	-	No personnel doors in building
Vehicle access & similar large doors	1.5	1.5	1.5	02000006:Surf[2]
High usage entrance doors	3.5	-	-	No high usage entrance doors in building
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	3

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- HVAC 03: VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	3.5	0	-	0.75
Standard value	2.5*	2.6	N/A	N/A	0.5
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. For types <=12 kW output, refer to EN 14825 for limiting standards.					

2- HVAC 02: EPH EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

3- HVAC 01: EPH NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

1- DHW 01: ASHP

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3.2	0.005
Standard value	2*	N/A
* Standard shown is for all types except absorption and gas engine heat pumps.		

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			
02.00.00 Reception	-	-	-	1.6	-	-	-	-	-	-	-	N/A
02.00.02 Dis WC	-	-	0.5	-	-	-	-	-	-	-	-	N/A
02.00.03 WC	-	-	0.5	-	-	-	-	-	-	-	-	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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
02.01.02 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
02.01.03 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A
02.01.04 Open Plan Office	-	-	-	1.6	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
02.00.00 Reception	NO
02.00.02 Dis WC	NO
02.00.03 WC	NO
02.00.04 Cleaners	NO
02.00.05 Warehouse Undercroft	NO
02.00.06 Stairs	NO
02.00.07 Unit 2 Warehouse	NO
02.01.00 Circulation	NO
02.01.02 WC	NO
02.01.03 Dis WC	NO
02.01.04 Open Plan Office	NO
02.01.05 Stairs	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
02.00.00 Reception	-	100	22	0
02.00.02 Dis WC	-	100	-	41
02.00.03 WC	-	100	-	29
02.00.04 Cleaners	100	-	-	3
02.00.05 Warehouse Undercroft	100	-	-	792
02.00.06 Stairs	-	100	-	40
02.00.07 Unit 2 Warehouse	100	-	-	13609
02.01.00 Circulation	-	100	-	78
02.01.02 WC	-	100	-	28
02.01.03 Dis WC	-	100	-	44
02.01.04 Open Plan Office	100	-	-	1367
02.01.05 Stairs	-	100	-	58

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?
02.00.00 Reception	NO (-62.2%)	NO
02.00.05 Warehouse Undercroft	NO (-8%)	NO
02.00.07 Unit 2 Warehouse	YES (+11.4%)	NO
02.01.04 Open Plan Office	NO (-45%)	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?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	3543.6	3543.6
External area [m ²]	9145.2	9145.2
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	3	5
Average conductance [W/K]	3497.21	2894.35
Average U-value [W/m ² K]	0.38	0.32
Alpha value* [%]	10.01	10

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

Building Use

% Area	Building Type
	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
100	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	2.24	2.22
Cooling	0.67	0.64
Auxiliary	0.65	0.44
Lighting	19.87	37.9
Hot water	1.56	1.67
Equipment*	42.78	42.78
TOTAL **	24.98	42.87

* 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	4.85	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]	20.28	18.73
Primary energy* [kWh/m ²]	76.68	125.07
Total emissions [kg/m ²]	10.4	21.4

* 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] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
Actual	274.1	0	76.1	0	0	1	0	1	0	
Notional	273.9	0	88.2	0	0	0.86	0	----	----	
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
Actual	131.8	0	36.6	0	28.2	1	0	1	0	
Notional	70.9	0	22.8	0	32.1	0.86	0	----	----	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
Actual	107.7	94.2	9.2	9.2	6.9	3.26	2.84	3.5	4	
Notional	63.3	121.4	6.9	8.9	3.7	2.56	3.79	----	----	
[ST] No Heating or Cooling										
Actual	0	0	0	0	0	0	0	0	0	
Notional	0	0	0	0	0	0	0	----	----	

Key to terms

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

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	0.35	02000000:Surf[10]
Floor	0.2	0.25	02000005:Surf[0]
Roof	0.15	0.25	0200000D:Surf[33]
Windows, roof windows, and rooflights	1.5	1.5	02000000:Surf[1]
Personnel doors	1.5	-	No personnel doors in building
Vehicle access & similar large doors	1.5	1.5	02000006:Surf[2]
High usage entrance doors	1.5	-	No high usage entrance doors in building
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	3

Project name

Shell and Core

Unit 3 - Atlas Park (Be Green)

As designed

Date: Mon Jun 05 13:53:53 2023

Administrative information

Building Details

Address: Unit 3 - Atlas Park, ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.21

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.21

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

Certifier details

Name: Max Stephenson

Telephone number: Phone

Address: Street Address, City, Postcode

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	20.8
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	20.8
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	10.4
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	0.35	0.35	0300000E:Surf[9]
Floor	0.25	0.25	0.25	03000001:Surf[0]
Roof	0.25	0.25	0.25	0300000E:Surf[48]
Windows***, roof windows, and rooflights	2.2	1.5	1.5	0300000E:Surf[47]
Personnel doors	2.2	-	-	No personnel doors in building
Vehicle access & similar large doors	1.5	1.5	1.5	0300000E:Surf[1]
High usage entrance doors	3.5	-	-	No high usage entrance doors in building
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	3

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- HVAC 01: EPH NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- HVAC 03: VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	3.5	0	-	0.75
Standard value	2.5*	2.6	N/A	N/A	0.5
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. For types <=12 kW output, refer to EN 14825 for limiting standards.

3- HVAC 02: EPH EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

1- DHW 01: ASHP

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3.2	0.005
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

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			
03.00.03 Reception	-	-	-	1.6	-	-	-	-	-	-	-	N/A
03.00.04 WC	-	-	0.5	-	-	-	-	-	-	-	-	N/A
03.00.06 Dis WC	-	-	0.5	-	-	-	-	-	-	-	-	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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
03.01.01 Open Plan Office	-	-	-	1.6	-	-	-	-	-	-	N/A
03.01.03 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A
03.01.04 WC	-	-	0.5	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
03.00.00 Unit 3 Warehouse	NO
03.00.01 Stairs	NO
03.00.02 Warehouse Undercroft	NO
03.00.03 Reception	NO
03.00.04 WC	NO
03.00.05 Cleaners	NO
03.00.06 Dis WC	NO
03.01.00 Stairs	NO
03.01.01 Open Plan Office	NO
03.01.02 Circulation	NO
03.01.03 Dis WC	NO
03.01.04 WC	NO

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
Standard value	60	60	22		
03.00.00 Unit 3 Warehouse	100	-	-		18502
03.00.01 Stairs	-	100	-		39
03.00.02 Warehouse Undercroft	100	-	-		782
03.00.03 Reception	-	100	22		0
03.00.04 WC	-	100	-		31
03.00.05 Cleaners	100	-	-		3
03.00.06 Dis WC	-	100	-		41
03.01.00 Stairs	-	100	-		57
03.01.01 Open Plan Office	100	-	-		1354
03.01.02 Circulation	-	100	-		77
03.01.03 Dis WC	-	100	-		44
03.01.04 WC	-	100	-		30

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?
03.00.00 Unit 3 Warehouse	YES (+11.1%)	NO
03.00.02 Warehouse Undercroft	NO (-27.5%)	NO
03.00.03 Reception	NO (-68.3%)	NO
03.01.01 Open Plan Office	NO (-48.4%)	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?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	4654.3	4654.3
External area [m ²]	11999.7	11999.7
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	3	5
Average conductance [W/K]	4577.98	3767.26
Average U-value [W/m ² K]	0.38	0.31
Alpha value* [%]	10	10

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

Building Use

% Area	Building Type
	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
100	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	1.7	1.66
Cooling	0.46	0.47
Auxiliary	0.49	0.33
Lighting	19.53	37.41
Hot water	1.55	1.68
Equipment*	43.04	43.04
TOTAL **	23.74	41.56

* 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	3.69	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]	14.98	13.94
Primary energy* [kWh/m ²]	72.87	121.98
Total emissions [kg/m ²]	10.4	20.8

* 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] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
Actual	282.2	0	78.4	0	0	1	0	1	0	
Notional	276.6	0	89.1	0	0	0.86	0	----	----	
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
Actual	133.1	0	37	0	28.2	1	0	1	0	
Notional	72.8	0	23.5	0	32.2	0.86	0	----	----	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
Actual	109.8	86.6	9.3	8.5	6.9	3.26	2.84	3.5	4	
Notional	64.5	118.6	7	8.7	3.7	2.56	3.79	----	----	
[ST] No Heating or Cooling										
Actual	0	0	0	0	0	0	0	0	0	
Notional	0	0	0	0	0	0	0	----	----	

Key to terms

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

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	0.35	03000001:Surf[2]
Floor	0.2	0.25	0300000E:Surf[0]
Roof	0.15	0.25	0300000E:Surf[48]
Windows, roof windows, and rooflights	1.5	1.5	0300000E:Surf[12]
Personnel doors	1.5	-	No personnel doors in building
Vehicle access & similar large doors	1.5	1.5	0300000E:Surf[1]
High usage entrance doors	1.5	-	No high usage entrance doors in building
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	3

Project name

Shell and Core

Unit 4 - Atlas Park (Be Green)

As designed

Date: Mon Jun 05 14:26:27 2023

Administrative information**Building Details**

Address: Unit 4 - Atlas Park, ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.21

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.21

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

Certifier details

Name: Max Stephenson

Telephone number: Phone

Address: Street Address, City, Postcode

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	20.6
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	20.6
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	11.4
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	0.35	0.35	04000000:Surf[13]
Floor	0.25	0.25	0.25	04000002:Surf[0]
Roof	0.25	0.25	0.25	04000000:Surf[66]
Windows***, roof windows, and rooflights	2.2	1.5	1.5	04000000:Surf[65]
Personnel doors	2.2	-	-	No personnel doors in building
Vehicle access & similar large doors	1.5	1.5	1.5	04000000:Surf[1]
High usage entrance doors	3.5	-	-	No high usage entrance doors in building
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	3

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- HVAC 02: EPH EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- HVAC 03: VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	3.5	0	-	0.75
Standard value	2.5*	2.6	N/A	N/A	0.5
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. For types <=12 kW output, refer to EN 14825 for limiting standards.

3- HVAC 01: EPH NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

1- DHW 01: ASHP

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3.2	0.005
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

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			
04.00.03 WC	-	-	0.5	-	-	-	-	-	-	-	-	N/A
04.00.04 Dis WC	-	-	0.5	-	-	-	-	-	-	-	-	N/A
04.00.05 Reception	-	-	-	1.6	-	-	-	-	-	-	-	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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard	
04.01.00 Open Plan Office	-	-	-	1.6	-	-	-	-	-	-	N/A	
04.01.02 WC	-	-	0.5	-	-	-	-	-	-	-	N/A	
04.01.03 WC	-	-	0.5	-	-	-	-	-	-	-	N/A	
04.01.04 WC	-	-	0.5	-	-	-	-	-	-	-	N/A	
04.01.05 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A	
04.02.00 Open Plan Office	-	-	-	1.6	-	-	-	-	-	-	N/A	
04.02.02 WC	-	-	0.5	-	-	-	-	-	-	-	N/A	
04.02.03 WC	-	-	0.5	-	-	-	-	-	-	-	N/A	
04.02.04 WC	-	-	0.5	-	-	-	-	-	-	-	N/A	
04.02.05 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A	

Shell and core configuration

Zone	Assumed shell?
04.00.00 Unit 4 Warehouse	NO
04.00.01 Warehouse Undercroft	NO
04.00.03 WC	NO
04.00.04 Dis WC	NO
04.00.05 Reception	NO
04.00.07 Store	NO
04.00.08 Stairs	NO
04.01.00 Open Plan Office	NO
04.01.01 Circulation	NO
04.01.02 WC	NO
04.01.03 WC	NO
04.01.04 WC	NO
04.01.05 Dis WC	NO
04.01.07 Store	NO
04.01.08 Stairs	NO
04.02.00 Open Plan Office	NO
04.02.01 Circulation	NO
04.02.02 WC	NO
04.02.03 WC	NO
04.02.04 WC	NO
04.02.05 Dis WC	NO
04.02.07 Store	NO
04.02.08 Stairs	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
04.00.00 Unit 4 Warehouse	100	-	-	25560
04.00.01 Warehouse Undercroft	100	-	-	1416
04.00.03 WC	-	100	-	30

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
04.00.04 Dis WC		-	100	-	41
04.00.05 Reception		-	100	22	0
04.00.07 Store		100	-	-	9
04.00.08 Stairs		-	100	-	43
04.01.00 Open Plan Office		100	-	-	1945
04.01.01 Circulation		-	100	-	86
04.01.02 WC		-	100	-	27
04.01.03 WC		-	100	-	27
04.01.04 WC		-	100	-	27
04.01.05 Dis WC		-	100	-	32
04.01.07 Store		100	-	-	9
04.01.08 Stairs		-	100	-	43
04.02.00 Open Plan Office		100	-	-	2042
04.02.01 Circulation		-	100	-	111
04.02.02 WC		-	100	-	27
04.02.03 WC		-	100	-	27
04.02.04 WC		-	100	-	27
04.02.05 Dis WC		-	100	-	33
04.02.07 Store		100	-	-	10
04.02.08 Stairs		-	100	-	55

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?
04.00.00 Unit 4 Warehouse	YES (+11.3%)	NO
04.00.01 Warehouse Undercroft	NO (-15.8%)	NO
04.00.05 Reception	NO (-34.8%)	NO
04.01.00 Open Plan Office	NO (-29.1%)	NO
04.02.00 Open Plan Office	NO (-26.6%)	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?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	6945.3	6945.3
External area [m ²]	17430.9	17430.9
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	3	5
Average conductance [W/K]	6800.53	5570.25
Average U-value [W/m ² K]	0.39	0.32
Alpha value* [%]	10.01	10

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

Building Use

% Area	Building Type
	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
100	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	2.33	2.06
Cooling	0.93	0.83
Auxiliary	0.79	0.5
Lighting	18.8	36.25
Hot water	1.52	1.67
Equipment*	42.95	42.95
TOTAL **	24.36	41.31

* 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	2.48	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]	23.02	20.49
Primary energy* [kWh/m ²]	74.78	120.6
Total emissions [kg/m ²]	11.4	20.6

* 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 SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
Actual	271.7	0	75.5	0	0	1	0	1	0	
Notional	229.4	0	73.9	0	0	0.86	0	----	----	
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
Actual	66.7	0	18.5	0	25.8	1	0	1	0	
Notional	26.3	0	8.5	0	29.4	0.86	0	----	----	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
Actual	76.6	96.8	6.5	9.5	6.7	3.26	2.84	3.5	4	
Notional	42.9	115.8	4.7	8.5	3.6	2.56	3.79	----	----	
[ST] No Heating or Cooling										
Actual	0	0	0	0	0	0	0	0	0	
Notional	0	0	0	0	0	0	0	----	----	

Key to terms

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

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	0.35	04000005:Surf[13]
Floor	0.2	0.25	04000000:Surf[0]
Roof	0.15	0.25	04000000:Surf[66]
Windows, roof windows, and rooflights	1.5	1.5	04000000:Surf[20]
Personnel doors	1.5	-	No personnel doors in building
Vehicle access & similar large doors	1.5	1.5	04000000:Surf[1]
High usage entrance doors	1.5	-	No high usage entrance doors in building
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	3

Project name

Shell and Core

Unit 5 - Atlas Park (Be Green)

As designed

Date: Mon Jun 05 14:33:09 2023

Administrative information

Building Details

Address: Unit 5 - Atlas Park, ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.21

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.21

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

Certifier details

Name: Max Stephenson

Telephone number: Phone

Address: Street Address, City, Postcode

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	19.8
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	19.8
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	11.3
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	0.35	0.35	0500000D:Surf[26]
Floor	0.25	0.25	0.25	05000001:Surf[0]
Roof	0.25	0.25	0.25	05000001:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.5	1.5	0500000D:Surf[98]
Personnel doors	2.2	-	-	No personnel doors in building
Vehicle access & similar large doors	1.5	1.5	1.5	05000005:Surf[1]
High usage entrance doors	3.5	-	-	No high usage entrance doors in building
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	3

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- HVAC 02: EPH EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- HVAC 01: EPH NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

3- HVAC 03: VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	3.5	0	-	0.75
Standard value	2.5*	2.6	N/A	N/A	0.5
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. For types <=12 kW output, refer to EN 14825 for limiting standards.

1- DHW 01: ASHP

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3.2	0.005
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

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			
05.00.01 Male WC	-	-	0.5	-	-	-	-	-	-	-	-	N/A
05.00.02 Female WC	-	-	0.5	-	-	-	-	-	-	-	-	N/A
05.00.03 Dis WC	-	-	0.5	-	-	-	-	-	-	-	-	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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
05.00.08 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
05.00.09 Reception	-	-	-	1.6	-	-	-	-	-	-	N/A
05.00.11 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A
05.01.02 Open Plan Office	-	-	-	1.6	-	-	-	-	-	-	N/A
05.01.05 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A
05.01.06 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
05.01.08 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
05.01.09 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
05.02.02 Open Plan Office	-	-	-	1.6	-	-	-	-	-	-	N/A
05.02.05 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A
05.02.06 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
05.02.08 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
05.02.09 WC	-	-	0.5	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
05.00.01 Male WC	NO
05.00.02 Female WC	NO
05.00.03 Dis WC	NO
05.00.04 Circulation	NO
05.00.05 Stairs	NO
05.00.06 Store	NO
05.00.07 Cleaners	NO
05.00.08 WC	NO
05.00.09 Reception	NO
05.00.11 Dis WC	NO
05.01.00 Stairs	NO
05.01.01 Store	NO
05.01.02 Open Plan Office	NO
05.01.03 Circulation	NO
05.01.05 Dis WC	NO
05.01.06 WC	NO
05.01.07 Circulation	NO
05.01.08 WC	NO
05.01.09 WC	NO
05.02.00 Stairs	NO
05.02.01 Store	NO
05.02.02 Open Plan Office	NO
05.02.03 Circulation	NO
05.02.05 Dis WC	NO
05.02.06 WC	NO
05.02.07 Circulation	NO
05.02.08 WC	NO
05.02.09 WC	NO
05.00.00 Unit 5 Warehouse	NO

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
05.00.01 Male WC		-	100	-	130
05.00.02 Female WC		-	100	-	129
05.00.03 Dis WC		-	100	-	41
05.00.04 Circulation		-	100	-	44
05.00.05 Stairs		-	100	-	41
05.00.06 Store		100	-	-	9
05.00.07 Cleaners		100	-	-	4
05.00.08 WC		-	100	-	29
05.00.09 Reception		-	100	22	0
05.00.11 Dis WC		-	100	-	41
05.01.00 Stairs		-	100	-	41
05.01.01 Store		100	-	-	9
05.01.02 Open Plan Office		100	-	-	1989
05.01.03 Circulation		-	100	-	64
05.01.05 Dis WC		-	100	-	32
05.01.06 WC		-	100	-	28
05.01.07 Circulation		-	100	-	20
05.01.08 WC		-	100	-	28
05.01.09 WC		-	100	-	28
05.02.00 Stairs		-	100	-	41
05.02.01 Store		100	-	-	9
05.02.02 Open Plan Office		100	-	-	1989
05.02.03 Circulation		-	100	-	64
05.02.05 Dis WC		-	100	-	32
05.02.06 WC		-	100	-	28
05.02.07 Circulation		-	100	-	20
05.02.08 WC		-	100	-	28
05.02.09 WC		-	100	-	28
05.00.00 Unit 5 Warehouse		100	-	-	57367

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?
05.00.09 Reception	NO (-16.2%)	NO
05.01.02 Open Plan Office	NO (-54.2%)	NO
05.02.02 Open Plan Office	NO (-50.8%)	NO
05.00.00 Unit 5 Warehouse	YES (+22.5%)	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?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	13983.4	13983.4
External area [m ²]	34257.5	34257.5
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	3	3
Average conductance [W/K]	13616	11022.5
Average U-value [W/m ² K]	0.4	0.32
Alpha value* [%]	10	10

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

Building Use

% Area Building Type

	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
100	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	1.83	1.23
Cooling	0.7	0.55
Auxiliary	0.52	0.39
Lighting	18.43	35.55
Hot water	1.51	1.68
Equipment*	43.2	43.2
TOTAL**	23	39.41

* 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	1.23	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]	17.58	13.18
Primary energy* [kWh/m ²]	70.6	116.17
Total emissions [kg/m ²]	11.3	19.8

* 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 SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
Actual	269.2	0	74.8	0	0	1	0	1	0	
Notional	156.9	0	50.5	0	0	0.86	0	----	----	
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
Actual	233.3	0	64.8	0	22.5	1	0	1	0	
Notional	142.8	0	46	0	25.7	0.86	0	----	----	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
Actual	109.9	144.1	9.4	14.1	6.7	3.26	2.84	3.5	4	
Notional	54	151.9	5.9	11.1	3.6	2.56	3.79	----	----	
[ST] No Heating or Cooling										
Actual	0	0	0	0	0	0	0	0	0	
Notional	0	0	0	0	0	0	0	----	----	

Key to terms

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

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	0.35	05000001:Surf[2]
Floor	0.2	0.25	0500000D:Surf[0]
Roof	0.15	0.25	05000001:Surf[1]
Windows, roof windows, and rooflights	1.5	1.5	05000009:Surf[1]
Personnel doors	1.5	-	No personnel doors in building
Vehicle access & similar large doors	1.5	1.5	05000005:Surf[1]
High usage entrance doors	1.5	-	No high usage entrance doors in building
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	3

