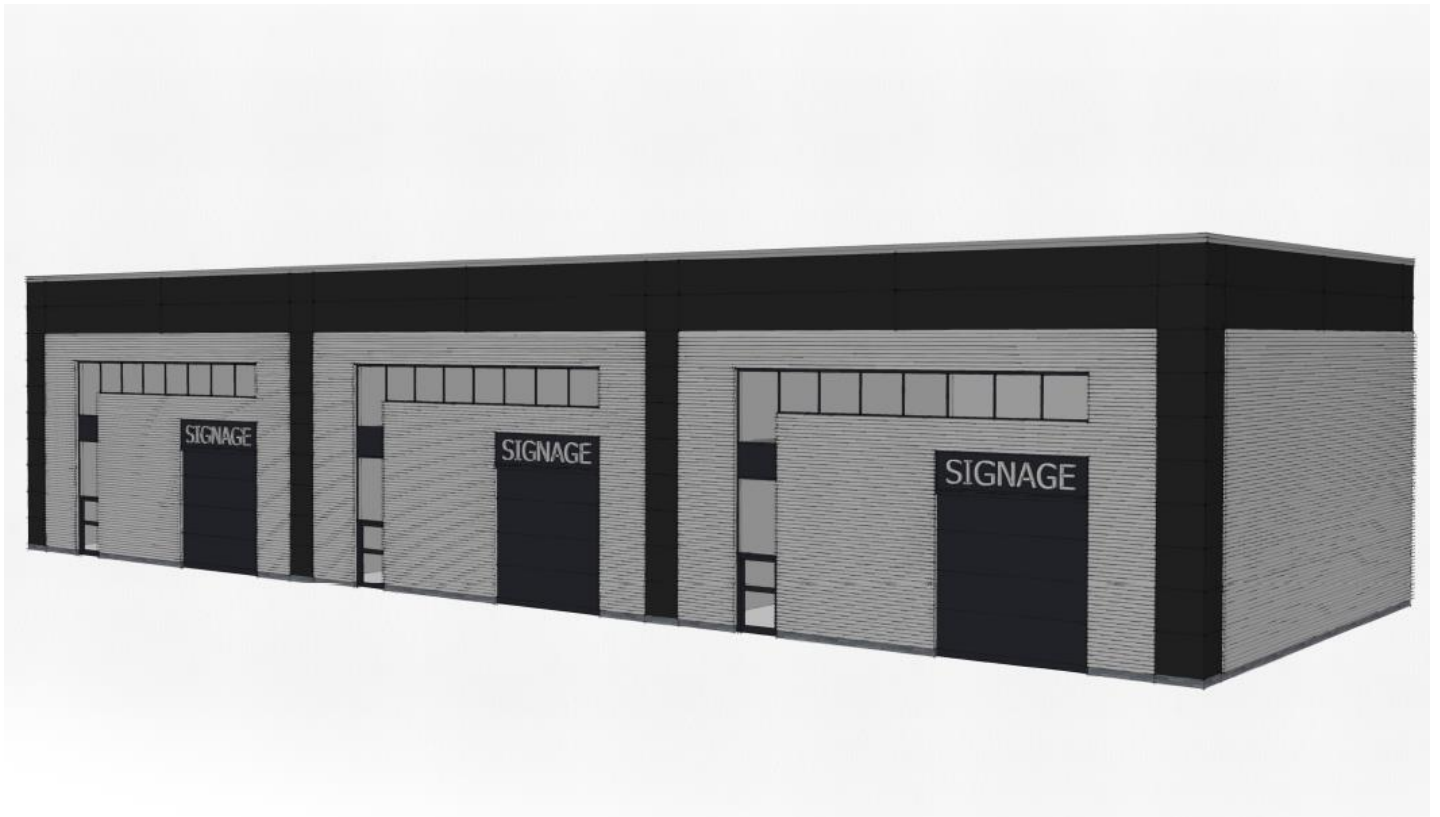




BUILDING
SERVICES DESIGN



ASHBROOK BUSINESS PARK HEALD GREEN, MANCHESTER

SUSTAINABILITY ENERGY & LZC FEASIBILITY STATEMENT – SHELL & CORE

(Revision 01)

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PROJECT INFORMATION

JOB TITLE	Ashbrook Park Heald Green
PROJECT NO.	210540
DOC TITLE	Ashbrook Business Park– Sustainability Energy & LZC Statement.
VERSION	01
FILE NAME	210540 – Ashbrook Park – Energy Statement

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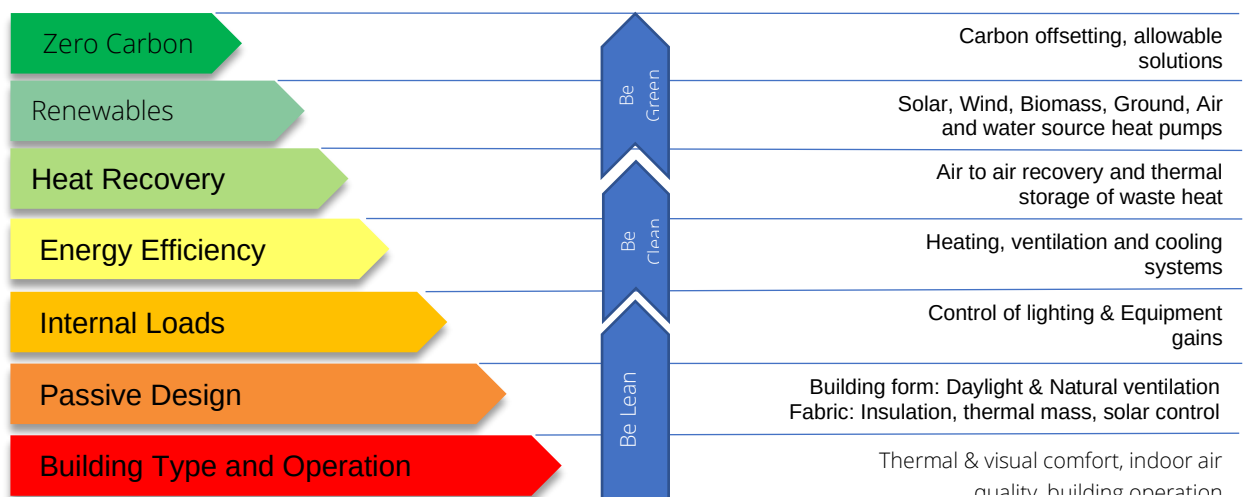
1.0 Introduction

SVM Building Services Design Ltd have been appointed by Calderpeel Architects, to develop the energy strategy for a warehouse development, shell & core design at Heald Green, Manchester – 4 Units located off Longstone Road.

Analysis of the building performance has been performed by creating a dynamic thermal model using an accredited simulation tool to guidance set out in CIBSE's (AM11, 2015).

This report identifies opportunities for passive design measures that will reduce the demand of energy consuming building services. The study will include analysis of free cooling technologies where appropriate and consider the feasibility of different low and/or zero carbon technologies applicable to the new development. Finally, the assessment will create a thermal model to establish the energy performance of the building. The thermal model and dynamic simulation will use national calculation methodology to compare the actual building to the part L 2013 notional building performance.

The aim of this study is to develop an energy strategy for the building using a hierarchy approach of reducing energy demand, applying efficient building services and finally utilising decentralised and/or renewable energy sources where appropriate.



The analysis uses detailed dynamic simulation. The geometry models were created using Calderpeel Architects drawings received 28.07.21. They were used to create the thermal model to assess the energy performance of the building. An IES-VE dynamic thermal model has been developed using software Version 2021.1.1.0, VE Compliance 7.0.13.0 with BRUKL compliance check version v5.6.b.0 to assess the performance of the design. The dynamic model has been used to validate the design against Approved Document L2A of the Building Regulations.

As the author of this report I am a fully certified CIBSE low carbon energy assessor and hold the following qualifications: Low carbon energy assessor (level 3, 4 & 5) for the production of Energy Performance Certificates to meet the requirements of the Energy Performance of Buildings Regulations in England, Wales and Northern Ireland. Low Carbon building design to comply with the building regulations and the EPBD in the United Kingdom. Computer software for the simulated evaluation of environmental performance of buildings related to building regulations in the United Kingdom. Ben Tysoe Certificate No. LCEA12623.

1.1 Energy and CO2 emission targets and aspirations

1.1.1 Building Regulations

The proposed building is required to meet the requirements of Part L2A 2013 of the building regulations. The building regulation document sets out minimum building fabric and services standards, limitations on the amount of acceptable solar gain and a Target CO2 Emission Rate (TER) that must not be exceeded by the actual Building Emission Rate (BER).

Building Control bodies in the UK will require evidence that the building complies with the five criteria set out in Approved Document L2A (2013), both at design stage and once built.

Approved Document L2A criteria:

Compliance with the Approved Document L2A for new non-dwellings is demonstrated by meeting the following five separate criteria [1]:

- Criterion 1: Predicted carbon dioxide emissions from the proposed building do not exceed the target emissions rating.
- Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits.
- Criterion 3: The building has appropriate passive control measures to limit solar gains in summer.
- Criterion 4: The performance of the building, as built, is consistent with the building emissions rating due to quality of construction and commissioning.
- Criterion 5: Providing information (building logbook).

This report assesses compliance with criteria 1 (BER/TER) and criteria 3 (solar gain check) of Part L2A of the building regulations. The Part L analysis is the “as designed” assessment and does not form the “as-built” Part L2A 2013 compliance report to be submitted to building control.

1.2 Local Planning Policy

Manchester's local development framework Core Strategy Development Plan Document (adopted 11th July 2012) sets out the following planning policies promoting energy efficiency and low and zero carbon technology

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

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.

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.

Target 3 is applicable to this development

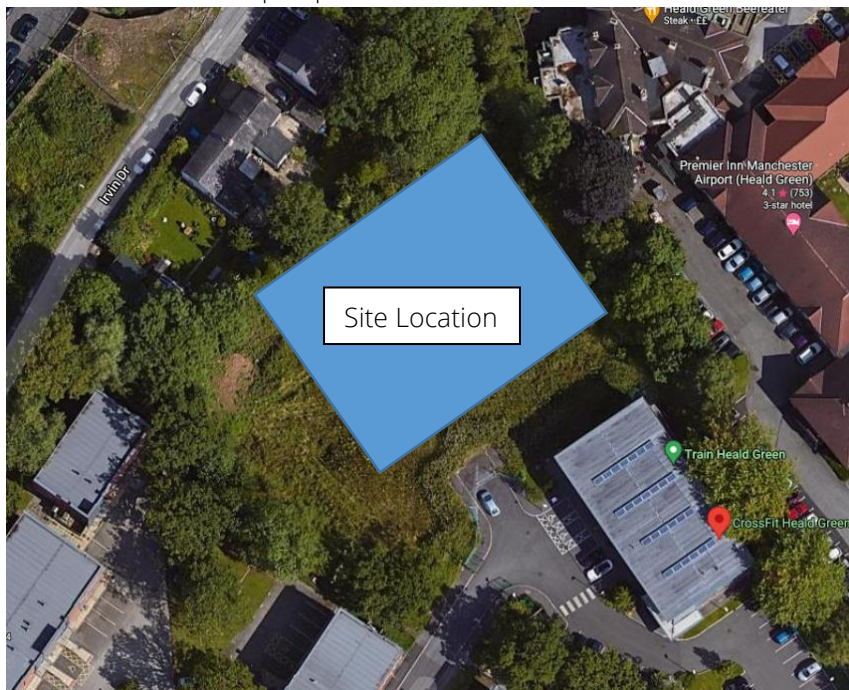
Non-domestic CO ₂ emissions reduction targets	
Table 12.2	
Target	% Minimum requirement
Target 1: Network development area	CHP/district heating anchor or connection or where not feasible, a 15% increase on Part L 2010
Target 2: Electricity intense buildings (Applies to commercial uses with a high proportion 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

Target 3 is applicable to this development Since the publication of the planning document part L of the building regulations have been updated to 2013 version providing a 9% improvement on aggregate over 2010 targets, therefore a CO₂ reduction of 6% against the PartL 2013 Building Regulations is required to fulfill the planning policy.

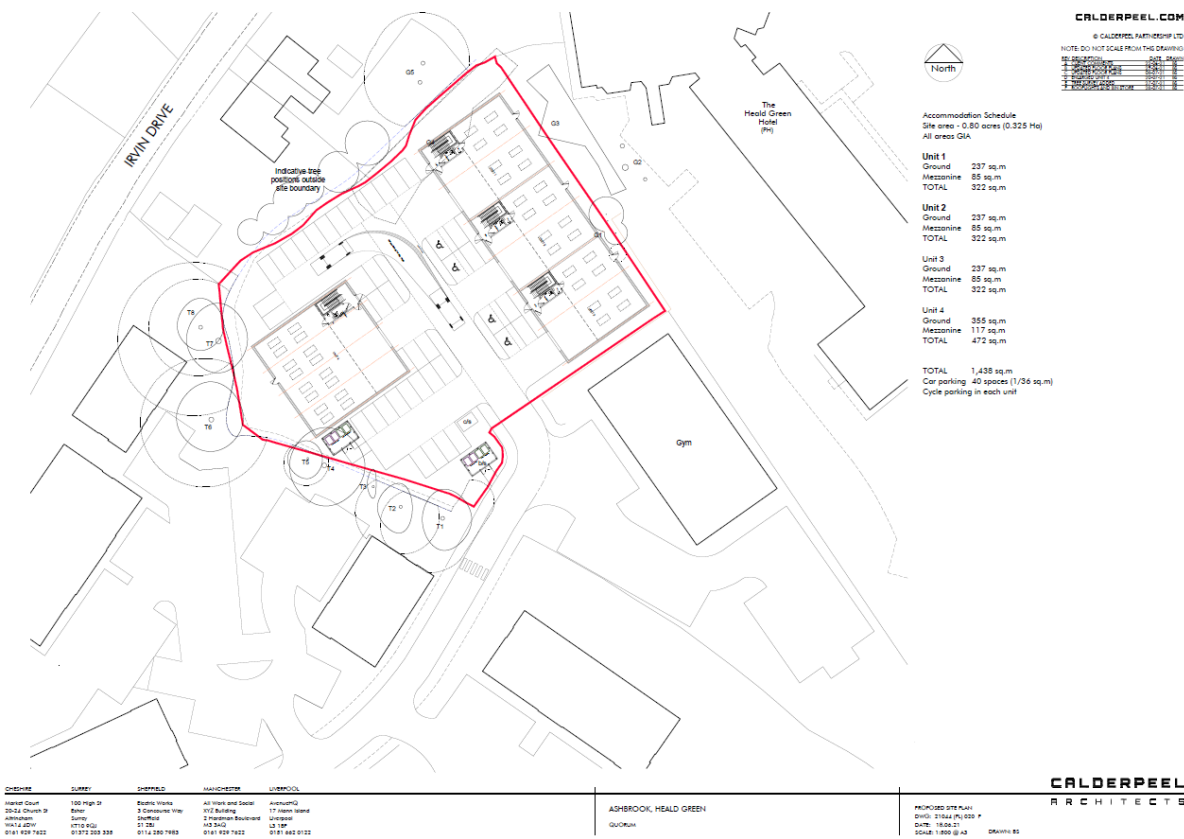
1.3 Site Proposals

The proposed development consists of a 4 No Warehouse units each consisting of

- Warehouse area,
- Circulation
- WC's
- Mezzanine open plan office

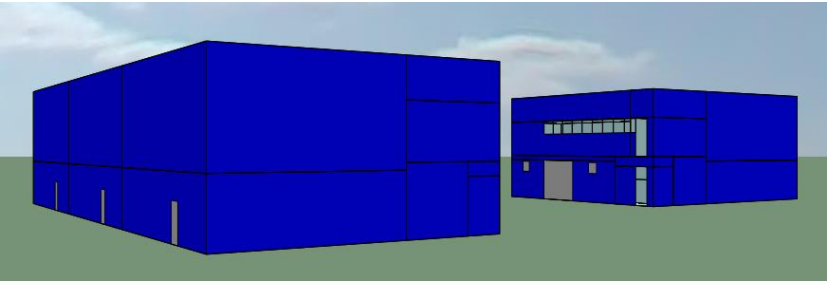


Proposed Site Plan

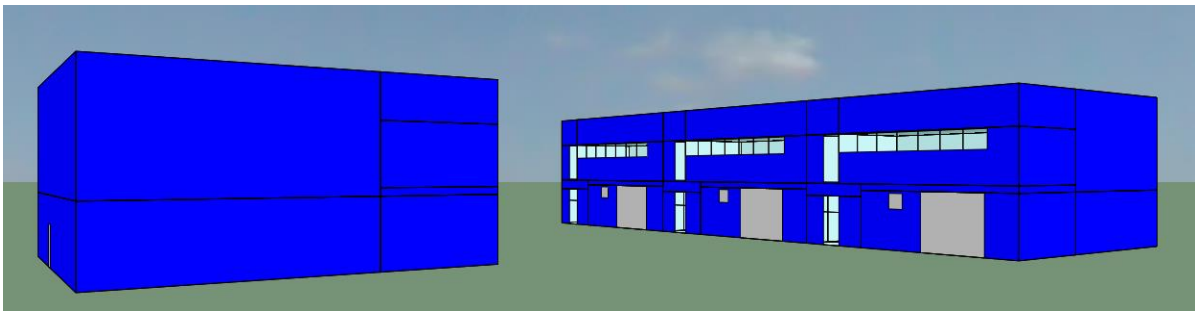


1.4 Model Images

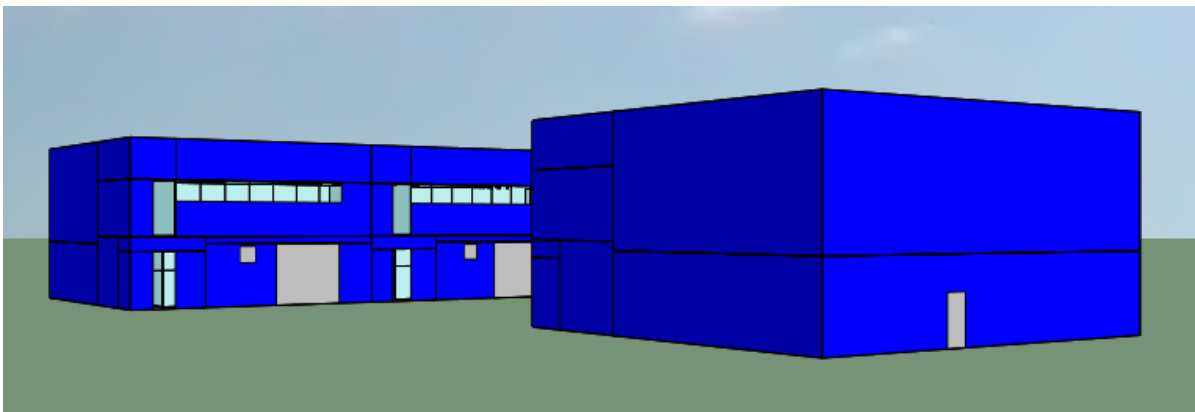
North View



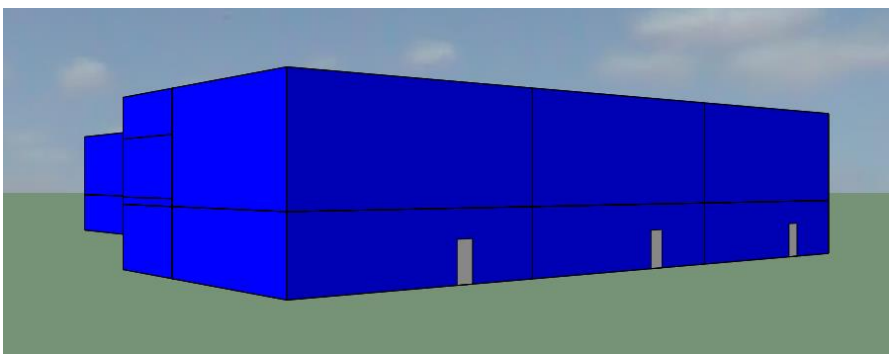
South View



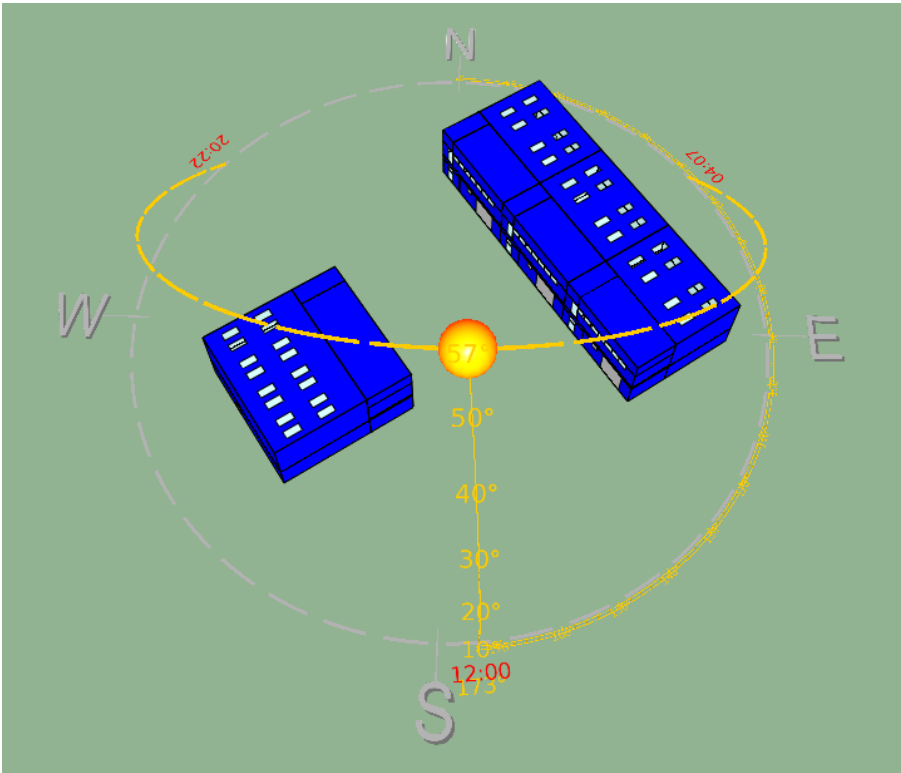
West View



East View



Solar overview (July 16th 12:00)



2.0 Building Information

2.1 Location Data

Building type: B8: Warehouse/storage (Warehouse)

Weather Location: Manchester Test Reference Year 05 for Part L2 compliance

2.2 Building Data

The geometry models were created using Calderpeel Architects drawings received 28.07.13.

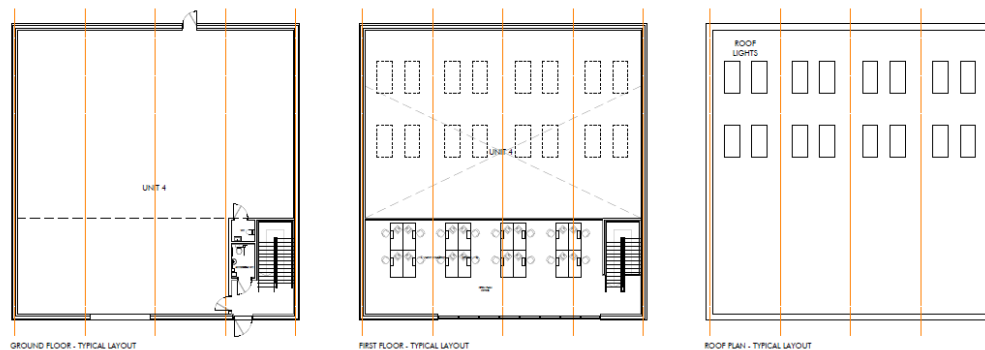
- 21044 (PL) 110 A – Proposed Floor Plans Unit 4
- 21044 (PL) 120 A – Proposed Floor Plans Unit 1-3
- 21044 (PL) 200 A – Proposed Elevations Units 1-3
- 21044 (PL) 210 B – Proposed Elevations Unit 4
- 21044 (PL) 020 F – Proposed Site Plan

The FFL to suspended ceiling height was modelled to 3.2m.

Proposed Floor Layout

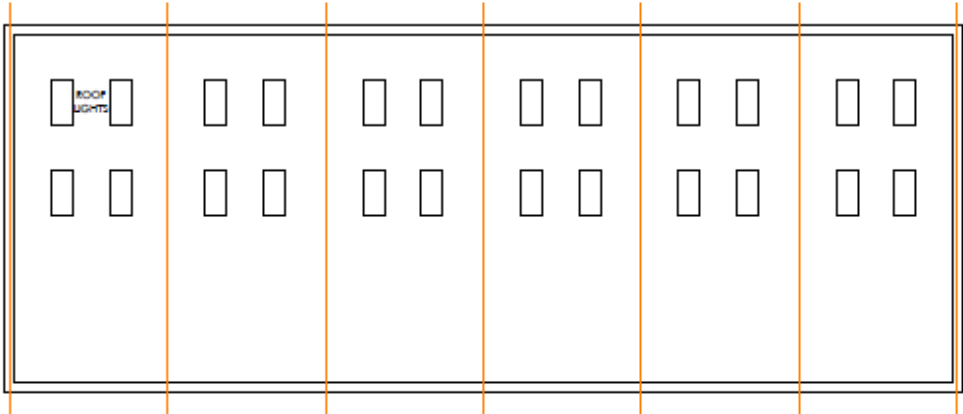
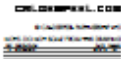
Unit 4 –

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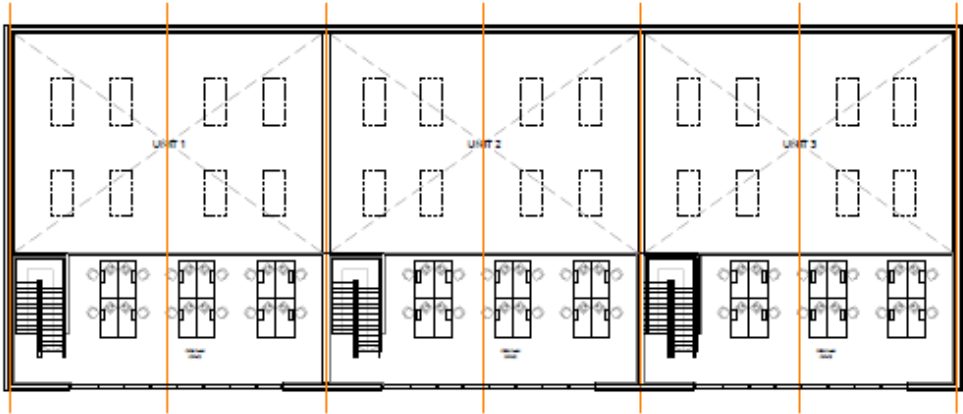


REVISIONS				PROJECT INFORMATION		CLIENT INFORMATION		
NO.	DATE	DESCRIPTION	BY	PROJECT NAME	LOCATION	CLIENT NAME	CLIENT ADDRESS	
01	28.07.13	ISSUED FOR PERMIT	CA	ASHBROOK HEALD GREEN	MANCHESTER	MANCHESTER ROOFING UNIT 4	100, 102, 104, 106, 108, 110, 112, 114, 116, 118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 138, 140, 142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186, 188, 190, 192, 194, 196, 198, 200, 202, 204, 206, 208, 210, 212, 214, 216, 218, 220, 222, 224, 226, 228, 230, 232, 234, 236, 238, 240, 242, 244, 246, 248, 250, 252, 254, 256, 258, 260, 262, 264, 266, 268, 270, 272, 274, 276, 278, 280, 282, 284, 286, 288, 290, 292, 294, 296, 298, 300, 302, 304, 306, 308, 310, 312, 314, 316, 318, 320, 322, 324, 326, 328, 330, 332, 334, 336, 338, 340, 342, 344, 346, 348, 350, 352, 354, 356, 358, 360, 362, 364, 366, 368, 370, 372, 374, 376, 378, 380, 382, 384, 386, 388, 390, 392, 394, 396, 398, 400, 402, 404, 406, 408, 410, 412, 414, 416, 418, 420, 422, 424, 426, 428, 430, 432, 434, 436, 438, 440, 442, 444, 446, 448, 450, 452, 454, 456, 458, 460, 462, 464, 466, 468, 470, 472, 474, 476, 478, 480, 482, 484, 486, 488, 490, 492, 494, 496, 498, 500, 502, 504, 506, 508, 510, 512, 514, 516, 518, 520, 522, 524, 526, 528, 530, 532, 534, 536, 538, 540, 542, 544, 546, 548, 550, 552, 554, 556, 558, 560, 562, 564, 566, 568, 570, 572, 574, 576, 578, 580, 582, 584, 586, 588, 590, 592, 594, 596, 598, 600, 602, 604, 606, 608, 610, 612, 614, 616, 618, 620, 622, 624, 626, 628, 630, 632, 634, 636, 638, 640, 642, 644, 646, 648, 650, 652, 654, 656, 658, 660, 662, 664, 666, 668, 670, 672, 674, 676, 678, 680, 682, 684, 686, 688, 690, 692, 694, 696, 698, 700, 702, 704, 706, 708, 710, 712, 714, 716, 718, 720, 722, 724, 726, 728, 730, 732, 734, 736, 738, 740, 742, 744, 746, 748, 750, 752, 754, 756, 758, 760, 762, 764, 766, 768, 770, 772, 774, 776, 778, 780, 782, 784, 786, 788, 790, 792, 794, 796, 798, 800, 802, 804, 806, 808, 810, 812, 814, 816, 818, 820, 822, 824, 826, 828, 830, 832, 834, 836, 838, 840, 842, 844, 846, 848, 850, 852, 854, 856, 858, 860, 862, 864, 866, 868, 870, 872, 874, 876, 878, 880, 882, 884, 886, 888, 890, 892, 894, 896, 898, 900, 902, 904, 906, 908, 910, 912, 914, 916, 918, 920, 922, 924, 926, 928, 930, 932, 934, 936, 938, 940, 942, 944, 946, 948, 950, 952, 954, 956, 958, 960, 962, 964, 966, 968, 970, 972, 974, 976, 978, 980, 982, 984, 986, 988, 990, 992, 994, 996, 998, 1000	100, 102, 104, 106, 108, 110, 112, 114, 116, 118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 138, 140, 142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186, 188, 190, 192, 194, 196, 198, 200, 202, 204, 206, 208, 210, 212, 214, 216, 218, 220, 222, 224, 226, 228, 230, 232, 234, 236, 238, 240, 242, 244, 246, 248, 250, 252, 254, 256, 258, 260, 262, 264, 266, 268, 270, 272, 274, 276, 278, 280, 282, 284, 286, 288, 290, 292, 294, 296, 298, 300, 302, 304, 306, 308, 310, 312, 314, 316, 318, 320, 322, 324, 326, 328, 330, 332, 334, 336, 338, 340, 342, 344, 346, 348, 350, 352, 354, 356, 358, 360, 362, 364, 366, 368, 370, 372, 374, 376, 378, 380, 382, 384, 386, 388, 390, 392, 394, 396, 398, 400, 402, 404, 406, 408, 410, 412, 414, 416, 418, 420, 422, 424, 426, 428, 430, 432, 434, 436, 438, 440, 442, 444, 446, 448, 450, 452, 454, 456, 458, 460, 462, 464, 466, 468, 470, 472, 474, 476, 478, 480, 482, 484, 486, 488, 490, 492, 494, 496, 498, 500, 502, 504, 506, 508, 510, 512, 514, 516, 518, 520, 522, 524, 526, 528, 530, 532, 534, 536, 538, 540, 542, 544, 546, 548, 550, 552, 554, 556, 558, 560, 562, 564, 566, 568, 570, 572, 574, 576, 578, 580, 582, 584, 586, 588, 590, 592, 594, 596, 598, 600, 602, 604, 606, 608, 610, 612, 614, 616, 618, 620, 622, 624, 626, 628, 630, 632, 634, 636, 638, 640, 642, 644, 646, 648, 650, 652, 654, 656, 658, 660, 662, 664, 666, 668, 670, 672, 674, 676, 678, 680, 682, 684, 686, 688, 690, 692, 694, 696, 698, 700, 702, 704, 706, 708, 710, 712, 714, 716, 718, 720, 722, 724, 726, 728, 730, 732, 734, 736, 738, 740, 742, 744, 746, 748, 750, 752, 754, 756, 758, 760, 762, 764, 766, 768, 770, 772, 774, 776, 778, 780, 782, 784, 786, 788, 790, 792, 794, 796, 798, 800, 802, 804, 806, 808, 810, 812, 814, 816, 818, 820, 822, 824, 826, 828, 830, 832, 834, 836, 838, 840, 842, 844, 846, 848, 850, 852, 854, 856, 858, 860, 862, 864, 866, 868, 870, 872, 874, 876, 878, 880, 882, 884, 886, 888, 890, 892, 894, 896, 898, 900, 902, 904, 906, 908, 910, 912, 914, 916, 918, 920, 922, 924, 926, 928, 930, 932, 934, 936, 938, 940, 942, 944, 946, 948, 950, 952, 954, 956, 958, 960, 962, 964, 966, 968, 970, 972, 974, 976, 978, 980, 982, 984, 986, 988, 990, 992, 994, 996, 998, 1000

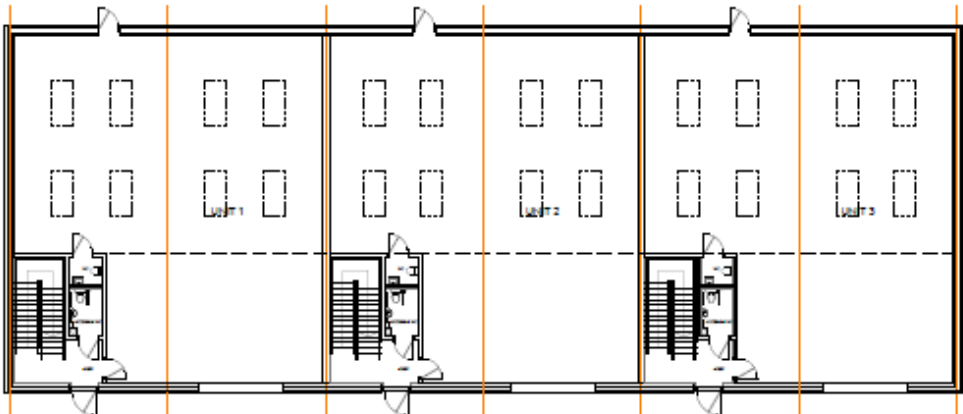
Unit 1 – 3



ROOF PLAN - TYPICAL LAYOUT



FIRST FLOOR - TYPICAL LAYOUT



GROUND FLOOR - TYPICAL LAYOUT

NO.	REVISION	DATE	BY	CHKD
1	Issue 1	20/10/2020	AL	AL
2	Issue 2	20/10/2020	AL	AL
3	Issue 3	20/10/2020	AL	AL
4	Issue 4	20/10/2020	AL	AL
5	Issue 5	20/10/2020	AL	AL
6	Issue 6	20/10/2020	AL	AL
7	Issue 7	20/10/2020	AL	AL
8	Issue 8	20/10/2020	AL	AL
9	Issue 9	20/10/2020	AL	AL
10	Issue 10	20/10/2020	AL	AL

ASHBROOK HEALD GREEN
GARAGE

PROPOSED TO BE USED AS A GARAGE
GARAGE, 1000 sq. ft. +
GARAGE, 1000 sq. ft. +
GARAGE, 1000 sq. ft. +

CALDERPEL
ARCHITECTS

3.0 Energy demand reduction (Be Lean)

3.1 Building Fabric

The energy strategy adopts a fabric first approach with u-values significant improvements to u-values.

3.1.1 Construction Element data

Summary of construction –

Generally, the model(s) has assumed exposed medium weight concrete blocks to the warehouse wall structure (internal envelope), 4m high with the remaining height a lightweight panel construction. Heavy weight construction for the warehouse area ground floor has been assumed by applying exposed concrete. Solar controlled glazing has been assumed.

The Construction Element U-values.

Construction Element	Part L2A 2013 Notional building U-value (W/m ² .K)	Proposed Actual Building U-Value (W/m ² K)	Improvement %
External Wall	0.26	0.18	30.7%
Ground Floor	0.22	0.20	9%
Roof	0.18	0.16	11%
Door	2.2	2.2	00.0%
Large Door	1.5	1.5	00.0%

3.1.2 Glazing Values Data

Glazing Reference	Thermal Transmittance (U-Value), W/m ² K	Solar Transmittance (G-Value)	Light Transmittance (LT)
Part L 2013 Notional Building	1.6	0.4	0.71
External Window	1.6	0.55	0.71
Rooflight – Kingspan polycarbonate Panel (Opal)	1.6	0.57	0.61

3.1.3 Design Air Permeability

Air Permeability	Part L2A 2013 Notional building (m ³ /m ² .h@50Pa)	Actual building air permeability (m ³ /m ² .h@50Pa)
Air Permeability	6	5

3.2 Building Services Data

For the purpose of the shell and core assessment the following specification has been assumed demonstrating that the building can achieve compliance.

3.2.1 Heating and cooling

Heating\Cooling strategy proposed as follows.

- VRF (ASHP) heating and cooling to the Open Plan Office with seasonal efficiencies of SCOP 3.5, SEER 5.00 & EER 3.4.
- Heating (ASHP) to the Warehouse with seasonal efficiencies of SCOP 3.5.
- Electric Panel heater to Acc WC & GF lobby.

compensating\room environment heating & cooling controls will improve the overall energy performance of the building.

3.2.1 Domestic Hot Water

Domestic hot water provided by instantaneous heaters (15ltr storage).

3.2.2 Mechanical Ventilation

System	Serving	SFP	HR
WC Extract	Acc WC & Warehouse WC	≤0.4W/l/s	n/a

3.2.3 Natural ventilation

- Open plan offices have been applied with natural ventilation (openable windows).
- Warehouse have been applied with natural ventilation (Openable large vehicle door).
- All entrance circulation & stairs have been applied with natural ventilation.

3.2.4 Lighting

High efficiency LED lighting is assumed throughout the building linked to a daylight dimming system where luminaries adjacent to the perimeter & roof glazing will reduce their output as natural daylight levels increase.

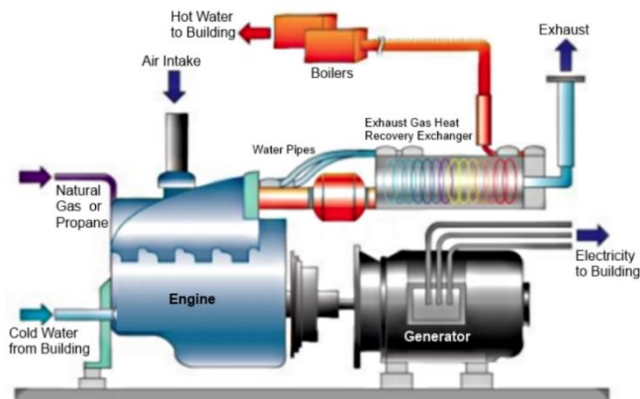
Area	Efficacy (lm/W)	Daylight control (Dimming)	Occupancy control
Offices	80	Yes	Absence
Circulation	80	No	Presence
WC's	70	No	Presence
Warehouse	80	Yes	Presence

4.0 Heating infrastructure (Be Clean)

4.1 District Heating

There is no district heating option at present for the location of the proposed development.

4.2 Combined Heat and Power (CHP)



Combined Heat and power is an electricity generator where the waste heat is captured and then re-used within a building.

Typically, for CHP engines used within buildings, the associated electricity efficiency is between 25-30% (depending on the size of the engine) with 40-50% of the waste heat being re-usable for heat distribution within a building (the remainder is lost heat through the flue).

There are renewable CHP engines available which use wood pellets as a fuel source. However, this technology is in its infancy and is very large when compared to both gas fired engine. Biomass CHP consequently is not appropriate for this project. Gas is the fuel predominately used for CHP system within buildings. Although this is not a renewable technology, it can provide significant carbon savings in the right application.

For CHP to be effective in terms of carbon reduction and cost effectiveness it is very important that the engine operates for long periods of the day, throughout the year. For heat dominant buildings such as swimming pool, hotel and other hospital where is constant hot water demand that either large hot water storage is provided.

Advantages

- Using a gas fired CHP system can produce significant savings per year if used in buildings with a significant constant heat/hot water load profile, such as hotels, leisure centres etc;
- CHP could be a clean form of energy.

Disadvantages

- Requires predictable and constant heating/ hot water loads e.g. significant hot water storage;
- Gas fired CHP is not a renewable technology.
- Fossil fuel based technology.

Site Conclusion

CHP is not suggested for this development due to the low demand for heat during summer and inconsistent heat load through the year that would cause the unit to sit idle.

Exclude CHP option for this development.

Individual heat sources for each unit is recommended.

5.0 Renewable Technology (Be Green)

5.1 Air Source Heat Pump (ASHP)



Air source heat pumps use a refrigeration cycle to extract heat energy from ambient external air converting the energy into heat. This can be used for heating in the winter but can be reversed for cooling in the summer months. ASHPs work by extracting heat from the outside air and passing it through a refrigeration compressor cycle, which increases its temperature. The heat is

then distributed to the rooms.

An ASHP consists of an indoor and outdoor unit. The outdoor unit uses a fan to blow air across a heat exchanger containing fluid refrigerant. This can generate noise and units must be positioned away from sensitive areas. Air to Air heat pumps have a negative visual impact on the building and should be located out of view in plant enclosures wherever possible.

An ASHP will typically have a lower COP (system efficiency) than a GSHP due to the lower temperature of outside air when compared to the earth. However, the capital cost of an ASHP is much lower, is easier to maintain than ground source, a tried and tested technology and there is no need for any extensive ground works. Air to water heat pumps can replace a conventional gas fired system working but working at lower temperatures.

Advantages

- Non fossil fuel source of heat. ASHP provide an 'all electric' solution that will continue to decarbonise as the national grid decarbonises.
- Cost effective renewable for heat dominant buildings, such as this development.
- Reduced running costs.
- Tried and tested technology
- Easy to maintain.

Disadvantages

- COP (efficiency) is dependent on-air temperature.
- Slightly lower COP than ground source heat pumps
- Visual impact & fan noise of external units.

Site Conclusion

An high efficiency Air to Water Heat pump would be suitable for the proposed development providing and 'all electric' solution and moving away from fossil fuels. Some of the energy consume by the heat pump could be offset by renewable electricity generated by PV if required. As the national grid electricity supply continues to decarbonise to meet the UKs 2050 net zero goal, the carbon emission rate of the building will also decrease.

Select ASHP renewable energy for this development.

5.2 Photovoltaic Panels



Photovoltaic panels convert solar energy directly into electrical energy for use within the building. A range of products are available including monocrystalline, polycrystalline, amorphous silicon and other thin films. These products vary in cost and efficiency, respectively. The most common panels are polycrystalline achieve typical efficiencies $\approx 15\%$. Hybrid panels are also available that generate both electricity and hot water.

In order to maximise solar radiation, the panels are ideally located facing south with a pitch of approximately 30° from the horizontal, away from any obstructions that would otherwise shade the panels. The panels are still up to 95% effective with small variation in the orientation $\pm 30^\circ$ or inclination $\pm 20^\circ$. The panels are versatile and can be mounted on flat or pitch roofs, vertical walls or integrated within building members.

Once installed panels require little maintenance other than routine cleaning. Photovoltaic panels are silent in operation and do not normally require any additional planning permission. Typically, they are installed on the roof of buildings and require a small amount of internal plant space.

With the appropriate power conversion equipment (inverters) PV systems can produce alternating current (AC) compatible with any conventional appliances and operate in parallel with the utility grid.

Advantages

- Electricity generating renewable.
- Zero carbon technology
- Visual statement of sustainability
- Electricity is generated during daylight hours.
- Electricity can be stored in batteries during the day for use in the evenings.

Disadvantages

- Obstructions will have a dramatic effect on the productivity of the panels.
- Best results produced when there is a clear sky and direct sunlight.
- Expensive technology, requiring large areas for significant production.
- Cleaning and maintenance issues, especially in areas with surrounding trees.

Site Conclusion

The roof of the building(s) gives sufficient unshaded space for a large number of solar panels. Solar panels require little maintenance and can be hidden from view by parapet walls if desired. Alternatively visible solar panels are clear visual statement of a building's green credentials. Roof mounted solar panels have no known planning permission issues. The energy generated can be used within the development to achieve a substantial reduction in carbon emissions.

Photovoltaic Panels (PV) renewable energy would be a good option and could be considered to further increase the carbon reduction.

5.3 Heating System – Biomass Boilers



Biomass is the burning of any plant-derived organic material (such as wood) that renews itself over a short period to generate energy. This fuel type is usually used for heating. Since the CO₂ released during the burning process is offset by the CO₂ absorbed during

the life of the biomass source, biomass is considered to be close to carbon neutral.

Biomass boilers can produce higher levels of NO_x emissions and particulates than conventional natural gas fired boilers which can conflict with local planning policy if located within areas controlled by the clean air act.

Biomass also requires additional space for fuel delivery and storage. Whilst conventional natural gas fired boilers require an annual service and maintenance visit, biomass needs much more regular attention. Weekly visual inspections of the boiler and fuel delivery mechanisms are required including disposal of ash, lubrication and cleaning where necessary.

Typically, a biomass system will burn wood in either a chip or pellet form instead of the conventional gas system. Biomass can save large amounts of carbon at a relatively low capital cost. Non-domestic biomass boilers mainly use either wood pellet or wood chip burners. Wood pellets are comprised of wood chips and sawdust that are compacted into smaller volumes. This means that they have lower moisture content and they can be produced in a consistent size.

Advantages

- Near “Carbon neutral”
- Will provide large carbon reductions within developments with a large heating load
- Economic alternative to fossil fuels
- Wide variety of sources

Disadvantages

- Storage areas required for wood pellets
- Slower start up time compared with fossil fuel boilers
- Requires good access areas for fuel deliveries
- Concerns with quality of fuel and the impact in Air Quality
- Requires regular inspection

Site Conclusion

The additional maintenance, space requirements, small/ intermittent heating load and high NO_x emissions described above exclude this option.

Exclude biomass option for this development.

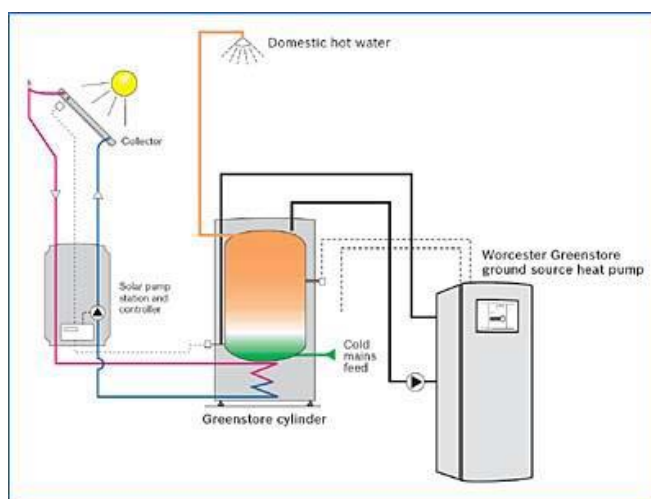
5.4 Solar Thermal Collectors



Solar Thermal collectors harness solar energy to heat water for use within the building. There are two main types of collector available on the market; Flat panels and evacuated tubes.

Evacuated tubes are the most efficient. Glass tubes form a vacuum insulating copper tubes at their core. Water running through the copper tubes is heated by the sun's rays and fed back to a hot water cylinder.

Flat Panel collectors use a dark coloured plate to absorb solar radiation. The heat is absorbed by fluid within a network of copper or silicon tubes insulated within the panel. The fluid containing antifreeze is passed through a heat exchanger with the hot water cylinder to heat water. Their efficiency depends on the insulation properties and type of construction. More expensive double-glazed units have a better efficiency, so that a smaller area of solar thermal panels is required – a compromise would need to be made between efficiency and cost.



Solar thermal panels must be located in direct unshaded sunlight and are therefore ideally located on a south the roof inclined to 30°. They are silent in operation and do not normally require any additional planning permission.

Advantages

- Hot water is produced during daylight hours
- Water can be stored during the day for use in the evenings and following morning.

Disadvantages

- Obstructions will have a dramatic effect on the productivity of the panels
- Best results produced when there is a clear sky and direct sunlight
- A high efficiency panel comes at a high cost

Site Conclusion

The demand for hot water in a warehouse is relatively low and therefore solar thermal collectors offer a smaller reduction in CO₂ emissions when compared to other renewable technology available.

Exclude solar thermal option for this development.

5.5 Wind Turbine



Wind turbines harness kinetic energy from the wind and convert it into electrical energy for use within the building. They can be mounted on dedicated poles from the ground or a relatively shorter mast on building roof. They must be located to maximise their exposure to prevailing winds and away from obstructions. There are two main types of wind turbine; vertical axis (VAWT) and horizontal axis (HAWT)

Horizontal Axis Wind Turbines are general the most efficient as the turbine itself rotates to expose all of its blades to the wind therefore producing more electricity for a given amount of wind.

Vertical Axis Wind Turbines are simpler in design making them lighter with less moving parts and maintenance requirements. VAWT can harness wind power from all 360 degrees or even top to bottom so can perform better in turbulent wind locations. Only a fraction of the blades produces torque whilst the remaining blades are being dragged through the air making them less efficient than HAWT.

Roof-mounted wind turbines are also an option, but if used structural considerations need to be taken into account due to the weight and vibrations that will be incurred. Roof-mounted wind turbines generally require an average wind speed of 3m/s to be viable, and larger, stand-alone wind turbines typically require 6m/s to be viable.

The principal factor affecting the energy generated by small scale wind turbines is wind speed. Wind speeds vary considerably on location, local geography and height above ground.

A system of this size would likely require planning permission with consideration given to noise and shadow flicker and visual impact.

Advantages

- Electricity generating renewable
- Zero carbon technology
- Visual statement of sustainability

Disadvantages

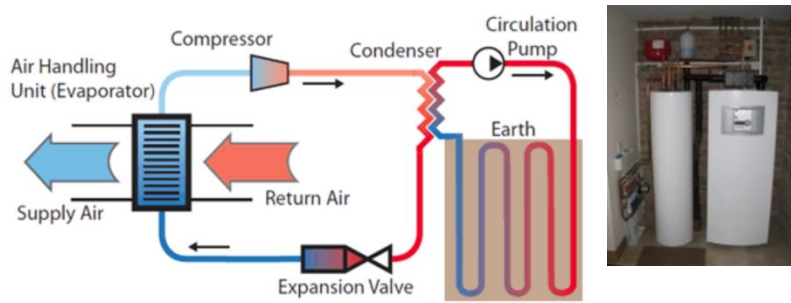
- Not suitable for Listed Buildings
- Planning permission can be a difficult and lengthy process
- Wind is an irregular source
- Can be noisy, especially if a gearbox is incorporated

Site Conclusion

Due to the built-up location & airport wind turbine would not be suitable for this proposed site. Wind turbine technology has greater maintenance costs compared to other renewable sources, making payback periods less attractive. Therefore, it is not proposed to use this technology.

Exclude wind turbine option for this development.

5.6 Ground Source Heat Pump



Ground source heat pumps use a small amount of electricity to transfer a larger amount of heat energy from the ground to the building. The naturally occurring heat in the ground is absorbed by circulating fluid through buried pipes. The heat is concentrated using a vapour compression cycle and transferred to the building.

The heat energy transferred to the building can be used within low temperature hot water circuits serving underfloor heating, radiators etc. The heat pump can also be used in reverse, extracting heat from the building providing cooling for building occupants. The heat exchanger buried beneath the ground can be in one of two forms; vertical bore holes or a horizontal ground loop.

Horizontal ground loops are suited to more rural locations where there is sufficient ground space to accommodate the necessary trenches. Vertical bore holes can be used in more built up areas where ground space is not available. Trial holes have to be drilled to determine the ground conditions.

GSHPs can achieve a higher Coefficient of Performance than Air Source Heat Pumps because the ground temperature is more stable than the ambient air temperature throughout the year.

A ground source heat pump uses buried pipes so there is no visual impact. The heat pump itself is about the size of large fridge. GSHPs are not silent but generate less noise than a conventional boilers or air source heat pumps.

Advantages

- Non fossil fuel source of heat. ASHP provide an 'all electric' solution that will continue to decarbonise as the national grid decarbonises.
- Can provide significant carbon savings in the correct application e.g. mixed-use schemes with significant heating and cooling loads
- Reduced running costs

Disadvantages

- Large area of land required for bore holes or loops
- Can be expensive (capital cost)
- Not generally recommended for heating only (or cooling only) systems. A site-specific study is required by a bore hole specialist to determine whether soil conditions are favourable for heating only systems. It should also be noted that this Site would need a significant heat extraction from the earth in order to provide the 10% on site contribution.

Site Conclusion

The capital cost of a GSHP can be high due to the extensive groundwork required.

Exclude GSHP option for this development.

5.7 Low & Zero Carbon Technology Assessment

The following section shows the recommend energy strategy for this building.

Table: LZC Technology initial assessment.

#	LZC	CO ₂ Reduction %	Selected	Comments
1	ASHP	16-23% see section 6 for breakdown per block	Yes	Low maintenance and impact on the site.
2	PV	A good option for renewable energy however is not required to meet the PartL BRUKL & planning requirements	No	
3	Biomass Boiler	Not viable due to maintenance costs, space requirements and NOx emissions.	No	
4	Solar Thermal	Not viable due to minimal CO ₂ reduction compared to other renewable sources.	No	
5	Wind Turbines	Not viable due to built up area, location of airport & maintenance costs.	No	
6	GSHP	Not viable due to capital cost of extensive ground work required.	No	
7	CHP	Not viable due to lack of simultaneous heat & power demand.	No	

6.0 Part L2A Assessment Results

This 'Part L2A 2013' analysis was conducted using the Integrated Environmental Solutions IESVE 2021.1.1.0, VE Compliance 7.0.13.0 with BRUKL compliance check version v5.6.b.0.

6.1 Criterion 1 – carbon dioxide emissions

Criterion 1 is assessed by comparing the building emissions rate against the proposed building target emissions rate. The target emission rate is based upon the notional building which is the same size and shape as the actual building but built to concurrent specification defined in PARTL of the building regulations.

The model calculations and results are based on the information stated in this report – electric power factor <0.9 & adding lighting controls/metering.

The following tables show the results of three iterations of the model and carbon reduction against a baseline building constructed to the 2013 notional building specification with gas fired heating.

- Baseline building constructed to 2013 notional building specification with gas fired heating and domestic hot water.
- Lean building incorporating passive and active energy demand reduction measures. (Improved u-values, high efficiency LED lighting with occupancy and daylight control) Space heating and domestic hot water remains as gas fired.
- Green building – Fossil fuel heat sources are removed and replaced with renewable air source heat pump.

Planning Policy EN6

Target 3: Micro generation area	+15% increase on Part L 2010
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Target 3 is applicable to this development however PartL 2013 improvement against PartL 2010 is 9%, therefore a CO₂ reduction of 6% against the PartL 2013 Building Regulations is required to fulfill the planning policy.

PartL 2013 Results for Units 1 – 4 PASS & meet the planning policy criteria refer to results table.

SAP10.0 Conversion -

Grid supplied electricity is decarbonising. The current carbon intensity of grid supplied electricity is 0.233KgCo₂/KWh (Defra) approximately 50% lower than the current building regulation emission factor. The next revision of Part L2A is in consultation and will recognise this by incorporating lower emission factors. To demonstrate the significant impact this will have on the building emission rate and carbon reduction the current BER has been converted to SAP10 emission levels in the table below.

Ashbrook Park Results Table												
Report Ref	Date	Run	Part L 2013 results				SAP10.0 Conversion			Indicative BREEAM ENE01 credits	ENG Planning Policy Achieved - 6% Above PartL 2013 Results	Comments
			Carbon				BASE NOTIONAL (Tonnes CO ₂ per annum)	ACTUAL (Tonnes CO ₂ per annum)	CO2 Reduction			
			Actual BER	Notional TER	PASS/FAIL	BRUKL PartL 2013 - % CO ₂ Reduction percentage against BASE TER (Lean notional)						
UNIT 1												
Stage 3	30.07.21	Base	n/a	24.9	n/a	n/a	5.644	n/a	n/a	n/a		Baseline - Gas fired builing to Part L 2013 notional building specification
Stage 3	30.07.21	LEAN	20.9	24.9	PASS	16.1%		4.5	20.3%		✓	LEAN MODEL. Gas fired builingd with passive and active demand redcution measures
Stage 3	30.07.21	GREEN	20.4	23.7	PASS	18.1%		2.958	47.6%	3	✓	GREEN - ASHP & ELEC DHW Applied as per stage 3 design.
UNIT 2												
Stage 3	30.07.21	Base	n/a	23.2	n/a	n/a	5.228	n/a	n/a	n/a		Baseline - Gas fired builing to Part L 2013 notional building specification
Stage 3	30.07.21	LEAN	19.6	23.2	PASS	15.5%		4.117	21.3%		✓	LEAN MODEL. Gas fired builingd with passive and active demand redcution measures
Stage 3	30.07.21	GREEN	19.4	22.1	PASS	16.4%		2.844	45.6%	3	✓	GREEN - ASHP & ELEC DHW Applied as per stage 3 design.
UNIT 3												
Stage 3	30.07.21	Base	n/a	24.9	n/a	n/a	5.641	n/a	n/a	n/a		Baseline - Gas fired builing to Part L 2013 notional building specification
Stage 3	30.07.21	LEAN	20.9	24.9	PASS	16.1%		4.48	20.6%		✓	LEAN MODEL. Gas fired builingd with passive and active demand redcution measures
Stage 3	30.07.21	GREEN	20.2	23.6	PASS	18.9%		2.922	48.2%	3	✓	GREEN - ASHP & ELEC DHW Applied as per stage 3 design.
UNIT 4												
Stage 3	30.07.21	Base	n/a	24.8	n/a	n/a	8.423	n/a	n/a	n/a		Baseline - Gas fired builing to Part L 2013 notional building specification
Stage 3	30.07.21	LEAN	20.1	24.8	PASS	19.0%		4.48	46.8%		✓	LEAN MODEL. Gas fired builingd with passive and active demand redcution measures
Stage 3	30.07.21	GREEN	19.1	23.3	PASS	23.0%		4.004	52.5%	4	✓	GREEN - ASHP & ELEC DHW Applied as per stage 3 design.
UNIT 1-4 (COMPLETE DEVELOPMENT)												
Stage 3	30.07.21	Base	n/a	24.5	n/a	n/a	24.9	n/a	n/a	n/a		Baseline - Gas fired builing to Part L 2013 notional building specification
Stage 3	30.07.21	LEAN	20.4	24.5	PASS	16.7%		19.7	20.9%		✓	LEAN MODEL. Gas fired builingd with passive and active demand redcution measures
Stage 3	30.07.21	GREEN	19.7	23.2	PASS	19.6%		12.73	48.9%	3	✓	GREEN - ASHP & ELEC DHW Applied as per stage 3 design.

6.2 Criterion 3 – limiting solar gain

Part L criterion 3 of the Building regulations is to assess the passive control measures to limit excessive solar gains reducing the risk of overheating or reduce the installed capacity of air conditioning equipment.

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?
U1 - 01 - Office	NO (-22.4%)	NO
U2 - 01 - Office	NO (-22.9%)	NO
U3 - 01 - Office	NO (-47.7%)	NO
U4 - 01 - Office	NO (-66.3%)	NO
U1 - 00 - Unit	NO (-44.7%)	NO
U2 - 00 - Unit	NO (-45.1%)	NO
U3 - 00 - Unit	NO (-44.5%)	NO
U4 - 00 - Unit	NO (-27.9%)	NO

7.0 Part L BRUKL's

The following BRUKL documents demonstrated compliance with the building regulations.

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name
Shell and Core

210540 - Ashbrook Park - GREEN Unit 1
As designed

Date: Fri Jul 30 13:03:47 2021

Administrative information

Building Details
 Address: Ashbrook, Manchester, Postcode

Certification tool
 Calculation engine: Apache
 Calculation engine version: 7.0.13
 Interface to calculation engine: IES Virtual Environment
 Interface to calculation engine version: 7.0.13
 BRUKL compliance check version: v5.6.b.0

Certifier details
 Name: Name
 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	23.7
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	23.7
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	20.4
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 _{s-Limit}	U _{s-Calc}	U _{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	10000003:Surf[1]
Floor	0.25	0.2	0.2	10000003:Surf[3]
Roof	0.25	0.16	0.16	01000001:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.46	1.6	00000002:Surf[2]
Personnel doors	2.2	2.2	2.2	10000003:Surf[0]
Vehicle access & similar large doors	1.5	1.5	1.5	10000003:Surf[5]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

U_{s-Limit} = Limiting area-weighted average U-values [W/(m²K)]

U_{s-Calc} = Calculated area-weighted average U-values [W/(m²K)]

U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

* 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	5

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area	Building Type
Area [m ²]	322.7	322.7		A1/A2 Retail/Financial and Professional services
External area [m ²]	912.9	912.9		A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
Weather	MAN	MAN		B1 Offices and Workshop businesses
Infiltration [m ³ /hm ² @ 50Pa]	5	6		B2 to B7 General Industrial and Special Industrial Groups
Average conductance [W/K]	240.34	321.5	100	B8 Storage or Distribution
Average U-value [W/m ² K]	0.26	0.35		C1 Hotels
Alpha value* [%]	10.66	10		C2 Residential Institutions: Hospitals and Care Homes
* Percentage of the building's average heat transfer coefficient which is due to thermal bridging				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	11.83	20.59
Cooling	1.88	0.77
Auxiliary	0.3	0.18
Lighting	21.39	24.29
Hot water	3.94	4.24
Equipment*	31.48	31.48
TOTAL**	39.34	50.07

* 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]	122.49	171.08
Primary energy* [kWh/m ²]	120.78	132.84
Total emissions [kg/m ²]	20.4	23.7

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

BRUKL Output Document**Compliance with England Building Regulations Part L 2013**

Project name

Shell and Core**210540 - Ashbrook Park - GREEN Unit 2****As designed**

Date: Fri Jul 30 13:15:04 2021

Administrative information**Building Details**

Address: Ashbrook, Manchester, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

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

Certifier details

Name: Name

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	22.1
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	22.1
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	19.4
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 _{s-Limit}	U _{s-Calc}	U _{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	20000001:Surf[2]
Floor	0.25	0.2	0.2	20000001:Surf[0]
Roof	0.25	0.16	0.16	10000009:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.46	1.6	20000000:Surf[1]
Personnel doors	2.2	2.2	2.2	20000001:Surf[1]
Vehicle access & similar large doors	1.5	1.5	1.5	20000001:Surf[4]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

U_{s-Limit} = Limiting area-weighted average U-values [W/(m²K)]U_{s-Calc} = Calculated area-weighted average U-values [W/(m²K)]U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

* 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	5

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area	Building Type
Area [m ²]	326.1	326.1		A1/A2 Retail/Financial and Professional services
External area [m ²]	765.8	765.8		A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
Weather	MAN	MAN		B1 Offices and Workshop businesses
Infiltration [m ³ /hm ² @ 50Pa]	5	6		B2 to B7 General Industrial and Special Industrial Groups
Average conductance [W/K]	213.85	260.22	100	B8 Storage or Distribution
Average U-value [W/m ² K]	0.28	0.34		C1 Hotels
Alpha value* [%]	10.8	10		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

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	9.88	17.69
Cooling	2.01	0.24
Auxiliary	0.27	0.18
Lighting	21.35	24.29
Hot water	3.92	4.22
Equipment*	31.35	31.35
TOTAL**	37.44	46.62

* 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]	107.9	144.19
Primary energy* [kWh/m ²]	114.94	124.75
Total emissions [kg/m ²]	19.4	22.1

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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Shell and Core

210540 - Ashbrook Park - GREEN Unit 3

As designed

Date: Fri Jul 30 13:47:59 2021

Administrative information**Building Details**

Address: Ashbrook, Manchester, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

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

Certifier details

Name: Name

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	23.6
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	23.6
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	20.2
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 _{s-Limit}	U _{s-Calc}	U _{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	30000004:Surf[2]
Floor	0.25	0.2	0.2	30000004:Surf[0]
Roof	0.25	0.16	0.16	30000002:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.46	1.6	20000007:Surf[1]
Personnel doors	2.2	2.2	2.2	30000004:Surf[1]
Vehicle access & similar large doors	1.5	1.5	1.5	30000004:Surf[5]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

U_{s-Limit} = Limiting area-weighted average U-values [W/(m²K)]U_{s-Calc} = Calculated area-weighted average U-values [W/(m²K)]U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

* 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	5

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area	Building Type
Area [m ²]	322.4	322.4		A1/A2 Retail/Financial and Professional services
External area [m ²]	912.9	912.9		A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
Weather	MAN	MAN		B1 Offices and Workshop businesses
Infiltration [m ³ /hm ² @ 50Pa]	5	6		B2 to B7 General Industrial and Special Industrial Groups
Average conductance [W/K]	240.33	308.42	100	B8 Storage or Distribution
Average U-value [W/m ² K]	0.26	0.34		C1 Hotels
Alpha value* [%]	10.65	10		C2 Residential Institutions: Hospitals and Care Homes
* Percentage of the building's average heat transfer coefficient which is due to thermal bridging				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	11.51	20.35
Cooling	1.85	0.96
Auxiliary	0.3	0.19
Lighting	21.32	24.16
Hot water	3.91	4.21
Equipment*	31.32	31.32
TOTAL **	38.89	49.86

* 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]	122.48	173.61
Primary energy* [kWh/m ²]	119.41	132.96
Total emissions [kg/m ²]	20.2	23.6

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

BRUKL Output Document**Compliance with England Building Regulations Part L 2013**

Project name

Shell and Core**210540 - Ashbrook Park - GREEN Unit 4****As designed**

Date: Fri Jul 30 13:57:45 2021

Administrative information**Building Details**

Address: Ashbrook, Manchester, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

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

Certifier details

Name: Name

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	23.3
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	23.3
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	19.1
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 _{s-Limit}	U _{s-Calc}	U _{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	40000005:Surf[3]
Floor	0.25	0.2	0.2	40000005:Surf[4]
Roof	0.25	0.16	0.16	40000004:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.41	1.6	1000000E:Surf[0]
Personnel doors	2.2	2.2	2.2	40000005:Surf[8]
Vehicle access & similar large doors	1.5	1.5	1.5	40000005:Surf[0]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

U_{s-Limit} = Limiting area-weighted average U-values [W/(m²K)]U_{s-Calc} = Calculated area-weighted average U-values [W/(m²K)]U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

* 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	5

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area	Building Type
Area [m ²]	468.1	468.1		A1/A2 Retail/Financial and Professional services
External area [m ²]	1424.6	1424.6		A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
Weather	MAN	MAN		B1 Offices and Workshop businesses
Infiltration [m ³ /hm ² @ 50Pa]	5	6		B2 to B7 General Industrial and Special Industrial Groups
Average conductance [W/K]	360.13	477.3	100	B8 Storage or Distribution
Average U-value [W/m ² K]	0.25	0.34		C1 Hotels
Alpha value* [%]	10.54	10		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

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	12.4	21.32
Cooling	1.43	0.62
Auxiliary	0.27	0.13
Lighting	18.58	22.46
Hot water	4.03	4.37
Equipment*	31.96	31.96
TOTAL**	36.71	48.9

* 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]	127.77	182.87
Primary energy* [kWh/m ²]	112.7	131.31
Total emissions [kg/m ²]	19.1	23.3

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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Shell and Core

210540 - Ashbrook Park - GREEN Unit 1-4

As designed

Date: Fri Jul 30 14:07:50 2021

Administrative information**Building Details**

Address: Ashbrook, Manchester, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

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

Certifier details

Name: Name

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	23.2
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	23.2
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	19.7
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	0.18	0.18	10000003:Surf[1]
Floor	0.25	0.2	0.2	10000003:Surf[3]
Roof	0.25	0.16	0.16	01000001:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.44	1.6	00000002:Surf[2]
Personnel doors	2.2	2.2	2.2	10000003:Surf[0]
Vehicle access & similar large doors	1.5	1.5	1.5	10000003:Surf[5]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

U_{a-Limit} = Limiting area-weighted average U-values [W/(m²K)]U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

* 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	5

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area	Building Type
Area [m ²]	1439.4	1439.4		A1/A2 Retail/Financial and Professional services
External area [m ²]	4016.2	4016.2		A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
Weather	MAN	MAN		B1 Offices and Workshop businesses
Infiltration [m ³ /hm ² @ 50Pa]	5	6		B2 to B7 General Industrial and Special Industrial Groups
Average conductance [W/K]	1054.64	1367.44	100	B8 Storage or Distribution
Average U-value [W/m ² K]	0.26	0.34		C1 Hotels
Alpha value* [%]	10.64	10		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

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	11.55	20.18
Cooling	1.77	0.64
Auxiliary	0.28	0.17
Lighting	20.45	23.66
Hot water	3.9	4.27
Equipment*	31.57	31.57
TOTAL**	37.96	48.92

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
 ** Total is net of any electrical energy displaced by CHP generators, 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]	121.32	169.86
Primary energy* [kWh/m ²]	116.52	130.7
Total emissions [kg/m ²]	19.7	23.2

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