



Access Self Storage Reading

Energy Strategy

Client	Precis
Date	July 2016
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Edition	Planning Issue

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Executive Summary

Precis are seeking full planning consent for the development of their Access Self-Storage facility at 62 Portman Road, Reading. The development comprises of an extension to the self-storage areas and provision of new office accommodation.

This document sets out the Energy Strategy for the proposed extension and supports the full planning application for the scheme showing how the development will result in a sustainable environment and reduce, or have a neutral impact upon, pollution and climate change.

The following energy efficiency hierarchy has been used through the design process:

- **Be Lean:** Use less energy, by adopting sustainable design and construction measures.
- **Be Clean:** Supply energy efficiently, in particular by prioritising decentralised energy generation.
- **Be Green:** Using renewable energy.

The building and building envelope have been designed to reduce energy demand, with the thermal performance of the building envelope being maximised with a strong focus placed on the optimisation of the glazed façade to minimise solar gain in summer, whilst achieving high thermal performance in winter. In addition, energy use is efficient due to the incorporation of features in the building services systems.

The base design solution, relying only on passive measures and energy efficiency of the services strategy performs well when compared with the Part L2A 2013 Target Emission Rate (TER), with an improvement on the TER of 4.21 %. This demonstrates that the passive measures in the design are performing well, with good levels of insulation provided and efficient building services systems.

The feasibility of a range of low and zero carbon technologies has been reviewed for use in this development including gas-fired CHP, biomass, ground source, wind turbines, and solar thermal systems. None of these renewable technology has been identified as appropriate for the site.

The only technically feasible renewable technology that could be utilised is the use of photovoltaic (PV) panels. Such panels are therefore proposed to be provided on the roof of the new office extension, which provides space for approximately 40 panels. The incorporation of these panels further reduces the CO₂ emissions associated with the extension such as a 24.3% improvement over the Part L2A TER is seen.

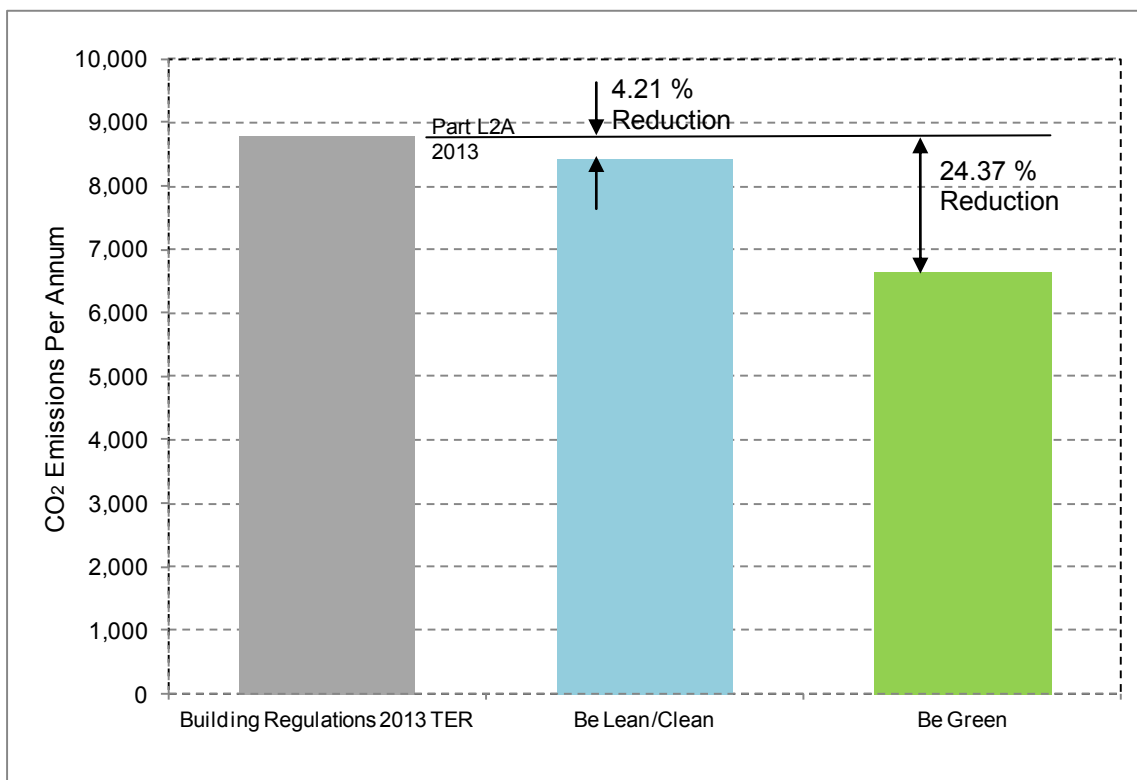
The tables below summarise the reductions in CO₂ emissions that the proposed development has been designed to achieve.

	Carbon Dioxide Emissions kgCO ₂ per annum	
	Regulated	Unregulated
Building Regulations 2013 Part L2A TER	8,787	17,773
Be Lean/Clean Stage	8,417	17,773
Be Green – After PV Incorporation	6,645	17,773

Carbon Dioxide Emissions at each stage of the Energy Hierarchy

	Regulated Carbon Dioxide Savings	
	(kgCO ₂ per annum)	(%)
Savings from Energy Demand Reduction	370	4.21 %
Savings after PV	1,772	21.05 %
Total Cumulative Savings	2,142	24.37 %

Regulated Carbon Dioxide Savings From Each Stage of the Energy Hierarchy

Comparison of Total CO₂ Reductions due to Energy Efficiency and Incorporation of LZC.

1.0 Introduction

1.1 Energy Strategy

Precis are seeking full planning consent for the development of their Access Self-Storage facility at 62 Portman Road, Reading. The development comprises of an extension to the self-storage areas and provision of new office accommodation within a separate extension.

This document sets out the Energy Strategy for the proposed extension and supports the full planning application for the scheme showing how the development will result in a sustainable environment and reduce, or have a neutral impact upon, pollution and climate change.

The following energy efficiency hierarchy has been used through the design process:

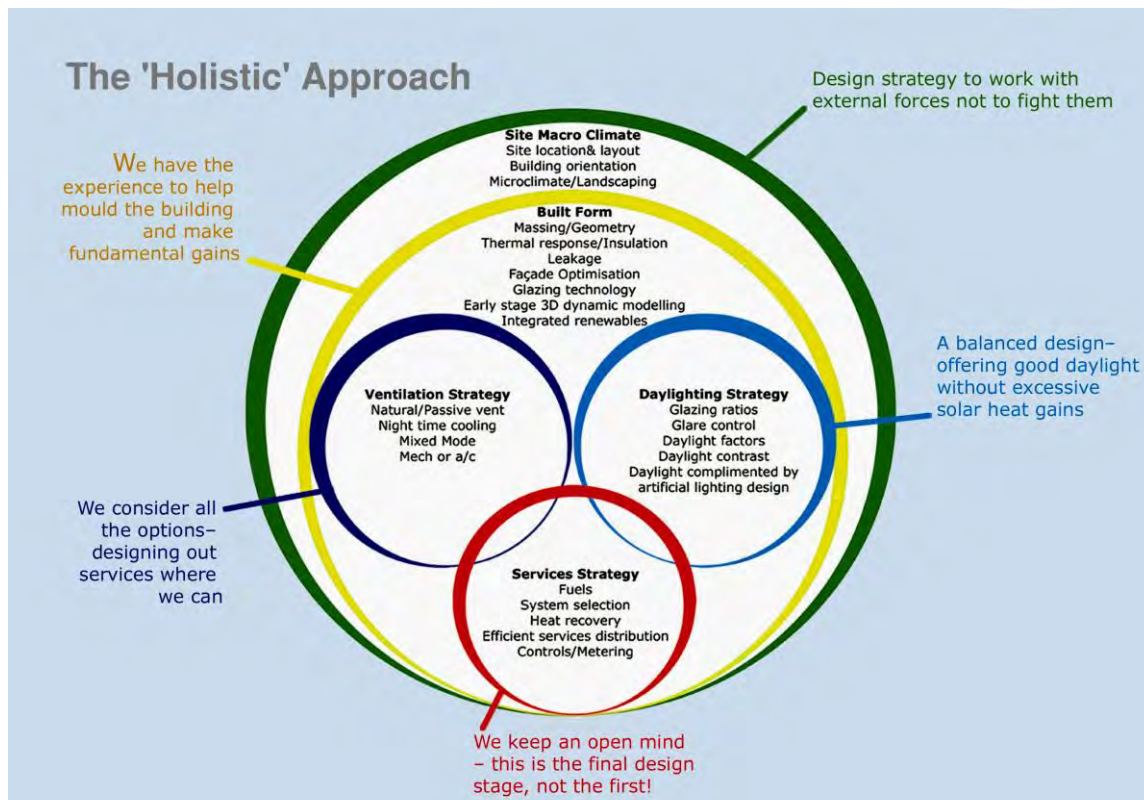
- Reduce energy demand through good design and construction measures
- Providing efficient energy supply.
- Providing energy from efficient renewable energy sources on site.

1.2 Basic Description of the Development

The proposed development consists of an expansion of the existing self-storage facility in Portland Road, Reading, providing additional storage area and an additional three levels of office accommodation for use by small and medium size companies.

2.0 Carbon Reduction Strategy

2.1 Carbon Reductions from Holistic Building Design



Services design is often seen as being the key to energy efficiency, however, as highlighted by strategies such as the Energy Hierarchy, taking an holistic approach should always be the first step, reducing the need for energy in the first place.

Foreman Roberts has worked closely with the design team for the proposed development to consider aspects of performance and design which can have an environmental impact, only focussing on services solutions when all passive solutions have been considered. As such, consideration has been given to the following which will continue throughout the detailed design stage:

Site Macro Climate –the impact of building orientation and the benefits of landscaping techniques to shelter buildings and external spaces in a passive way;

Built Form – shape, building geometry, thermal mass, façade design (incl. reduction in façade air leakage, insulation levels);

Ventilation Strategy – the use of natural ventilation with controllable openings where appropriate;

Daylighting Strategy - use of natural daylight, avoiding the dependency on artificial lighting, switching lights off where possible, controlling glare so that internal blinds are not heavily relied upon on a daily basis.

2.2 Building Regulations Part L – Conservation of Fuel and Power 2013

The UK has committed to cut emissions of greenhouse gases, the most significant of which being carbon dioxide. To achieve this we need to use energy more efficiently, and to increase

substantial uptake of the utilisation of renewable energy sources. The procedure in place to control and regulate this is Part L (Conservation of Fuel and Power) of the Building Regulations.

The current version of the Building Regulations Approved Document for new non-dwellings is Part L2A 2013 which came into force April 2014. The document associated with existing non-dwellings is Part L2B 2010 as amended in 2013.

Part L2A will be used to assess the new office extension, in line with paragraph 3.4 of the regulations, with compliance demonstrated using the whole building calculation method, and SBEM software used to determine compliance. Since the extension to the storage area will not be heated, cooled or ventilated, i.e. is unconditioned, this is not included within this calculation.

Requirements for Consequential Improvements under Approved Document Part L2B, triggered by the office extension, will be covered within the Building Control application.

3.0 Passive Design Measures

In applying the recognised energy hierarchy as part of a holistic design approach, the first stage is to **be lean**, i.e. use less energy, and in particular adopting sustainable design and construction measures.

3.1 Facade Engineering

The considered selection of the buildings fabric can go a considerable way to reducing the buildings base energy consumption, by reducing the incidental heat gains and losses. Working in conjunction with the architect, consideration has been given to:

- Orientation of glazed areas north to reduce solar gain;
- Good thermal transmittance (U-Values)
- Optimisation of solid to glazed ratios for day-lighting whilst minimising heatloss.
- The provision of effective day-lighting;

Energy modelling has been completed in order to conduct a preliminary assessment of the Part L2A requirements and as a basis for determining the proposed development's predicted carbon emissions. The following cladding make-ups have been determined from the modelling and are proposed for the development:

Table 1: Proposed U-value and Infiltration Rates

Thermal Transmittance (U-Values)	
Wall:	0.20 W/m ² K
Glazing:	1.40 W/m ² K
Roof:	0.18 W/m ² K
Floor:	0.18 W/m ² K
Building & Window Infiltration: Maximum air permeability 10 m ³ /m ² h @ 50 Pa*	
*As suitable for a naturally ventilated building	

3.2 Natural Ventilation

Fresh air requirements to the offices will be met by natural ventilation via openable windows, therefore eliminating the need for mechanical ventilation systems. These opening windows will also allow occupants to minimise comfort cooling use by mitigating against summer overheating; therefore reducing energy use under suitable conditions.

4.0 Services Design

Using energy efficiently (*be clean*) will result in a reduced energy demand for the proposed development. Energy Efficiency measures which will be incorporated in the project would include:

4.1 Lighting

Low energy lighting will be included to maximise energy efficiency and reduce the energy required for lighting. The lighting system will also include daylight sensing and PIR control to ensure that artificial lighting is only provided when and at the level required.

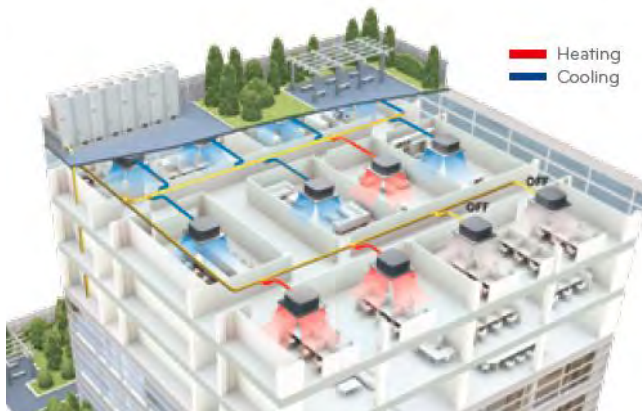
External lighting will also be low energy and controlled through PIR sensors and/or daylight cut-off devices.

4.2 Controls & Metering

Heating and cooling control will be zoned such that each individual office area has independent temperature and time clock control. Each office will also be individually metered for all services in excess of the minimum requirements of Part L for separate billing of tenants and to facilitate energy efficient operation practices.

4.3 Heating & Cooling Systems

Heating and comfort cooling is provided by VRF (Variable Refrigerant Flow) systems, these being a very efficient technology that allows different areas to be simultaneously heated and cooled to take advantage of heat recovery within the system. When heating is required, the system is operated as an air-source heat pump, utilising renewable heat within the air. These systems are therefore sometimes referred to as a renewable or a low carbon source, although they have not been counted as such in the context of this report.



Diagrammatic of a VRF system in operation

4.4 Ventilation Fans.

Fans and pumps can account for a large percentage of annual energy consumption in a non-domestic building. Natural ventilation can therefore produce useful energy savings, and is therefore used within the offices to meet their fresh air requirements.

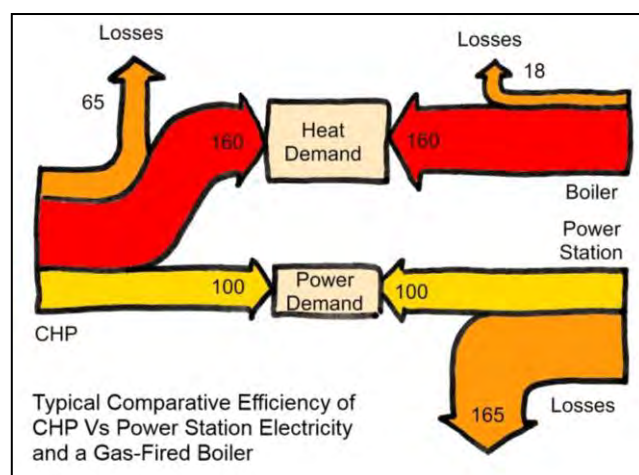
Where mechanical ventilation is required (toilets and kitchenette areas) this will be provided by fans with low specific fan powers, minimising the power consumption associated with their operation.

5.0 Low & Zero Carbon Technologies

The use of Low and Zero Carbon Technologies is step three of the Energy Hierarchy (**be green**). This section of the report therefore reviews the feasibility of employing the following renewable energy technologies in this development. Although this does not set out to explain in detail the technologies themselves, important technical issues are considered.

5.1 Combined Heat and Power (CHP)

Gas-fired CHP is a low carbon technology, which is supported by government and local authorities due to the carbon savings achievable when compared to conventional gas boilers and grid-supplied electricity. A CHP unit incorporates a reciprocating gas engine, which drives an electrical generator and produces waste heat from the engine cooling jacket and exhaust. The use of this heat locally greatly improves the overall energy efficiency achievable when compared to a conventional power station.



CHP requires a fairly constant and coincident electricity and heat load; otherwise the whole process is inefficient and difficult to integrate into other services. The unit has to be sized on heat demands, rather than electrical demands, and most units only run during the day; to match the main loads, with a buffer vessel provided to smooth out the peaks and troughs of heat use. Back-up boilers would be required to meet loads outside of the peak heating periods.

The office provision to the Access Self-Storage units will not have a year round demand for heat, the heating load

actually being a small proportion of the total energy use (refer to section 6.0) and an even smaller use of energy for hot water heating. For this reason, the use of CHP would not be appropriate.

5.2 Biofuel Boiler Plant

When the renewable policy first became part of various local authorities planning requirement, biomass boilers were the preferred option for many proposed developments since they were, in the main, a cost effective solution for most buildings to meet their requirements, especially if there was a considerable base heating load.

The extensive use of biomass, particularly in urban developments, is however falling out of favour. This is in part due to problems associated with the increased emissions of NO_x and PM₁₀ particles when compared with gas-fired equipment. The delivery of biofuel is also commonly by road, which also has associated negative environmental impacts. In addition, there are also concerns with the sustainability of fuel source and ensuring that only certified sources are used, particularly in the South-East of the country.

Biodiesel, as with biomass, releases when it is burnt the carbon dioxide it had absorbed when it is grown. Biodiesel does have some advantages over biomass, in that it is a cleaner fuel with less emissions, and plant and storage size is less than that required of biomass. There are now commercial manufacturers of boilers that burn biofuel, which generally suggest that rapeseed oil or recycled cooking oil are used. It should be noted that fuel costs are currently greater than natural gas.

There are however still environmental concerns – primarily in relation to the sources of the oil used in biodiesel. Friends of the Earth campaign against biofuels, mainly on the grounds that their large scale production on a global scale leads to deforestation and a reduction in valuable agricultural land for food production. Although there are some suppliers in the UK of recycled cooking oil, there is no established and viable supply chain for suitable quantities and quality of fuel for a commercial heating installation.

Due to the issues detailed above, along with the fact that the heat demand of the new offices is relatively small, make the use of a biofuel heating strategy impractical.

5.3 Ground Coupled Systems

Subject to the suitability of the local geology, ground source heat pumps can extract low temperature heat from the ground and convert it to useful heat for a heating using the vapour compression cycle of the heat pump unit, the system can also reject heat to the ground using the reverse cycle refrigerant cycle, therefore also providing cooling.

The geothermal loops which provide the heat transfer from the ground can be laid vertically or horizontally, the choice of a vertical or horizontal system depends upon the available land, local soil type, evacuation costs and the topological features.

Ground source heat pumps work most effectively where they provide both heating and cooling. In winter, heat is extracted from the ground to heat the occupied spaces, in summer; heat is rejected back into the ground providing cooling to the spaces. This creates a heat balance over a year.

Although the office building will utilise heating and cooling and lend itself theoretically well to a ground source solution, the costs associated with such a solution, particularly one that utilises vertical loops as would be required because of the limited footprint of the extension, would be extremely high, disproportionately so because of the relatively small scale of the area provided with heating and cooling. The currently suggested strategy of an air-source solution, already offers high levels of efficiency, and would therefore be more appropriate to this scale of development.

5.4 Wind Turbines

If space can be provided, a large, free standing turbine can offer significant on-site renewable energy, and has the added advantage of being a very visual commitment to on site power generation and energy efficiency. There are, however, issues to consider with the use of larger wind turbines revolving around noise and visual impact, and the fact that they will usually be subject to a separate planning application.



The site area around the existing self-storage facility is quite limited, being required for car-parking and vehicle movement associated with the buildings operation, which along with the visual impact to adjacent residences and turbulence issues from surrounding buildings, makes the use of such a free standing turbine impractical.

Where free standing wind turbines cannot be located on a site, roof-mounted wind turbines could be used, however their operational performance is considerably less. Concerns around issues such as noise and visual impact again can however severely restrict their acceptability in urban environments.

The characteristics of neighbouring building and local topography will also adversely affect the operation of any roof mounted wind turbine(s) on the building due to turbulence. In addition there is increasing evidence that such turbines are not achieving their anticipated performance in practice, and are starting to be seen as little more than roof decoration, with a common sight being rows of stationary turbines on recently completed developments.

5.5 Solar Water Heating



For proposed developments with considerable hot water demand, the use of solar collectors can have a positive impact in reducing carbon emissions by using the sun's power to heat domestic hot water.

As stated previously however, the building will not have a high hot water demand, therefore, should space be available for the utilisation of a solar technology, then the use of photovoltaic's would be a more practical solution.

5.6 Photovoltaics (PV)

The cost of producing electricity by PV was once seen as being prohibitive with high embodied energy marginalising medium term benefits and net environmental pay back. However, with improved efficiencies, reduced costs, and the availability of the Feed-in Tariff in the UK, the use of PV is now considered a more viable renewable technology.

To achieve maximum output from photovoltaics they should be oriented to be South facing, with clear, unobstructed views of the sky. Ideally mounted at an elevation of 30-40° they can be installed on flat roofs, but provide 90% of their peak performance, and on vertical elevations produce 70% of their peak output.

The lightweight construction of the existing roof to the self-storage unit would not allow PV panels to be located there due to the additional weight they would impose. Their siting is therefore limited to the roofs of the new build elements of the development.

The pitched arrangement required of the roofs means that the PV panels could only be located on the roof of the new office extension, this roof, pitching in a southerly direction, is however ideal for panel location. Initial review indicates that some 40 No panels (approximately 58m²) could be located here, providing 9.6 kW_p electrical power.

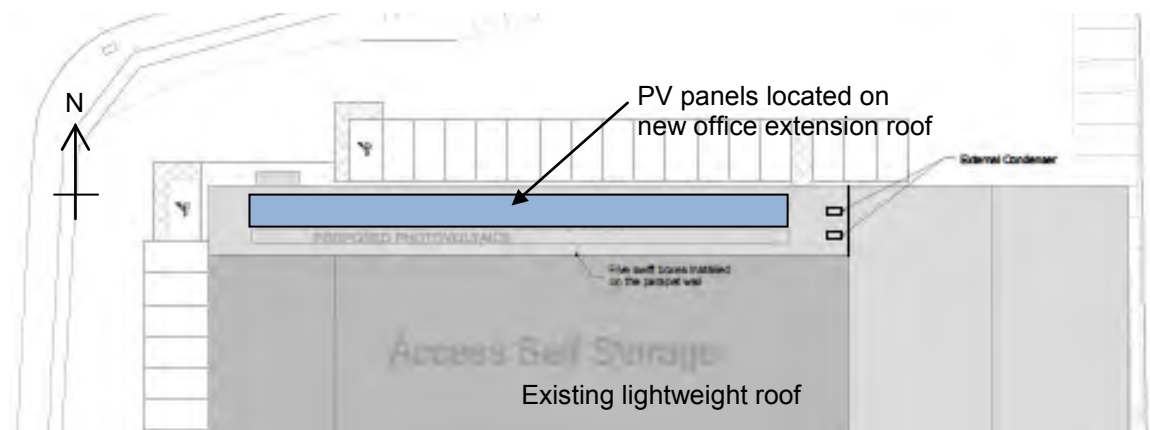


Figure 1: Proposed Location of PV Panels

The use of photovoltaic panels will therefore be incorporated into the scheme and their contribution to savings of CO₂ emissions included within the SBEM modelling in Section 6.0

5.7 Conclusion

The feasibility of various renewable energy technologies have been reviewed for use in this development. We would suggest that the use of wind turbines is impractical, and because of the issues of fuel deliveries air quality and other environmental concerns, we would also suggest that the use of biofuels in this location is inappropriate.

The limited demand for heating and hot water within the office area means that a CHP-led heating solution is not practical and that a solar hot water solution would have minimal effect, and the small scale of this part of the development is disproportionate with the high costs associated with a ground source solution.

Therefore the use of PV would be the only feasible renewable technology, and it is therefore proposed that a total of 40 panels will be provided on the roof of the new office extension.

6.0 Energy Assessment

6.1 Modelling

SBEM calculations have been completed for the new office extension using approved software Bentley Hevacomp version v5.2.d.2. All software and associated macros used are accredited for use in Part L2A calculations by the Department of Communities and Local Government (DCLG), formerly the Office of the Deputy Prime Minister (ODPM) for Part L compliance work.

6.2 Assessment Methodology

The performance of the new extension of the proposed development has been assessed following the stages as set out in the energy hierarchy, with comparison made to a Base Case of the Building Regulations Part L2A 2013 Target Emission Rate (TER).

The Be Lean/Clean stage records the results of the buildings as proposed, with glazing areas and layout as per design drawings and thermal properties, air tightness etc as detailed in Section 3.0 and a services strategy as detailed in Section 4.0.

The SBEM calculations have then been run based upon the use of low and zero carbon technologies (PV), Be Green.

6.3 Results

Tables 2 and 3 summarise the results of the SBEM calculations at the stages of assessment as described in Section 6.2. The BRUKL reports and SBEM Output Documents are provided within the Appendix of this report.

	Carbon Dioxide Emissions kgCO ₂ per annum	
	Regulated	Unregulated
Building Regulations 2013 Part L2A TER	8,787	17,773
Be Lean/Clean Stage	8,417	17,773
Be Green – After PV Incorporation	6,645	17,773

Table 2: Summary of Carbon Dioxide Emissions at each stage of the Energy Hierarchy

	Regulated Carbon Dioxide Savings	
	(kgCO ₂ per annum)	(%)
Savings from Energy Demand Reduction	370	4.21 %
Savings after PV	1,772	21.05 %
Total Cumulative Savings	2,142	24.37 %

Table 3: Summary of Carbon Dioxide Savings

The base design solution, relying only on passive measures and energy efficiency of the services strategy performs well when compared with the Part L2A 2013 Target Emission Rate (TER), with an improvement on the TER of 4.21%. This demonstrates that the passive measures in the design are performing well, with good levels of insulation provided and efficient building services systems.

The inclusion of low and zero carbon technologies in the form of photovoltaic panels further improves the CO₂ emissions such that a 24.37% improvement in the Part L2A 2013 TER is demonstrated.

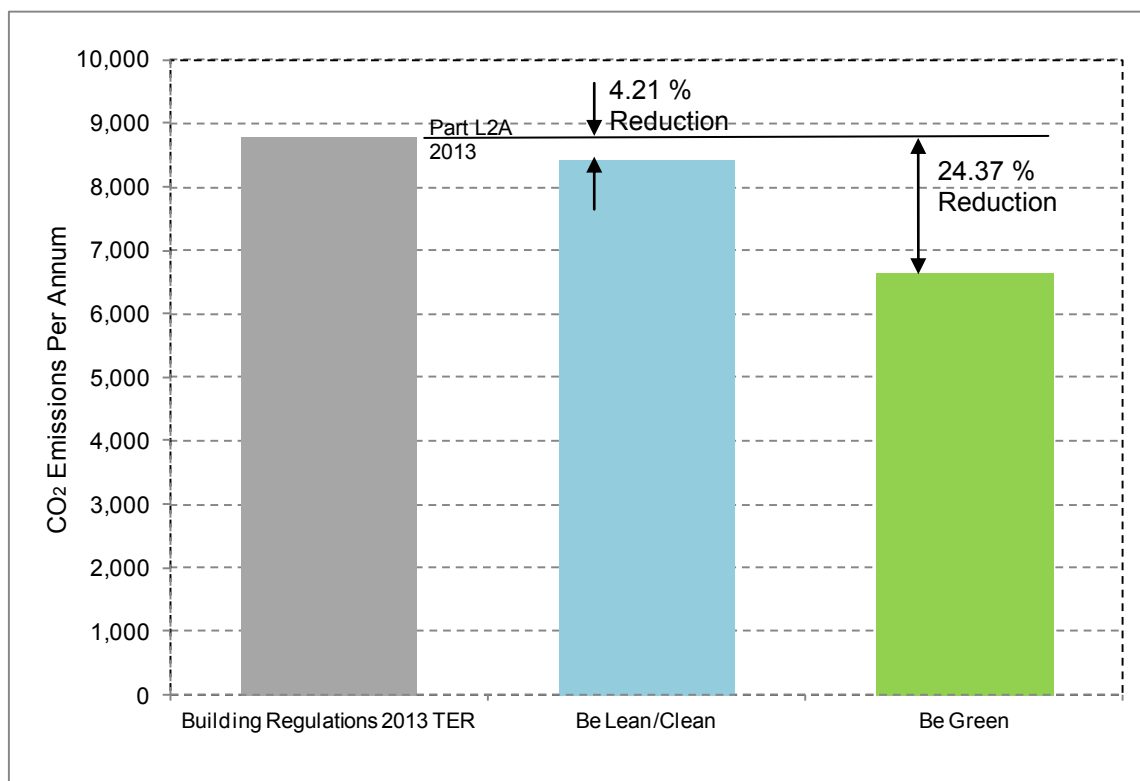


Figure 2: Comparison of Total CO₂ Reductions due to Energy Efficiency and Incorporation of LZC.

7.0 CONCLUSION

The building and building envelope of the new office extension to the self-storage facility have been designed to reduce energy demand, with the thermal performance of the building envelope being maximised with a strong focus placed on the optimisation of the glazed areas to minimise solar gain in summer, whilst achieving high thermal performance in winter. In addition, energy use is efficient due to the incorporation of features in the building services systems.

The base design solution, relying only on passive measures and energy efficiency of the services strategy performs well when compared with the Part L2A 2013 Target Emission Rate (TER), with an improvement on the TER of 4.21%. This demonstrates that the passive measures in the design are performing well, with good levels of insulation provided and efficient building services systems.

The feasibility of a range of low and zero carbon technologies has been reviewed for use in this development including gas-fired CHP, biomass, ground source, wind turbines, and solar thermal systems. None of these renewable technology has been identified as appropriate for the site.

The only technically feasible renewable technology that could be utilised is the use of photovoltaic (PV) panels, with suitable space provision provided on the roof of the new office extension, where some 40 panels could be located. The incorporation of this technology further improves the CO₂ emissions such that a 24.37% improvement in the Part L2A 2013 TER is demonstrated.

Appendix A Modelling Software Outputs

BRUKL Output Document

Compliance with England Building Regulations Part L 2013



Project name

Access Self Storage Reading

As designed

Date: Fri Jul 08 10:02:32 2016

Administrative information

Building Details

Address: 62 Portman Road, Reading,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.d.2

Interface to calculation engine: Design Database

Interface to calculation engine version: v26.03

BRUKL compliance check version: v5.2.d.2

Owner Details

Name: Information not provided by the user

Telephone number: Information not provided by the user

Address: Information not provided by the user, Information not provided by the user, Information not provided by the user

Certifier details

Name: Foreman Roberts

Telephone number: 0161 831 6565

Address: 19 Spring Gardens, Manchester, M2 1FB

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

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	11.9
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	11.9
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 the building services should achieve reasonable overall standards of energy efficiency

Values not achieving 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	0.2	0.2	24 Wall 1
Floor	0.25	0.2	0.2	G01 Exposed Floor 1
Roof	0.25	-	-	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	1.3	1.3	24 Window 1 (1)
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

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	10

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 2

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3	4	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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- Default DHW

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

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I			
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		Zone	Standard
2	-	-	-	-	-	-	-	-	-	-	-	N/A
2 (2)	-	-	-	-	-	-	-	-	-	-	-	N/A
4	-	-	-	-	-	-	-	-	-	-	-	N/A
4 (2)	-	-	-	-	-	-	-	-	-	-	-	N/A
5	-	-	-	-	-	-	-	-	-	-	-	N/A
5 (2)	-	-	-	-	-	-	-	-	-	-	-	N/A
6	-	-	-	-	-	-	-	-	-	-	-	N/A
6 (2)	-	-	-	-	-	-	-	-	-	-	-	N/A
G03	-	-	-	-	-	-	-	-	-	-	-	N/A
G04	-	-	-	-	-	-	-	-	-	-	-	N/A
G04 (2)	-	-	-	-	-	-	-	-	-	-	-	N/A
G04 (2)	-	-	-	-	-	-	-	-	-	-	-	N/A
G09	-	-	-	-	-	-	-	-	-	-	-	N/A
G10	-	-	-	-	-	-	-	-	-	-	-	N/A
G12	-	-	-	-	-	-	-	-	-	-	-	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
G13		-	-	-	-	-	-	-	-	-	-	N/A
G13 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G13 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G14		-	-	-	-	-	-	-	-	-	-	N/A
G14 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G14 (2)		-	-	-	-	-	-	-	-	-	-	N/A
24		-	-	-	-	-	-	-	-	-	-	N/A
24 (2)		-	-	-	-	-	-	-	-	-	-	N/A
3		-	-	-	-	-	-	-	-	-	-	N/A
3 (2)		-	-	-	-	-	-	-	-	-	-	N/A
9		-	-	-	-	-	-	-	-	-	-	N/A
9 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G01		-	-	-	-	-	-	-	-	-	-	N/A
G01 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G01 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G02		-	-	-	-	-	-	-	-	-	-	N/A
G02 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G02(2)		-	-	-	-	-	-	-	-	-	-	N/A
G05		-	-	-	-	-	-	-	-	-	-	N/A
G05 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G05 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G06		-	-	-	-	-	-	-	-	-	-	N/A
G06 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G06 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G07		-	-	-	-	-	-	-	-	-	-	N/A
G07 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G07 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G08		-	-	-	-	-	-	-	-	-	-	N/A
G11		-	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
2		-	112	-	44
2 (2)		-	116	-	44
4		-	137	-	11
4 (2)		-	137	-	11
5		-	127	-	13
5 (2)		-	127	-	13
6		-	145	-	5
6 (2)		-	145	-	5
G03		-	111	-	69
G04		-	126	-	125

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
G04 (2)		-	126	-	125
G04 (2)		-	113	-	125
G09		-	134	-	13
G10		68	-	-	22
G12		57	-	-	34
G13		-	106	-	109
G13 (2)		-	106	-	109
G13 (2)		-	104	-	109
G14		-	124	-	18
G14 (2)		-	124	-	13
G14 (2)		-	115	-	13
24		46	-	-	102
24 (2)		46	-	-	102
3		45	-	-	107
3 (2)		45	-	-	107
9		44	-	-	141
9 (2)		44	-	-	141
G01		42	-	-	292
G01 (2)		42	-	-	292
G01 (2)		42	-	-	292
G02		44	-	-	149
G02 (2)		42	-	-	225
G02(2)		42	-	-	225
G05		44	-	-	141
G05 (2)		44	-	-	141
G05 (2)		44	-	-	141
G06		42	-	-	292
G06 (2)		42	-	-	292
G06 (2)		42	-	-	292
G07		44	-	-	141
G07 (2)		44	-	-	141
G07 (2)		44	-	-	141
G08		46	-	-	97
G11		45	-	-	119

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?
G10	N/A	N/A
24	NO (-51.3%)	NO
24 (2)	NO (-51.3%)	NO
3	NO (-88.9%)	NO
3 (2)	NO (-88.9%)	NO
9	NO (-49.8%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
9 (2)	NO (-49.8%)	NO
G01	NO (-63.5%)	NO
G01 (2)	NO (-63.5%)	NO
G01 (2)	NO (-63.5%)	NO
G02	NO (-64.3%)	NO
G02 (2)	NO (-68.3%)	NO
G02(2)	NO (-68.3%)	NO
G05	NO (-62.4%)	NO
G05 (2)	NO (-62.4%)	NO
G05 (2)	NO (-62.4%)	NO
G06	NO (-63.5%)	NO
G06 (2)	NO (-63.5%)	NO
G06 (2)	NO (-63.5%)	NO
G07	NO (-62.4%)	NO
G07 (2)	NO (-62.4%)	NO
G07 (2)	NO (-62.4%)	NO
G08	NO (-62.4%)	NO
G11	NO (-69.1%)	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?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	738.4	738.4
External area [m ²]	823.3	823.3
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	10	3
Average conductance [W/K]	354.86	523.45
Average U-value [W/m ² K]	0.43	0.64
Alpha value* [%]	34.85	18.39

* 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
100	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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	3.5	3.47
Cooling	3.56	3.67
Auxiliary	0	0
Lighting	13.46	15.28
Hot water	1.4	1.62
Equipment*	24.07	24.07
TOTAL**	21.93	24.04

* Energy used by equipment does not count towards the total for 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]	131.45	148.24
Primary energy* [kWh/m ²]	67.31	68.9
Total emissions [kg/m ²]	11.4	11.9

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

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] No Heating or Cooling									
Actual	78	36.9	0	0	0	0	0	0	0
Notional	90.5	67.7	0	0	0	0	0	—	—
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	73.4	75.9	7.3	7.4	0	2.8	2.84	3	4
Notional	63.2	74.3	7.2	7.6	0	2.43	2.7	—	—

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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	24 Wall 1
Floor	0.2	0.2	G01 Exposed Floor 1
Roof	0.15	-	"No heat loss roofs"
Windows, roof windows, and rooflights	1.5	1.3	24 Window 1 (1)
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)] U _{i-Min} = Minimum individual element U-values [W/(m²K)] * There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	10

BRUKL Output Document

Compliance with England Building Regulations Part L 2013



Project name

Access Self Storage Reading

As designed

Date: Fri Jul 08 10:10:50 2016

Administrative information

Building Details

Address: 62 Portman Road, Reading,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.d.2

Interface to calculation engine: Design Database

Interface to calculation engine version: v26.03

BRUKL compliance check version: v5.2.d.2

Owner Details

Name: Information not provided by the user

Telephone number: Information not provided by the user

Address: Information not provided by the user, Information not provided by the user, Information not provided by the user

Certifier details

Name: Foreman Roberts

Telephone number: 0161 831 6565

Address: 19 Spring Gardens, Manchester, M2 1FB

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

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	11.9
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	11.9
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	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 the building services should achieve reasonable overall standards of energy efficiency

Values not achieving 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	0.2	0.2	24 Wall 1
Floor	0.25	0.2	0.2	G01 Exposed Floor 1
Roof	0.25	-	-	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	1.3	1.3	24 Window 1 (1)
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

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	10

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 2

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3	4	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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- Default DHW

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

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I			
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard	
2	-	-	-	-	-	-	-	-	-	-	N/A	
2 (2)	-	-	-	-	-	-	-	-	-	-	N/A	
4	-	-	-	-	-	-	-	-	-	-	N/A	
4 (2)	-	-	-	-	-	-	-	-	-	-	N/A	
5	-	-	-	-	-	-	-	-	-	-	N/A	
5 (2)	-	-	-	-	-	-	-	-	-	-	N/A	
6	-	-	-	-	-	-	-	-	-	-	N/A	
6 (2)	-	-	-	-	-	-	-	-	-	-	N/A	
G03	-	-	-	-	-	-	-	-	-	-	N/A	
G04	-	-	-	-	-	-	-	-	-	-	N/A	
G04 (2)	-	-	-	-	-	-	-	-	-	-	N/A	
G04 (2)	-	-	-	-	-	-	-	-	-	-	N/A	
G09	-	-	-	-	-	-	-	-	-	-	N/A	
G10	-	-	-	-	-	-	-	-	-	-	N/A	
G12	-	-	-	-	-	-	-	-	-	-	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
G13		-	-	-	-	-	-	-	-	-	-	N/A
G13 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G13 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G14		-	-	-	-	-	-	-	-	-	-	N/A
G14 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G14 (2)		-	-	-	-	-	-	-	-	-	-	N/A
24		-	-	-	-	-	-	-	-	-	-	N/A
24 (2)		-	-	-	-	-	-	-	-	-	-	N/A
3		-	-	-	-	-	-	-	-	-	-	N/A
3 (2)		-	-	-	-	-	-	-	-	-	-	N/A
9		-	-	-	-	-	-	-	-	-	-	N/A
9 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G01		-	-	-	-	-	-	-	-	-	-	N/A
G01 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G01 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G02		-	-	-	-	-	-	-	-	-	-	N/A
G02 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G02(2)		-	-	-	-	-	-	-	-	-	-	N/A
G05		-	-	-	-	-	-	-	-	-	-	N/A
G05 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G05 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G06		-	-	-	-	-	-	-	-	-	-	N/A
G06 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G06 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G07		-	-	-	-	-	-	-	-	-	-	N/A
G07 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G07 (2)		-	-	-	-	-	-	-	-	-	-	N/A
G08		-	-	-	-	-	-	-	-	-	-	N/A
G11		-	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
2		-	112	-	44
2 (2)		-	116	-	44
4		-	137	-	11
4 (2)		-	137	-	11
5		-	127	-	13
5 (2)		-	127	-	13
6		-	145	-	5
6 (2)		-	145	-	5
G03		-	111	-	69
G04		-	126	-	125

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
G04 (2)		-	126	-	125
G04 (2)		-	113	-	125
G09		-	134	-	13
G10		68	-	-	22
G12		57	-	-	34
G13		-	106	-	109
G13 (2)		-	106	-	109
G13 (2)		-	104	-	109
G14		-	124	-	18
G14 (2)		-	124	-	13
G14 (2)		-	115	-	13
24		46	-	-	102
24 (2)		46	-	-	102
3		45	-	-	107
3 (2)		45	-	-	107
9		44	-	-	141
9 (2)		44	-	-	141
G01		42	-	-	292
G01 (2)		42	-	-	292
G01 (2)		42	-	-	292
G02		44	-	-	149
G02 (2)		42	-	-	225
G02(2)		42	-	-	225
G05		44	-	-	141
G05 (2)		44	-	-	141
G05 (2)		44	-	-	141
G06		42	-	-	292
G06 (2)		42	-	-	292
G06 (2)		42	-	-	292
G07		44	-	-	141
G07 (2)		44	-	-	141
G07 (2)		44	-	-	141
G08		46	-	-	97
G11		45	-	-	119

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?
G10	N/A	N/A
24	NO (-51.3%)	NO
24 (2)	NO (-51.3%)	NO
3	NO (-88.9%)	NO
3 (2)	NO (-88.9%)	NO
9	NO (-49.8%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
9 (2)	NO (-49.8%)	NO
G01	NO (-63.5%)	NO
G01 (2)	NO (-63.5%)	NO
G01 (2)	NO (-63.5%)	NO
G02	NO (-64.3%)	NO
G02 (2)	NO (-68.3%)	NO
G02(2)	NO (-68.3%)	NO
G05	NO (-62.4%)	NO
G05 (2)	NO (-62.4%)	NO
G05 (2)	NO (-62.4%)	NO
G06	NO (-63.5%)	NO
G06 (2)	NO (-63.5%)	NO
G06 (2)	NO (-63.5%)	NO
G07	NO (-62.4%)	NO
G07 (2)	NO (-62.4%)	NO
G07 (2)	NO (-62.4%)	NO
G08	NO (-62.4%)	NO
G11	NO (-69.1%)	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?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	738.4	738.4
External area [m ²]	823.3	823.3
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	10	3
Average conductance [W/K]	354.86	523.45
Average U-value [W/m ² K]	0.43	0.64
Alpha value* [%]	34.85	18.39

* 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
100	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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	3.5	3.47
Cooling	3.56	3.67
Auxiliary	0	0
Lighting	13.46	15.28
Hot water	1.4	1.62
Equipment*	24.07	24.07
TOTAL **	21.93	24.04

* Energy used by equipment does not count towards the total for 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	4.55	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]	131.45	148.24
Primary energy* [kWh/m ²]	67.31	68.9
Total emissions [kg/m ²]	9	11.9

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

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] No Heating or Cooling									
Actual	78	36.9	0	0	0	0	0	0	0
Notional	90.5	67.7	0	0	0	0	0	—	—
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	73.4	75.9	7.3	7.4	0	2.8	2.84	3	4
Notional	63.2	74.3	7.2	7.6	0	2.43	2.7	—	—

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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	24 Wall 1
Floor	0.2	0.2	G01 Exposed Floor 1
Roof	0.15	-	"No heat loss roofs"
Windows, roof windows, and rooflights	1.5	1.3	24 Window 1 (1)
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)] U _{i-Min} = Minimum individual element U-values [W/(m²K)]			
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	10