KGA (UK) Ltd

Chartered Building Services Consulting Engineers

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Energy Statement

Project

Maple Cross, Maple Lodge Close

Units 1 & 2

5000

Revision 4

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Contents

1. EXECUTIVE SUMMARY

This Energy Statement has been prepared by KGA (UK) Ltd to accompany an application for full planning permission being submitted by the Applicant, BCL (Maple Cross) LLP, to Three Rivers District Council (TRDC). Planning permission is sought for the following development:

'Comprehensive redevelopment to provide 2 no. warehouse Class E(g)(iii) /B2/B8 units comprising a total of 16,115 sqm including 1,882 sqm ancillary E(g)(i) office space, access, landscaping and associated works.'

This application follows the refusal of planning application ref. 19/1179/FUL 'the 'refused application') in November 2019, dismissed at appeal in June 2020 for a similar development. This report comprises a revision of the report which accompanied the refused application and is submitted in support of this revised scheme. It considers the amendments in the context of the scheme as a whole and relevant clarifications provided through the determination of the refused scheme.

For full details of the proposed development see the Design and Access Statement prepared by C4. For details in in terms of how this application relates to the refused scheme see the Planning Statement prepared by Avison Young.

1.1 ENERGY AND CARBON TARGETS

Multiple layers of energy and carbon requirements apply to the development at a national, regional and local level, each of which requires different targets to be met. The development will be designed to target the most onerous requirements applicable for this proposal.

On that basis, the implications of the relevant targets for the proposed development can be summarised as follows:

- All development must meet the prevailing Building Regulations requirements. The development will be brought forward under Part L 2013 and this has been used as the basis of this energy statement.
- Three Rivers District Council requires that major development achieves a 5% further reduction in carbon emissions over Part L 2013 baseline. This may be achieved through a combination of energy efficiency measures, incorporation of on-site low carbon and renewable technologies, connection to a local, decentralized, renewable or low carbon energy supply.

1.2 ENERGY STRATEGY

This energy statement has been structured in line with the energy hierarchy: Be Lean, Be Clean, Be Green.

The proposals for the scheme have been developed in accordance with the desire to achieve an energy efficient and sustainable development. The development will be designed to achieve optimum energy performance and will incorporate the following design features:

- Significantly exceed the minimum fabric requirements of Part L2A (2013) of the Building Regulations.
- All buildings will include 100% low energy lighting and lighting control.
- All buildings will be provided with mechanical ventilation with heat recovery (MVHR) systems for ventilation within Offices.
- The open plan offices is heated and cooled via a high efficiency heat pump. Note: Previous revision of this report/assessment incorporated a wet heating system via gas fired boilers.

- It is not possible to serve the development from a district heating network.
- In line with the requirements of Core Strategy we therefore propose to provide a high efficient boiler plant to feed low temperature hot water heating and hot water production.
- Renewable and zero carbon technology such as photoelectric solar panel are not required to meet the 5% reduction in CO2 emissions. However photoelectric solar panels are being proposed with the results detailed below.

1.3 RESULTS

Accredited IES VE software was used to determine the regulated carbon emissions. The results were then used to assess the total baseline carbon emissions, the carbon emissions after the application of energy efficiency measures and the carbon emissions after the application of improvement in fabric, energy efficient building services and low and zero carbon technologies. The results are shown in Table 1-1 below and exceed the -5% target reduction.

Table 1-1 Carbon Emissions Reduction Over Part L 2013

	Part L2A 2013 Benchmark (TER) (kgCO2/m2)	**Be Lean Part L2A 2013 Benchmark (TER) (kgCO2/m2)**	**Be Clean Part L2A 2013 Benchmark (TER) (kgCO2/m2)**	**Part L2A 2013 Benchmark (TER) (kgCO2/m2) With 250m2 PV**
Unit 1	10.9	8.3 (-24%)	8.3 (-24%)	6.5 (-40%)
Unit 2	10.8	9.0 (-8%)	9.0 (-8%)	6.8 (-37%)

2. PROJECT BACKGROUND

2.1 DEVELOPMENT DESCRIPTION

The Maple Cross site, as defined by the red line boundary on the site location plan submitted with this application (Figure 2-1) comprises an undeveloped open grassed area of approximately 3.4 hectares. Mature trees and vegetation align the eastern, southern and western site boundaries.

The site is accessed via a road leading from the A412/Denham Way. The access road already serves other commercial/industrial sites most noticeably Maple Lodge Sewage Treatment Works which lies to the south east of the site beyond a further undeveloped plot of land.

Immediately to the south, beyond the undeveloped field is a locally designated nature reserve and Wildlife site, Maple Lodge Nature Reserve. To the north and west of the site is Maple Cross/Maple Lodge Employment Site, a designated employment area within the Site Allocations Local Development Document (adopted October 2014) and of which the application site forms part. There are also residential properties to the west of the site and an industrial/commercial building and depot to the north. To the immediate north of the site is an area of land fronting the A412/Denham Way where planning permission has been granted for a hotel. To the east are open fields. Part of the site is located within the floodzone. The site lies within Groundwater Source Protection Zone 1.

The Maple Cross site, the subject of this application, provides an opportunity to construct a sustainable commercial industrial unit. The design strategy is to be lean be, be green and be clean.

Full planning permission is sought for a Comprehensive redevelopment to provide 2 no. warehouse Class E(g)(iii) /B2/B8 units comprising a total of 16,115 sqm including 1,882 sqm ancillary E(g)(i) office space, access, landscaping and associated works.'

Figure 2-1 Site Location Map for the Proposed Development (site boundary within red line)

3. POLICY CONTEXT

Local planning authorities should expect new development to:

- Comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
- Take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

Three Rivers District Council's approach to sustainable development is underpinned by core policies from the adopted Local Plan. The Core Strategy (2011) provides overarching strategy and policies and the long term vision for Three Rivers District Council. The Development Management Policies Development Plan Document (2013) sets out the criteria against which all planning applications within the District will be considered.

3.1 LOCAL PLAN

Key policies underpinning the Local Plan approach to sustainable development include:

- Policy CP1 – Over-arching Policy on Sustainable Development
- Policy DM4 – Carbon Dioxide Emissions and On Site Renewable Energy

The Local Plan sets out policy in the Three Rivers District Council context and identifies a number of objectives to reduce emissions and encourage sustainable construction. Policy DM4 sets out the requirements to minimise CO2 emissions through the application of the energy hierarchy. The following energy hierarchy has been used for this development:

1. **Be lean**: use less energy
2. **Be clean**: supply energy efficiently
3. **Be green**: use renewable energy

The policy requires commercial developments to achieve a 5% carbon emissions reduction over Part L (2013) of the Building Regulations.

The Policy requires an assessment of energy demand that demonstrates the steps taken to apply the energy hierarchy. The Policy includes planning policies both for reducing energy consumption within buildings and the use of renewable energy. These policies cover the role of the energy strategy and the requirements of planning applications.

From 2013, applicants will be required to demonstrate that development will produce 5% less carbon dioxide emissions than Building Regulations Part L requirements (2013) having regard to feasibility and viability. This may be achieved through a combination of energy efficiency measures, incorporation of on-site low carbon and renewable technologies, connection to a local, decentralized, renewable or low carbon energy supply.

3.2 SUSTAINABLE DEVELOPMENT

Sustainable development is the key principle underpinning the Three Rivers Core Strategy, and is critical to the delivery of many of the Council's and community's aspirations. It requires social progress which recognises the needs of everyone, effective protection of the environment, prudent use of natural resources and the maintenance of high and stable levels of economic growth and employment.

Particular priorities for sustainable development within Three Rivers are to:

- Improve access to jobs, services and facilities for all groups;
- Achieve a high quality environment;
- Reduce the carbon footprint of the area.

All development in Three Rivers will contribute to the sustainability of the District. This means considering the need to tackling climate change by reducing carbon emissions, increasing energy and water efficiency of buildings, promoting the use of renewable energy systems, and using other natural resources wisely, including through the use of sustainable building materials.

4. BASELINE CARBON EMISSIONS

The first stage of the energy assessment is to establish the baseline site energy demand and CO2 emissions based on accredited Part L software for the commercial development.

IES VE software was used to establish the baseline regulated carbon emissions.

The results for the units were then used as the baseline carbon emissions and energy demand for the site.

Table 4-2 Summarises sample of models considered.

In order to calculate the baseline carbon emissions, a Part L2A calculation was produced which calculates the Target Emission Rate (TER) kgCO2/m2. The TER is calculated using a notional building which the below U-values.

Table 4-1 Fabric performance notional and backstop values

ELEMENT	NOTIONAL FABRIC PERFORMANCE
External Wall U-value (W/m2K)	0.26
Party wall U-value (W/m2K)	0.26
Ground floor U-value (W/m2K)	0.22
Roof U-value (W/m2K)	1.8
Curtain Wall / Glazing U-value (W/m2K)	1.6U / G0.4 / LT 0.71
Roof Light / Glazing G-value	1.6U / G0.55 / LT 0.6
Air permeability (m3/hr.m2 @ 50 Pa)	5.0

Table 4-2 summarises the baseline carbon emissions for each unit.

Table 4-2 Overall baseline regulated carbon emissions

		BUILDING REGULATIONS PART L 2013 COMPLIANT DEVELOPMENT
UNIT 1	REGULATED EMISSIONS (kgCO2/m2)	10.9
UNIT 2	REGULATED EMISSIONS (kgCO2/m2)	10.8

5. BE LEAN: REDUCE ENERGY DEMAND

The first step to achieving Building Regulations compliance and the targets outlined previously is to reduce energy demand. The measures associated with reducing demand can be termed as 'Energy Efficiency Measures'.

The Proposed Development will incorporate a number of relevant energy conservation measures the benefits of which are discussed below. In summary the following measures will be included:

- Improved air tightness;
- High performance building fabric;
- High performance glazing;
- 100% low energy lighting and controls;
- Mechanical ventilation with heat recovery.

5.1 BUILDING FABRIC

The building will be clad with a unitised curtain walling system.

At this stage it is anticipated that an overall U-value for the curtain walling system of around 1.6W/m2K or better will be achieved. For the purposes of this assessment this value has been used, though solutions will be sought to reduce the U-value further where possible in order to realise further carbon reductions.

Glazing to the units will be specified to achieve a g-value of around 0.32. This is considered to provide an appropriate year-round balance between maximising daylighting and beneficial wintertime solar gain, and minimising summertime solar gains to reduce the overheating risk and need for comfort cooling.

The current proposals for the building fabric performance for the Proposed Development are summarised in Table 5-1.

Table 5-1 Fabric performance targets

ELEMENT	NOTIONAL FABRIC PERFORMANCE
External Wall U-value (W/m2K)	0.26
Party wall U-value (W/m2K)	0.26
Ground floor U-value (W/m2K)	0.18
Roof U-value (W/m2K)	0.18
Curtain Wall / Glazing U-value (W/m2K)	1.6U / G0.28 / LT 0.7
Roof Lights / Glazing G-value	1.6U / G0.32 / LT 0.7
Air permeability (m3/hr.m2 @ 50 Pa)	4.0

5.2 BUILDING SERVICES

A high performance MEP building services is proposed for the scheme. Table 5-2 lists the general specification for the heating system, lighting and ventilation strategy for the proposed commercial units.

Table 5-2 General heating, cooling, ventilation and lighting specification for dwellings

ELEMENT	GENERAL SPECIFICATION
Ventilation	Mechanical ventilation with heat recovery (MVHR) units to achieve a specific fan power of 1.6W/l/s with a heat recovery efficiency of 70% or more.
Internal lighting	100% low energy, daylight control within warehouses
Primary heat source	Heating and cooling provided by High Efficiency heat pump with heating SCOP of 5.5 and cooling SEER of 9.0. Warehouse to be unheated/treated as frost protection only.
Heating controls	Optimum, including weather compensation
Heat emitters	Air conditioning cassettes
Overheating control / cooling	VRF comfort cooling/heating within office.

5.3 CARBON EMISSION REDUCTION

Based upon the energy efficiency measures outlined, the following total carbon emissions are calculated using the thermal dynamic software and detailed in Table 5-3.

The carbon emissions for the development are shown to be lower than the minimum requirements of the Building Regulations.

This is achieved via the use of the energy efficiency measures proposed (including a highly efficient building fabric, 100% low energy lighting and mechanical ventilation with heat recovery systems) which far exceed the minimum requirements of the Regulations.

Also, appropriate glazing percentages were used on the facade so that a good balance between favouring daylight levels and beneficial heat gains in winter and avoiding excessive heat gains in summer could be achieved.

Table 5-3 Be Lean: Unit 1&2 Carbon emissions after the application of energy efficiency measures

	Part L2A 2013 Benchmark (TER) (kgCO2/m2)	Be Lean Part L2A 2013 Benchmark (TER) (kgCO2/m2)
Unit 1	10.9	8.3 (-24%)
Unit 2	10.8	9.0 (-8%)

6. BE CLEAN: SUPPLY ENERGY EFFICIENTLY

After consumption has been reduced through the application of energy efficiency measures, the next step is to consider low carbon technologies in order to provide further reduction in carbon dioxide emissions.

The following low carbon technologies have been investigated for the Proposed Development.

- District heating network
- Combined Heat and Power (CHP)

6.1 DISTRICT HEATING NETWORK

There are no existing district heating networks in the vicinity of the development.

Therefore, connection for District Heating has not been considered viable for this scheme.

6.2 COMBINED HEAT AND POWER (CHP)

On the basis that the development cannot be supplied directly from a district heating network, in line with the requirements of Three Rivers council the use of CHP led LTHW heating system has been considered. A primarily commercial development, domestic hot water consumption is likely to make up a significant proportion of the total heat demand, which provides an ideal baseline heat load for the use of CHP.

However, as the building is predominatly heated via VRF within the office area and the warehouse will be unheated or heated for frost protection heating only, LTHW heating production would be limited to hot water production in WC faclities and limited number of radiators. Therefore the use of CHP would not be viable throughout the year and has not been considered for this scheme.

6.3 CARBON EMISSIONS REDUCTION

The impact of servicing the development by a central CHP led energy centre on the overall carbon emissions for the development is shown in Table 6-1.

Table 6-1 Be Clean: Unit 1&2 Carbon emissions after the provision of energy efficiency supply measures

	Part L2A 2013 Benchmark (TER) (kgCO2/m2)	**Be Lean Part L2A 2013 Benchmark (TER) (kgCO2/m2)**	**Be Clean Part L2A 2013 Benchmark (TER) (kgCO2/m2)**
Unit 1	10.9	8.3 (-24%)	8.3 (-24%)
Unit 2	10.8	9.0 (-8%)	9.0 (-8%)

7. BE GREEN: RENEWABLE ENERGY TECHNOLOGIES

Renewable Energy Technologies are those listed below which can provide a source of energy onsite that is not primarily based on the consumption of fossil fuels or grid electricity and/or utilises a heat source that is renewable such as ground source and solar thermal systems.

- Wind Power
- Biomass Heating
- Solar Thermal Hot Water Heating
- Photovoltaic Panels

In accordance with the requirements of DM4 of the Local Plan, we have evaluated a number of renewable energy technologies and outlined how they may be applied to the development.

7.1 WIND POWER

Harnessing the kinetic energy of wind can provide a renewable source of on-site electricity generation. Wind turbines need to be positioned where a frequent and steady source of wind is available that is not too turbulent or uneven in direction. Typically wind turbines are positioned on the roof of buildings that are significantly higher than their surroundings and or located in open areas where there is minimum disruption to prevailing winds.

The development is located within an urban environment with numerous adjacent buildings of similar height providing turbulent wind conditions unsuitable for wind power generation.

In addition, wind turbines are not considered to be appropriate in townscape and architectural terms to provide wind turbines on top of the building. On that basis they are not proposed for the Maple Cross site development.

7.2 BIOMASS HEATING

Biomass heating has embodied environmental impacts from transport and fuel combustion which makes it less desirable in Air Quality Management Areas (AQMAs). A review of the potential impact on air quality from increased wood fuelled biomass use in London has been carried out by AEA Energy & Environment, and was published in December 2007. Whilst the development is not within a London Borough the assessment indicates that potentially increasing the contribution from small-scale wood fuelled biomass combustion may lead to a substantial increase in nitrogen dioxide and particulate matter concentrations.

However there are several technologies such as ceramic filters, electrostatic precipitators or bag filters which can all be used to significantly reduce the emissions to air and have successfully been used on biomass systems located within AQMAs Solid biomass relies on a reliable fuel supply which must be delivered and stored on site. Sites using biomass solutions therefore require good access routes both of which are viable on this site. Biomass boilers also have weekly maintenance requirements and relatively high fuel costs compared to gas.

However, as the building is predominatly heated via VRF within the office area and the warehouse will be unheated or heated for frost protection heating only, LTHW heating production would be limited to hot water production in WC faclities and limited number of radiators. Therefore the use of Biomass would not be viable throughout the year and has not been considered for this scheme.

7.3 SOLAR THERMAL

Solar thermal generation involves capturing solar radiant heat to preheat or heat domestic hot water. Correctly located and orientated, solar thermal systems can meet a proportion of a building's domestic hot water dependent on the expected demand profile and available space for locating ST collectors.

The development's centralised heating system will be served by the Boiler heating system. A solar thermal hot water system would offset some proportion of the baseline load throughout the summer months if provided. The available roof space and the steady demand for hot water throughout the day make solar thermal a potential option. The construction of a nearby high rose hotel Planning Ref: 18/1424/CLPD may limit the amount of Solar Thermal at the Maple Cross Site.

7.4 PHOTOVOLTAIC PANELS

The feasibility of providing photovoltaic (PV) panels has been assessed for this scheme. Solar PV panels located on the top roof areas can be used to provide electricity generation which can contribute to the Local Authority Targets.

Photovoltaic (PV) modules convert sunlight into DC electricity and can be integrated into buildings. PV is distinct from other renewable energy technologies since it has no moving parts to be maintained and is silent. PV systems can be incorporated into buildings in various ways; on sloped roofs and flat roofs, on facades, atria and as shading devices.

Table 7.1 Three most common types of photovoltaic cell

Property	Monocrystalline Silicon	Polycrystalline Silicon	Thin Film Amorphous Silicon
			
Cell efficiency at standard test conditions	15-17%	14-15%	8-12%
Module efficiency	13-15%	12-14%	5-7%
Advantages/Disadvantages	Most efficient but highest cost	Less expensive than monocrystalline but slightly less efficient	Considerably cheaper but approximately half the efficiency of a typical monocrystalline panel

Since PV's generate DC output, an inverter and other equipment is needed to deliver the power to a building or the grid in an acceptable AC form. The cost of the inverter and these 'balance of system' (BOS) components can approach 50% of the total cost of a PV system.

There are several issues which will need to be considered further if one or more photovoltaic arrays are to be included. Consideration must be given to any over-shading provided by surrounding buildings as well as orientation and elevation of the panels. The construction of a nearby high rose hotel Planning Ref: 18/1424/CLPD may limit the viability of implementing PV at the Maple Cross Site.

A particular advantage of solar PV, over other types of LZC technology, is that the running costs are very low (requires no fossil fuel for operation) and since there are no moving parts, very little maintenance is required.

The suitability of this technology for the site is dependent on space availability for panel mounting. For the warehouse building, the available area is a south facing roof.

A PV system would offset some proportion of the baseline load if provided. The available roof space and the high electrical load and percentage of electrical load attributed to lighting throughout the day.

7.5 SUITABILITY APPRAISAL

All renewable energy technologies which may be considered feasible for the scheme have been assessed and summarised in table 7-1.

Table 7-2 Renewable technology suitability appraisal

TECHNOLOGY	APPRAISAL
Wind	Not suitable at this site
Biomass	Limited all round heating
Solar Thermal	Limited to HWS demand and summertime operation
Photovoltaic Panels	Potentially suitable at this site

7.6 CARBON EMISSIONS REDUCTION

All renewable energy technologies which may be considered feasible for the scheme have been assessed, the outcomes of which are summarised above. From that exercise, it was concluded that Solar PV panels were the most suitable for this scheme and would work effectively alongside the proposed HVAC services. 250m2 of PV has been included with the calculation for Be Green with the results detailed below:

Table 7-3 Be Green: Unit 1&2 Carbon Emissions

	Part L2A 2013 Benchmark (TER) (kgCO2/m2)	Be Lean Part L2A 2013 Benchmark (TER) (kgCO2/m2)	Be Clean Part L2A 2013 Benchmark (TER) (kgCO2/m2)	Part L2A 2013 Benchmark (TER) (kgCO2/m2) With PV
Unit 1	10.9	8.3 (-24%)	8.3 (-24%)	6.5 (-40%)
Unit 2	10.8	9.0 (-8%)	9.0 (-8%)	6.8 (-37%)

It shall be noted that the PV technology was not included within the previously submitted revision of this energy statement.

8. RESULTS

The three principal steps taken; Be Lean (Use Less Energy), Be Clean (Supply Energy Efficiently) and finally Be Green (Renewable Technology measures) are summarised below. The target (Building Regulations compliant) carbon emissions for the Proposed Development are as shown in Figure 8.1 & 8.2 below.

8.1 ENERGY CONSERVATION AND ENERGY EFFICIENCY (BE LEAN)

Through the application of the measures identified in Section 5 the regulated carbon emissions are shown to be 123.8 T CO2 per annum.

Table 8-1 Be Lean: Carbon Emission Reduction

	Part L2A 2013 Benchmark (TER) (kgCO2/m2)	**Be Lean Part L2A 2013 Benchmark (TER) (kgCO2/m2)**
Unit 1	10.9	8.3 (-24%)
Unit 2	10.8	9.0 (-8%)

8.2 SUPPLY ENERGY EFFICIENTLY (BE CLEAN)

The application of low carbon technologies has been explored and no solutions are proposed.

Table 8-2 Be Clean: Carbon Emission Reduction

	Part L2A 2013 Benchmark (TER) (kgCO2/m2)	**Be Lean Part L2A 2013 Benchmark (TER) (kgCO2/m2)**	**Be Clean Part L2A 2013 Benchmark (TER) (kgCO2/m2)**
Unit 1	10.9	8.3 (-24%)	8.3 (-24%)
Unit 2	10.8	9.0 (-8%)	9.0 (-8%)

8.3 RENEWABLE TECHNOLOGY (BE GREEN)

The feasibility of a range of renewable technologies has been assessed in the context of the Local Plan. Photovoltaics is the most suitable technology and 250m2 of PV has been included within the calculation.

	Part L2A 2013 Benchmark (TER) (kgCO2/m2)	**Be Lean Part L2A 2013 Benchmark (TER) (kgCO2/m2)**	**Be Clean Part L2A 2013 Benchmark (TER) (kgCO2/m2)**	**Part L2A 2013 Benchmark (TER) (kgCO2/m2) With PV**
Unit 1	10.9	8.3 (-24%)	8.3 (-24%)	6.5 (-40%)
Unit 2	10.8	9.0 (-8%)	9.0 (-8%)	6.8 (-37%)

9. CONCLUSION

In accordance with the policy to reduce CO2 emissions by 5% below Baseline Part L2A 2013, both units substantially meet this by reducing CO2 emissions by 40% for unit 1, and 37% for Unit 2 utilising a combination of "Be Clean" measures and "Be Green" measures.

APPENDIX A

BRUKL DOCUMENTS REV 2

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Unit 1 Maple Cross (No PV)

As designed

Date: Mon Dec 14 09:24:09 2020

Administrative information

Building Details

Address: Maple Lodge Close, , WD3 9SN

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: KGA (UK) Ltd

Telephone number: 01516475021

Address: Trinity CHambers, 10 Ivy Street, Birkenhead, CH41 5EF

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	10.9
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	10.9
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	8.3
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.26	0.26	NT000000:Surf[25]
Floor	0.25	0.22	0.22	NT000000:Surf[0]
Roof	0.25	0.18	0.18	RF000000:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.84	1.89	0F000000:Surf[36]
Personnel doors	2.2	2.2	2.2	0F000000:Surf[115]
Vehicle access & similar large doors	1.5	1.5	1.5	0F000000:Surf[120]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* 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

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- Rads and Nat Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	-	0.2	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

2- Rads and Extract

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	-	0.2	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

3- AC and HRU

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.5	4	0	0	0.75
Standard value	2.5*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

"No HWS in project, or hot water is provided by HVAC system"

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
0F04 - Store	-	-	0.4	-	-	-	-	-	-	-	N/A
1F04 - Acc WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1F05 - WC	-	-	0.4	-	-	-	-	-	-	-	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
1F06 - WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1F07 - Cleaners	-	-	0.4	-	-	-	-	-	-	-	N/A
1F08 - Open Plan Office	-	-	-	1.6	-	-	-	-	-	-	N/A
2F04 - Acc WC	-	-	0.4	-	-	-	-	-	-	-	N/A
2F05 - WC	-	-	0.4	-	-	-	-	-	-	-	N/A
2F06 - WC	-	-	0.4	-	-	-	-	-	-	-	N/A
2F07 - Cleaners	-	-	0.4	-	-	-	-	-	-	-	N/A
2F08 - Open Plan Office	-	-	-	1.6	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
Standard value	Luminaire	Lamp	Display lamp	
	60	60	22	
0F01 - Entrance Lobby	-	85	-	71
0F02 - Staircase	-	85	-	53
0F03 - Lift	85	-	-	42
0F04 - Store	85	-	-	24
1F01 - Lobby	-	85	-	72
1F02 - Staircase	-	85	-	53
1F03 - Lift	85	-	-	42
1F04 - Acc WC	-	85	-	40
1F05 - WC	-	85	-	33
1F06 - WC	-	85	-	33
1F07 - Cleaners	85	-	-	7
1F08 - Open Plan Office	85	-	-	3254
2F01 - Lobby	-	85	-	61
2F02 - Staircase	-	85	-	41
2F03 - Lift	85	-	-	31
2F04 - Acc WC	-	85	-	29
2F05 - WC	-	85	-	27
2F06 - WC	-	85	-	27
2F07 - Cleaners	85	-	-	6
2F08 - Open Plan Office	85	-	-	3210
0F05 - Warehouse	85	-	-	40283

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?
1F08 - Open Plan Office	NO (-35.2%)	NO
2F08 - Open Plan Office	NO (-35.3%)	NO
0F05 - Warehouse	YES (+3.8%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	8879.7	8879.7
External area [m²]	20527.4	20527.4
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	5
Average conductance [W/K]	7135.96	6531.59
Average U-value [W/m²K]	0.35	0.32
Alpha value* [%]	10.16	10

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
100	**B8 Storage or Distribution**
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	1.28	1.93
Cooling	0.74	1.18
Auxiliary	0.82	0.41
Lighting	11.83	16.76
Hot water	4.82	4.6
Equipment*	31.6	31.6
TOTAL**	**19.49**	**24.88**

* 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 & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	23.8	25.95
Primary energy* [kWh/m²]	48.9	64.02
Total emissions [kg/m²]	8.3	10.9

* 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 SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	33.9	163.5	1.8	7.1	6.7	5.13	6.39	5.5	9
	Notional	56.1	154.9	6.1	11.4	3.6	2.56	3.79	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	142.2	0	47.1	0	4	0.84	0	0.94	0
	Notional	270.4	0	87.1	0	3.2	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	172.6	0	57.2	0	2.6	0.84	0	0.94	0
	Notional	178.5	0	57.5	0	1.2	0.86	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

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

Key Features

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

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.26	NT000000:Surf[25]
Floor	0.2	0.22	NT000000:Surf[0]
Roof	0.15	0.18	RF000000:Surf[0]
Windows, roof windows, and rooflights	1.5	1.6	NT000000:Surf[1]
Personnel doors	1.5	2.2	0F000000:Surf[115]
Vehicle access & similar large doors	1.5	1.5	0F000000:Surf[120]
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = 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
$m^3/(h.m^2)$ at 50 Pa	5	5

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Unit 1 Maple Cross (250m2 PV)

As designed

Date: Mon Dec 14 10:59:40 2020

Administrative information

Building Details

Address: Maple Lodge Close, , WD3 9SN

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: KGA (UK) Ltd

Telephone number: 01516475021

Address: Trinity CHambers, 10 Ivy Street, Birkenhead, CH41 5EF

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, kgCO_2/m^2.annum	10.9
Target CO_2 emission rate (TER), kgCO_2/m^2.annum	10.9
Building CO_2 emission rate (BER), kgCO_2/m^2.annum	6.5
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.26	0.26	NT000000:Surf[25]
Floor	0.25	0.22	0.22	NT000000:Surf[0]
Roof	0.25	0.18	0.18	RF000000:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.84	1.89	0F000000:Surf[36]
Personnel doors	2.2	2.2	2.2	0F000000:Surf[115]
Vehicle access & similar large doors	1.5	1.5	1.5	0F000000:Surf[120]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^{2}K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^{2}K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^{2}K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m^3/(h.m^2) at 50 Pa	10	5

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- Rads and Nat Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	-	0.2	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

2- Rads and Extract

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	-	0.2	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

3- AC and HRU

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.5	4	0	0	0.75
Standard value	2.5*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

"No HWS in project, or hot water is provided by HVAC system"

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
0F04 - Store	-	-	0.4	-	-	-	-	-	-	-	N/A
1F04 - Acc WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1F05 - WC	-	-	0.4	-	-	-	-	-	-	-	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
1F06 - WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1F07 - Cleaners	-	-	0.4	-	-	-	-	-	-	-	N/A
1F08 - Open Plan Office	-	-	-	1.6	-	-	-	-	-	-	N/A
2F04 - Acc WC	-	-	0.4	-	-	-	-	-	-	-	N/A
2F05 - WC	-	-	0.4	-	-	-	-	-	-	-	N/A
2F06 - WC	-	-	0.4	-	-	-	-	-	-	-	N/A
2F07 - Cleaners	-	-	0.4	-	-	-	-	-	-	-	N/A
2F08 - Open Plan Office	-	-	-	1.6	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
Standard value	Luminaire	Lamp	Display lamp	
	60	60	22	
0F01 - Entrance Lobby	-	85	-	71
0F02 - Staircase	-	85	-	53
0F03 - Lift	85	-	-	42
0F04 - Store	85	-	-	24
1F01 - Lobby	-	85	-	72
1F02 - Staircase	-	85	-	53
1F03 - Lift	85	-	-	42
1F04 - Acc WC	-	85	-	40
1F05 - WC	-	85	-	33
1F06 - WC	-	85	-	33
1F07 - Cleaners	85	-	-	7
1F08 - Open Plan Office	85	-	-	3254
2F01 - Lobby	-	85	-	61
2F02 - Staircase	-	85	-	41
2F03 - Lift	85	-	-	31
2F04 - Acc WC	-	85	-	29
2F05 - WC	-	85	-	27
2F06 - WC	-	85	-	27
2F07 - Cleaners	85	-	-	6
2F08 - Open Plan Office	85	-	-	3210
0F05 - Warehouse	85	-	-	40283

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?
1F08 - Open Plan Office	NO (-35.2%)	NO
2F08 - Open Plan Office	NO (-35.3%)	NO
0F05 - Warehouse	YES (+3.8%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	8879.7	8879.7
External area [m^2]	20527.4	20527.4
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	5
Average conductance [W/K]	7135.96	6531.59
Average U-value [W/m^2K]	0.35	0.32
Alpha value* [%]	10.16	10

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
100	**B8 Storage or Distribution**
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	1.28	1.93
Cooling	0.74	1.18
Auxiliary	0.82	0.41
Lighting	11.83	16.76
Hot water	4.82	4.6
Equipment*	31.6	31.6
TOTAL**	**19.49**	**24.88**

* 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/m^2]

	Actual	Notional
Photovoltaic systems	3.55	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	23.8	25.95
Primary energy* [kWh/m^2]	48.9	64.02
Total emissions [kg/m^2]	6.5	10.9

* 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 SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	33.9	163.5	1.8	7.1	6.7	5.13	6.39	5.5	9
	Notional	56.1	154.9	6.1	11.4	3.6	2.56	3.79	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	142.2	0	47.1	0	4	0.84	0	0.94	0
	Notional	270.4	0	87.1	0	3.2	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	172.6	0	57.2	0	2.6	0.84	0	0.94	0
	Notional	178.5	0	57.5	0	1.2	0.86	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

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

Key Features

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

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.26	NT000000:Surf[25]
Floor	0.2	0.22	NT000000:Surf[0]
Roof	0.15	0.18	RF000000:Surf[0]
Windows, roof windows, and rooflights	1.5	1.6	NT000000:Surf[1]
Personnel doors	1.5	2.2	0F000000:Surf[115]
Vehicle access & similar large doors	1.5	1.5	0F000000:Surf[120]
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = 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
$m^3/(h.m^2)$ at 50 Pa	5	5

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Unit 2 Maple CRoss (No PV)

As designed

Date: Mon Dec 14 10:33:30 2020

Administrative information

Building Details

Address: Maple Lodge Close, , WD3 9SN

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: KGA (UK) Ltd

Telephone number: 0151 647 5021

Address: Trinity Chambers, 10 Ivy Street, Birkenhead, CH41 5EF

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, kgCO_2/m^2.annum	10.8
Target CO_2 emission rate (TER), kgCO_2/m^2.annum	10.8
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 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	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.26	0.26	NT000000:Surf[16]
Floor	0.25	0.22	0.22	NT000000:Surf[0]
Roof	0.25	0.18	0.18	0F000003:Surf[14]
Windows***, roof windows, and rooflights	2.2	1.84	1.89	0F000003:Surf[2]
Personnel doors	2.2	2.2	2.2	SC000000:Surf[1]
Vehicle access & similar large doors	1.5	1.5	1.5	0F000003:Surf[89]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^{2}K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^{2}K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^{2}K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m^3/(h.m^2) at 50 Pa	10	5

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- Rad and Nat Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	-	0.2	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

2- Rad and Extract Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	-	0.2	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

3- AC and HRU

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.5	4	0	0	0.75
Standard value	2.5*	1	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

"No HWS in project, or hot water is provided by HVAC system"

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
0F05 - Acc WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1F05 - WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1F06 - WC	-	-	0.4	-	-	-	-	-	-	-	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
1F07 - Open Office	-	-	-	1.6	-	-	-	-	-	-	N/A
2F04 - WC	-	-	0.4	-	-	-	-	-	-	-	N/A
2F05 - WC	-	-	0.4	-	-	-	-	-	-	-	N/A
2F06 - Open Office	-	-	-	1.6	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
0F01 - Entrance Lobby	-	85	-	65
0F02 - Staircase	-	85	-	40
0F03 - Escape Stair	-	85	-	41
0F04 - Lift	85	-	-	39
0F05 - Acc WC	-	85	-	40
0F06 - Warehouse	85	-	-	32938
1F01 - Lobby	-	85	-	66
1F02 - Staircase	-	85	-	46
1F03 - Escape Stair	-	85	-	41
1F04 - Lift	85	-	-	39
1F05 - WC	-	85	-	28
1F06 - WC	-	85	-	28
1F07 - Open Office	85	-	-	2877
2F01 - Lobby	-	85	-	51
2F02 - Staircase	-	85	-	37
2F03 - Lift	85	-	-	29
2F04 - WC	-	85	-	24
2F05 - WC	-	85	-	24
2F06 - Open Office	85	-	-	2847

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?
0F06 - Warehouse	NO (-25.7%)	NO
1F07 - Open Office	NO (-48.8%)	NO
2F06 - Open Office	NO (-48.8%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	7340.9	7340.9
External area [m^2]	16567.1	16567.1
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	5
Average conductance [W/K]	5224.69	5294.64
Average U-value [W/m^{2}K]	0.32	0.32
Alpha value* [%]	10.13	10

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
100	**B8 Storage or Distribution**
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	1.04	1.56
Cooling	0.73	1.18
Auxiliary	0.88	0.43
Lighting	13.12	16.86
Hot water	4.89	4.61
Equipment*	31.82	31.82
TOTAL**	**20.67**	**24.63**

* 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/m^2]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	23.25	24.01
Primary energy* [kWh/m^2]	52.86	63.7
Total emissions [kg/m^2]	9	10.8

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	34.5	150.8	1.9	6.6	6.7	5.13	6.39	5.5	9
	Notional	42.1	143.3	4.6	10.5	3.6	2.56	3.79	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	135.4	0	44.8	0	2.6	0.84	0	0.94	0
	Notional	172.3	0	55.5	0	1.2	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	42.4	0	14.1	0	4	0.84	0	0.94	0
	Notional	78.6	0	25.3	0	3.2	0.86	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

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

Key Features

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

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.26	NT000000:Surf[16]
Floor	0.2	0.22	NT000000:Surf[0]
Roof	0.15	0.18	0F000003:Surf[14]
Windows, roof windows, and rooflights	1.5	1.6	NT000000:Surf[1]
Personnel doors	1.5	2.2	SC000000:Surf[1]
Vehicle access & similar large doors	1.5	1.5	0F000003:Surf[89]
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = 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
$m^3/(h.m^2)$ at 50 Pa	5	5

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Unit 2 Maple CRoss (250m2 PV)

As designed

Date: Mon Dec 14 10:57:19 2020

Administrative information

Building Details

Address: Maple Lodge Close, , WD3 9SN

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: KGA (UK) Ltd

Telephone number: 0151 647 5021

Address: Trinity Chambers, 10 Ivy Street, Birkenhead, CH41 5EF

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, kgCO_2/m^2.annum	10.8
Target CO_2 emission rate (TER), kgCO_2/m^2.annum	10.8
Building CO_2 emission rate (BER), kgCO_2/m^2.annum	6.8
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.26	0.26	NT000000:Surf[16]
Floor	0.25	0.22	0.22	NT000000:Surf[0]
Roof	0.25	0.18	0.18	0F000003:Surf[14]
Windows***, roof windows, and rooflights	2.2	1.84	1.89	0F000003:Surf[2]
Personnel doors	2.2	2.2	2.2	SC000000:Surf[1]
Vehicle access & similar large doors	1.5	1.5	1.5	0F000003:Surf[89]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^{2}K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^{2}K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^{2}K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m^3/(h.m^2) at 50 Pa	10	5

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- Rad and Nat Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	-	0.2	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

2- Rad and Extract Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	-	0.2	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

3- AC and HRU

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.5	4	0	0	0.75
Standard value	2.5*	1	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

"No HWS in project, or hot water is provided by HVAC system"

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
0F05 - Acc WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1F05 - WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1F06 - WC	-	-	0.4	-	-	-	-	-	-	-	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
1F07 - Open Office	-	-	-	1.6	-	-	-	-	-	-	N/A
2F04 - WC	-	-	0.4	-	-	-	-	-	-	-	N/A
2F05 - WC	-	-	0.4	-	-	-	-	-	-	-	N/A
2F06 - Open Office	-	-	-	1.6	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
0F01 - Entrance Lobby	-	85	-	65
0F02 - Staircase	-	85	-	40
0F03 - Escape Stair	-	85	-	41
0F04 - Lift	85	-	-	39
0F05 - Acc WC	-	85	-	40
0F06 - Warehouse	85	-	-	32938
1F01 - Lobby	-	85	-	66
1F02 - Staircase	-	85	-	46
1F03 - Escape Stair	-	85	-	41
1F04 - Lift	85	-	-	39
1F05 - WC	-	85	-	28
1F06 - WC	-	85	-	28
1F07 - Open Office	85	-	-	2877
2F01 - Lobby	-	85	-	51
2F02 - Staircase	-	85	-	37
2F03 - Lift	85	-	-	29
2F04 - WC	-	85	-	24
2F05 - WC	-	85	-	24
2F06 - Open Office	85	-	-	2847

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?
0F06 - Warehouse	NO (-25.7%)	NO
1F07 - Open Office	NO (-48.8%)	NO
2F06 - Open Office	NO (-48.8%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	7340.9	7340.9
External area [m²]	16567.1	16567.1
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	5
Average conductance [W/K]	5224.69	5294.64
Average U-value [W/m²K]	0.32	0.32
Alpha value* [%]	10.13	10

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
100	**B8 Storage or Distribution**
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	1.04	1.56
Cooling	0.74	1.18
Auxiliary	0.88	0.43
Lighting	13.12	16.86
Hot water	4.89	4.61
Equipment*	31.82	31.82
TOTAL**	**20.67**	**24.63**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	4.16	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	23.27	24.01
Primary energy* [kWh/m²]	52.86	63.7
Total emissions [kg/m²]	6.8	10.8

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	34.3	151.2	1.9	6.6	6.7	5.13	6.39	5.5	9
	Notional	42.1	143.3	4.6	10.5	3.6	2.56	3.79	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	135	0	44.7	0	2.6	0.84	0	0.94	0
	Notional	172.3	0	55.5	0	1.2	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	42.2	0	14	0	4	0.84	0	0.94	0
	Notional	78.6	0	25.3	0	3.2	0.86	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

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

Key Features

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

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.26	NT000000:Surf[16]
Floor	0.2	0.22	NT000000:Surf[0]
Roof	0.15	0.18	0F000003:Surf[14]
Windows, roof windows, and rooflights	1.5	1.6	NT000000:Surf[1]
Personnel doors	1.5	2.2	SC000000:Surf[1]
Vehicle access & similar large doors	1.5	1.5	0F000003:Surf[89]
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = 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
$m^3/(h.m^2)$ at 50 Pa	5	5