Horton Road, West Drayton

Energy Strategy

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Horton Road, West Drayton

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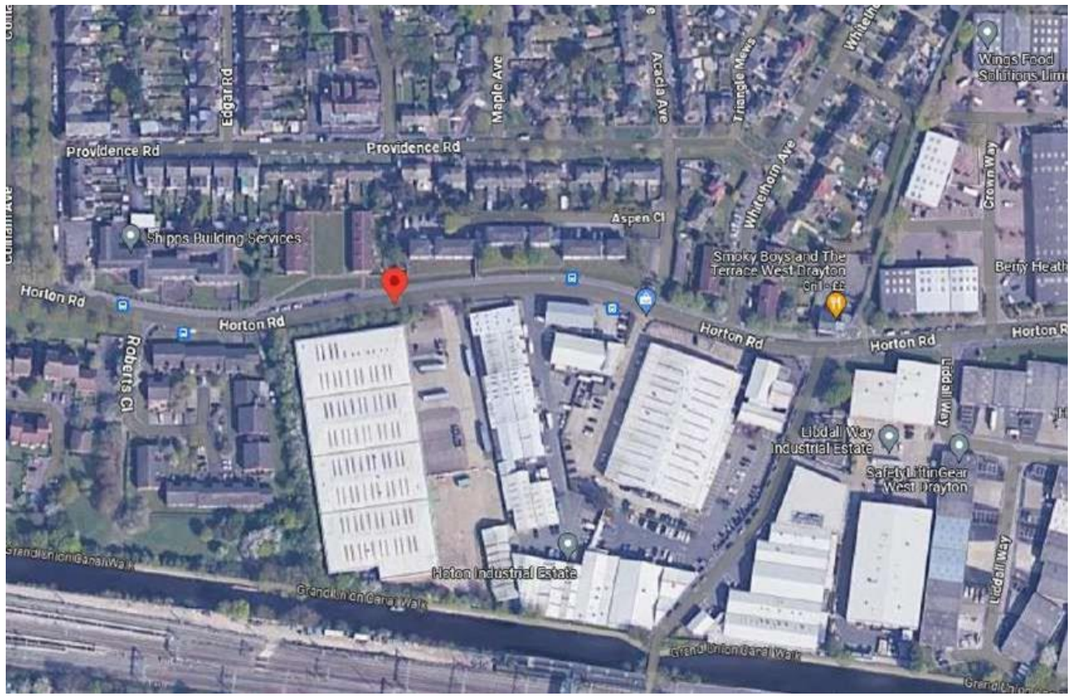

1. Executive Summary

This Energy Strategy has been prepared by Ramboll on behalf of LMO Overseas Investments Ltd ('The Client') to support the full planning application for the development of 2 modern, energy efficient employment units to provide 3,155 sq.m of flexible Class (E(g)(iii), B2 and B8 use with ancillary offices supported by car parking, service yards, landscaping and associated works. Hereafter referred as the 'Proposed Development'.

The site falls within London Borough of Hillingdon and forms part of the Orbital Industrial Estates. The site comprises 13 existing employment units that are coming to the end of their design life, including a variety of smaller premises with low internal clear heights. These units currently provide in the region of 3,937 sq.m of floorspace. The Proposed Development will replace these existing units with modern, energy efficient units which responds to market demand and occupier interest.

The Proposed Development consists of the demolition of existing buildings and construction of 2 new buildings, Unit 1 with 1,079 s.qm (GIA) and Unit 2 with 2,076 sq.m (GIA) which equates to a combined GIA of approximately 3,155 sq.m.

Energy Strategy Summary

This Energy Strategy was carried out to consider alternative ways of meeting the requirements of Part L 2021 of the Building Regulations, and the relevant policies of the Local Plan of London Borough of Hillingdon.

The Proposed Development is a major development but is not referable to the GLA. In line with the Hillingdon's Local Plan Policy DMEI 2, which refers to The London Plan Policy SI2, the Proposed Development will follow the London Plan Energy Hierarchy of 'Be Lean', 'Be Clean' and 'Be Green' to reduce the carbon emissions of the development. The regulated carbon emissions reduction target is zero-carbon with a minimum of 35% carbon reduction on-site.

Be Lean

The Proposed Development passes the baseline scheme (Part L 2021 compliant development) prior to the consideration of any Low Zero Carbon (LZC) technologies. Following incorporation of passive design and energy efficient measures, the Proposed Development is anticipated to achieve 6.4% reduction in carbon emissions beyond the Baseline Part L 2021 scheme.

Be Clean

There are no possible connection to an area wide low carbon heating distribution network. In addition, incorporation of onsite CHP system has been deemed unsuitable. Therefore, a heat network and CHP technology has been discounted.

Be Green

A number of renewable technologies have been appraised in terms of their technical, physical and financial feasibility, as potential renewable systems to use on the project. It was deemed that heat pump (VRF) and Photovoltaic Panels were considered the most appropriate technologies. Following the adoption of heat pump and approximately 365sq.m of PV panels, the Proposed Development is anticipated to achieve a further 94.7% reduction in carbon emissions when compared to the Be Lean scheme.

Proposed CO2 Emissions Reduction

Overall, it is anticipated that the Proposed Development can achieve 101.1% reduction in CO2 emissions beyond the Baseline Part L 2021 scheme, therefore a zero-carbon development is attained.

A zero-carbon development is proposed which is in line with the zero-carbon emission target (100% reduction in regulated carbon emissions against Part L 2021 Baseline) within the London Plan Policy SI 2 for all major development.

Please refer to Table 1.1 and Figure 1.1 for Part L regulated carbon emission savings for the Proposed Development at each stage of the energy strategy.

Table 1.1: Part L regulated carbon emissions savings for the Proposed Development at each stage of the energy hierarchy

Part L 2021 regulated carbon emissions savings after each stage of the energy hierarchy

	Carbon Emissions [Tonnes CO_2/annum]	
	Regulated	**Unregulated**
Building Regulations Part L 2021 Compliant Development	8.2	26
After Be Lean	7.7	26
After Be Clean	7.7	26
After BE Green	-0.1	26

Part L 2021 regulated carbon emissions savings from each stage of the energy hierarchy

	Total Regulated Carbon Emissions Savings	
	[Tonnes CO_2/annum]	**%**
Be Lean: Savings from energy demand reduction	0.5	6.4%
Be Clean: Savings from heat network	0.0	0.0%
Be Green: Savings from renewable energy	7.8	94.7%
Cumulative on-site savings	8.3	101.1%

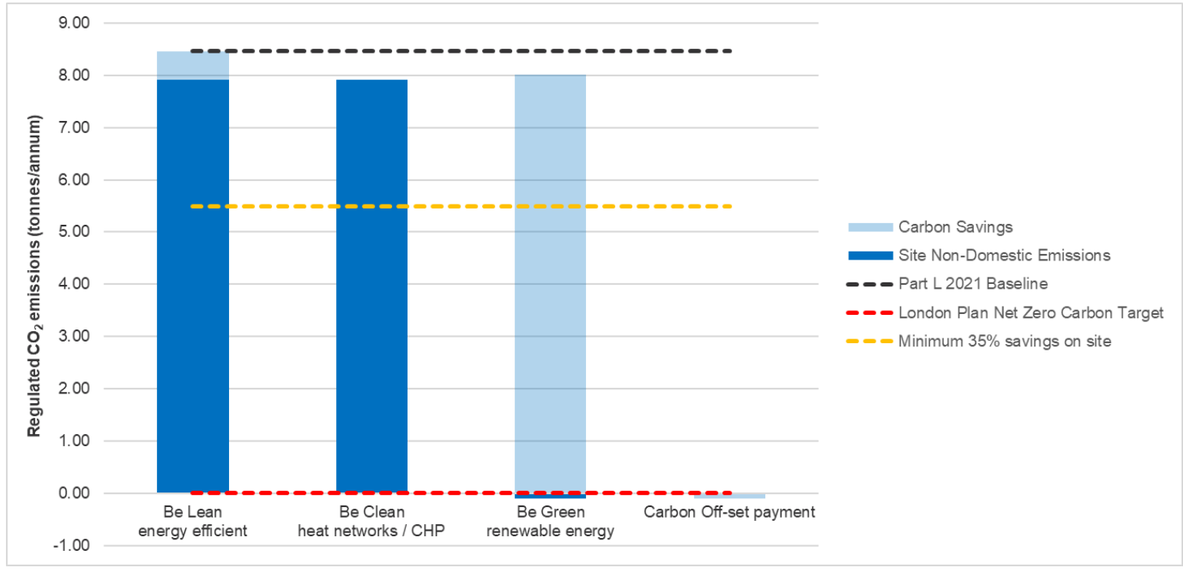

Figure 1.1: Sitewide summary Part L 2021 regulated carbon emission for the Proposed Development

2. Introduction

2.1 Background

Ramboll UK Limited '(Ramboll') has been appointed by LMO Overseas Investments Limited to undertake an energy strategy to support the full planning application for the development of 2 modern, energy efficient employment units to provide 3,155 sq.m of flexible Class (E(g)(iii), B2 and B8 use with ancillary offices supported by car parking, service yards, landscaping and associated works. Hereafter referred as the 'Proposed Development'.

2.2 Objective and Scope of Works

This report sets out a sustainable design and construction philosophy in response to the following planning policies:

Current National level policies:

- National Planning Policy Framework – NPPF (Feb 2025),
- Climate Change Act 2008,
- Building Regulations Part L 2021.

Current Local and Regional level policies – London Borough of Hillingdon and The Local Plan (Adopted January 2020)

- Policy EM 1 Climate Change Adaption and Mitigation,
- Policy DMEI 2 Reducing Carbon Emissions,
- Policy DMEI 3 Decentralised Energy

The London Plan (Adopted March 2021)

- Policy SI 2 Minimising Greenhouse Gas Emissions
- Policy SI 4 Managing heat risk

The aim of this document is to demonstrate a formal design response and commitment to achieve compliance with the policies defined above, and set out the vision, strategy and core policies for the development and building specification.

Dynamic simulation analysis and recognised design calculations have been undertaken and provided for the Proposed Development to demonstrate compliance with Part L 2021 (Volume 2) of the Building Regulations and planning policy carbon reduction targets.

Overall, this report aims to demonstrate that the Proposed Development considers energy, carbon emissions and key sustainability issues to meet the above mentioned regulatory and planning policy requirements.

2.3 Limitations and Constraints

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This energy strategy for this planning application assesses the Proposed Development buildings as 'shell and core' specification using proposed mechanical and electrical systems solution specifications to the office, reception and auxiliary areas (toiles, cleaner cupboards, and staircases). Final fit-out will be determined by the future tenant (end user).

This document shows building fabric performance and MEP systems strategy and adopted efficiencies to achieve compliance with the proposed energy strategy for the scheme.

3. Site Details

3.1 Site location and description

The site is located to the south of Horton Road, West Drayton and currently comprises 13 employment units associated with Orbital Industrial Estate, comprised of E(g), B2 and B8 land use. The existing site equates to a combined GIA of approximately 3,155 sq.m.

Generally, the site is located within an area characterised by industrial and business land uses, primarily located east, along Horton Road. To the north, and west beyond the neighbouring industrial units, extensive residential land use is available.

The south of the site is bound by the Grand Union Canal, south of which runs the Elizabeth and Great Western Railway Lines.

3.2 Proposed Development

The current scheme being considered is for the redevelopment of existing industrial units to provide two employment units, totalling 3,155 sq.m GIA of flexible E(g), B2 and B8 use class.

The two units comprise the following individual GIA:

- Unit 1 – 1,079 sq.m; and
- Unit 2 – 2,076 sq.m.

Unit 1 and Unit 2 will be served by separate points of access, utilising the existing Orbital Industrial Estate access and the Northpoint Business Centre access, respectively. The separation between the two existing junctions is approximately 45m.

Please refer to Figure 3.1 for site layout plan.

Figure 3.1 – Site Layout

4. Policy Objectives

4.1 National Level Policies

There are a number of national policies and regulations related to energy, those most relevant to the energy assessment of new developments are detailed below.

National Planning Policy Framework – NPPF (Feb 2025)

The National Planning Policy Framework (NPPF) was last updated in February 2025 and superseded the former planning policy statements (PPS) documents. The NPPF is designed to make the planning system less complex and more accessible; to protect the environment and promote sustainable growth. It provides a framework within which local people and their respective councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

At the heart of the National Planning Policy Framework is a presumption in favour of sustainable development. The three dimensions of sustainable development can be defined as the economic, social and environmental.

The NPPF aims to strengthen local decision making, with the use of decision-taking in a positive way, as a means of fostering the delivery of sustainable development. However, the NPPF also highlights that pursuing sustainable development requires careful attention to the viability and costs in plan-making and decision-taking. Plans should be deliverable. Therefore, the sites and the scale of development identified in the plan should not be subject to such a scale of obligations and policy burdens, that their ability to be developed viably is threatened.

Climate Change Act, 2008

The Government has introduced legislation and several policies during recent years focusing on the reduction of CO2 emissions. The Climate Change Act (2008) sets a legally binding target for the reduction in UK carbon dioxide emissions. Upon ratification of the Kyoto Protocol, the UK committed to a reduction in its CO2 emissions by 80% compared to 1990 levels (by 2050). In addition, under the Climate Change Act an interim target of a 34% reduction by 2020 was set.

In order to enforce these targets, the Government is using the Building Regulations: Part L 2021 (Conservation of fuel and power) which set the standards to which all new and existing buildings must comply.

Building Regulations Part L

Building Regulations are statutory instruments that seek to ensure that the policies set out within any relevant UK legislation are carried out. Building Regulations approval is required for the majority of building work carried out in the UK.

Part L of these regulations covers the requirements with respect to the conservation of fuel and power in all building types. It controls the insulation values of building fabric elements and openings, the air permeability of the structure, the heating efficiency of heating, ventilation and air conditioning systems together with hot water storage and lighting efficiency. It also sets out the requirements for calculating the carbon dioxide emissions and the Carbon Emission Targets for each building type.

An update of Part L has recently been released which is in-force for new projects registered on and after 15 June 2021. The approved software platforms to calculate compliance with Part L 2021 have been approved for use. Part L 2021 is split into two sections:

- Part L Volume 1: Dwellings; and
- Part L Volume 2: Buildings other than dwellings.

Due to the development being an industrial (non-domestic) building, the Proposed Development will need to comply with Part L 2021 Volume 2.

4.2 Local and Regional Level Policies

Planning policy for the proposed site location is set out in the policies denoted below; these set out an integrated social, economic and environmental framework for future development within Hillingdon. The planning guidance documents noted below contain several policies relating to energy; those most relevant to the energy assessment of new developments are detailed below.

London Borough of Hillingdon Local Plan

<u>Policy EM1: Climate Change Adaptation and Mitigation</u>

The Council will ensure that climate change mitigation is addressed at every stage of the development process by:

1. Prioritising higher density development in urban and town centres that are well served by sustainable forms of transport.
2. Promoting a modal shift away from private car use and requiring new development to include innovative initiatives to reduce car dependency.
3. Ensuring development meets the highest possible design standards whilst still retaining competitiveness within the market.
4. Working with developers of major schemes to identify the opportunities to help provide efficiency initiatives that can benefit the existing building stock.
5. Promoting the use of decentralised energy within large scale development whilst improving local air quality levels.
6. Targeting areas with high carbon emissions for additional reductions through low carbon strategies. These strategies will also have an objective to minimise other pollutants that impact on local air quality. Targeting areas of poor air quality for additional emissions reductions.
7. Encouraging sustainable techniques to land remediation to reduce the need to transport waste to landfill. In particular developers should consider bioremediation(39) as part of their proposals.
8. Encouraging the installation of renewable energy for all new development in meeting the carbon reduction targets savings set out in the London Plan. Identify opportunities for new sources of electricity generation including anaerobic digestion, hydroelectricty and a greater use of waste as a resource.
9. Promoting new development to contribute to the upgrading of existing housing stock where appropriate.

4. Policy Objectives

Policy DMEI 2: Reducing Carbon Emissions

1. All developments are required to make the fullest contribution to minimising carbon dioxide emissions in accordance with London Plan targets.
2. All major development proposals must be accompanied by an energy assessment showing how these reductions will be achieved.
3. Proposals that fail to take reasonable steps to achieve the required savings will be resisted. However, where it is clearly demonstrated that the targets for carbon emissions cannot be met onsite, the Council may approve the application and seek an off-site contribution to make up for the shortfall.

Policy DMEI 3: Decentralised Energy

1. All major developments are required to be designed to be able to connect to a Decentralised Energy Network (DEN).
2. Major developments located within 500 metres of an existing DEN, and minor new-build developments located within 100 metres, will be required to connect to that network, including provision of the means to connect to that network and a reasonable financial contribution to the connection charge, unless a feasibility assessment demonstrates that connection is not reasonably possible.
3. Major developments located within 500 metres of a planned future DEN, which is considered by the Council likely to be operational within 3 years of a grant of planning permission, will be required to provide a means to connect to that network and developers shall provide a reasonable financial contribution for the future cost of connection and a commitment to connect via a legal agreement or contract, unless a feasibility assessment demonstrates that connection is not reasonably possible.
4. The Council will support the development of DENs and energy centres in principle, subject to meeting the wider policy requirements of this plan and in particular on design and air quality.

The London Plan

The London Plan 2021 is legally part of each of London's Local Planning Authorities' Development Plan and must be considered when planning decisions are taken in any part of London.

Planning applications should be determined in accordance with it, unless there are sound planning reasons (other material considerations) which indicate otherwise. The plan provides the strategic, London-wide policy context for borough local development plan documents. The London Plan issued by the Mayor of London provides guidance on minimising greenhouse emissions, including the following key requirements:

Policy SI 2 Minimising Greenhouse Gas Emissions

Requires major developments to be net zero carbon and outlines a framework under which the GLA requires sustainable building design to be approached.

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

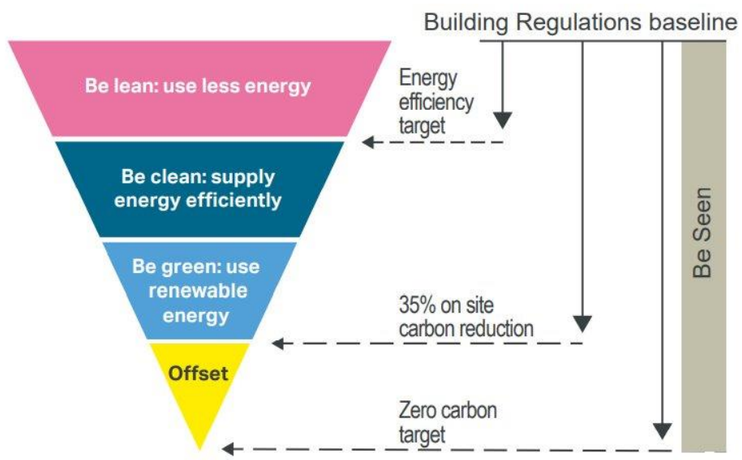

Figure 4.1 - GLA energy hierarchy

The policy also requires a minimum on-site reduction in regulated carbon emissions of 35% beyond Building Regulations. Residential development is required to achieve a 10% betterment though energy efficient measures and non-residential development a 15% betterment from energy efficient measures. Once on-site reductions have been maximised, the remaining carbon emissions are to be off-set to 100% where zero carbon target not achieved.

Policy SI 4 Managing heat risk

Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:

1. Reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure.
2. Minimise internal heat generation through energy efficient design.
3. Manage the heat within the building through exposed internal thermal mass and high ceilings.
4. Provide passive ventilation.
5. Provide mechanical ventilation.
6. Provide active cooling systems.

5. Assessment Methodology

The National Calculation Method (NCM) for the Energy Performance of Buildings Directive (EPBD) is defined by the Department for Levelling Up, Housing, and Communities (DLUHC) and it is the procedure for demonstrating compliance with the Building Regulations for buildings other than dwellings. Depending on the complexity of the assessment, either the Simplified Building Energy Model (SBEM) or Dynamic Simulation Methodology (DSM) can be used. Both of these tools are Government approved.

In order to identify the energy consumption and consequential carbon dioxide emissions, a DSM assessment was carried out. Images of this model are shown in Figures 5.1 and 5.2. The energy demand calculated using the NCM methodology is relative to the Regulated Emissions which includes the energy consumed to power space heating, domestic hot water, cooling, ventilation, and internal lighting systems.

The Actual Building Emission Rate (BER) and the Notional Building Target Emission Rate (TER) are the headline carbon dioxide emission figures which SBEM-DSM Calculations measure. These figures will determine whether a new building (actual) passes or fails on its carbon dioxide emission target (notional building) set within Part L of the Building Regulations. Therefore, the BER must be better than TER (BER < TER) to pass Part L of the Building Regulations.

The Proposed Development target a minimum 15% reduction in regulated carbon emissions from the Be Lean stage and minimum 35% reduction in regulated carbon emissions beyond Building Regulation Part L 2021 baseline as per Policy DMEI 2 of the London Borough of Hillingdon Local Plan and Policy SI 2 of the London Plan.

The results of the indicative calculations should not be used for any other purpose other than those for which they are intended (namely as a basis for this energy strategy). Formal assessments will be required at a later stage in the development process to satisfy Building Control requirements.

The closest weather files relevant to this location are from London. Therefore, the model used the London Test Reference Year (TRY) weather data. This data is provided by CIBSE to IESVE for use in calculations.

A TRY weather file of the type used in this simulation consists of weather data from a historical sequence of 12 non-consecutive months selected from the last 30 years' weather data for the relevant location. The individual months are selected based on their correlation with the average weather conditions for that month over the 30-year selection period and combined to make a 12-month compilation of "typical" months.

The design for this project will attain a final carbon emission rating that goes beyond the one required to comply with Approved Document Part L 2021 Volume 2 of the Building Regulations.

The proposed energy strategy approach is based on a recognised structure of reduction in carbon dioxide emissions through:

- Reducing the building energy consumption by optimising the design and construction of the building form and fabric and applying energy efficiency measures to ensure less energy is required.
- Supplying the energy from Low and Zero Carbon (LZC) Energy Sources.

Overall, it is more expensive to implement both carbon reduction and sustainability measures the further along the design process, as the opportunities available diminish. This highlights the importance of early consideration of these measures within the design process.

A passive, well insulated envelope will last for the life of the building with this being difficult to upgrade once building work is complete. The services installed within the building have a shorter life span and can be replaced / upgraded later, when their lifetime will have expired and new more efficient services will be available. Once the most efficient building envelope and services are provided, the installation of LZC technologies should be considered.

Baseline

The first step is to establish the "Baseline TER" in tonnes carbon per annum for the Proposed Development. The TER is calculated in accordance with the Part L 2021 requirements and sets the highest carbon level permissible in Part L Building Regulations for new buildings.

Proposed Development

The energy efficiency measures are applied to the building envelope (building fabric / air tightness) and the mechanical and electrical systems to reduce building energy demands with appropriate controls to optimise the use of systems. In addition, LZC (VRF heat pump and PV array) technologies are also proposed.

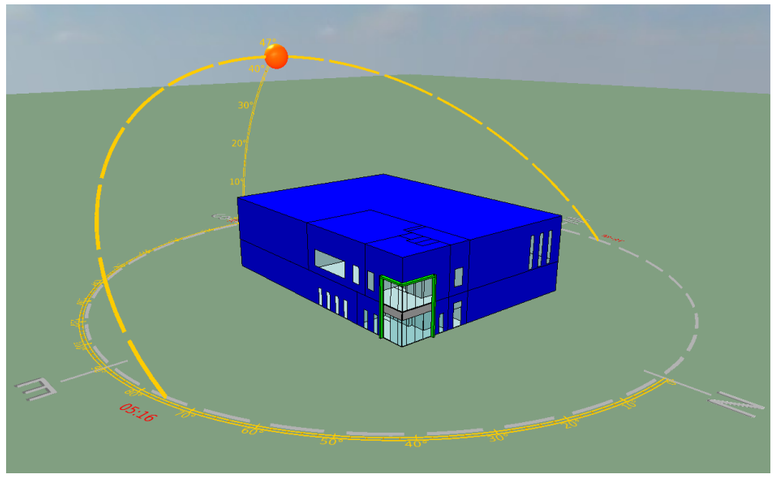

Figure 5.1 – Image of the IESVE model for Unit 1.

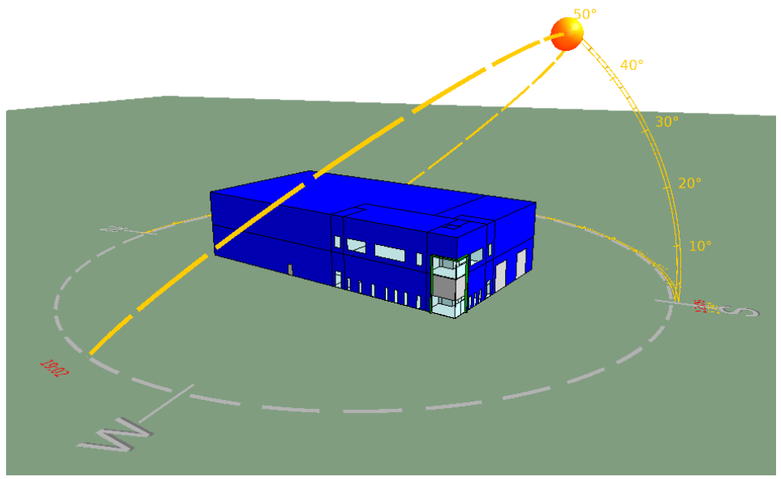

Figure 5.2 – Image of the IESVE model for Unit 2.

5. Assessment Methodology

5.1 Calculations for non-residential buildings

For non-residential buildings, the energy demands, and carbon emissions are calculated using the Part L 2021 methodology within the Integrated Environmental Solutions Virtual Environment (IES-VE) software, version 2024.1.0.0. The results from the analysis are presented in Building Regulations Part L 2021 (BRUKL) output documents.

The development mainly comprises a warehouse and ancillary offices. Therefore, the NCM templates assigned to assess the building for compliance with Part L have used the building type B8: Storage or Distribution.

Table 5.1 shows the NCM templates assigned to the Proposed Development.

Table 5.1 – NCM templates used for the Part L assessment.

Space type	Thermal template
Warehouse	NCM Ware: 24x7 warehouse storage
Office	NCM Ware: Office (Open)
Reception	NCM Ware: Reception
Circulation	NCM Ware: Circulation
Store	NCM Ware: Cupboard
Toilet	NCM Ware: Toilet

6. Proposed Development

As part of a suitable Energy Statement, the Proposed Development should feature best practice measures to achieve compliance with Part L 2021 of the Building Regulations.

Minimising energy use through design has been factored in from early concept design. A number of architectural and building fabric measures (passive design), energy efficient services (active design), appraisal of low zero carbon and renewable technologies have been explored and will be adopted/integrated into the design into the Proposed Development.

6.1 Be Lean

Passive design and energy efficiency measures form the basis for the reduction in overall energy demand and carbon emissions for the Proposed Development. This Energy Strategy aims to reduce the energy demand initially by optimising the envelope and building services efficiencies within the Proposed Development.

Be Lean measures refer to passive design and energy efficient solutions. The Proposed Development is seeking to maximise the potential of the measures in the strategy outlined in the following sections.

6.1.1 Passive Design Measures

The following passive design measures will be included in order to limit, as far as practically possible, the energy demands and carbon emissions arising from the Proposed Development:

- The general internal layout is designed to provide good daylight access for the majority of occupied spaces.
- High performing engineered façade with optimised U-values have been proposed;
- Air Tightness target of less than 3 m3/hr/m2 @ 50Pa.

Table 6.1 – Building fabric performance parameters.

Building fabric parameters for the proposed development		
U value (W/m2K)	Roof	0.15
	External Walls	0.18
	Ground Floor	0.15
	Rooflights	-
	Vehicle Doors	1.30
Glazing Parameters	External doors	1.40
	U-value	1.40
	G value	0.28
	Light Transmittance	0.56
	Frame Factor (%)	15-20%
Rooflights Parameters	U-value	-
	G value	-
	Light Transmittance	-
	Frame Factor	-
Air Permeability (m3/hr m2@50 Pa)		3.0

6.1.2 Active Design Measures

In addition to the passive design measures, the following energy efficiency measures will be included in the Proposed Development in order to limit the demand for primary energy.

1. Energy Efficient LED lighting to be installed throughout.
2. Circulations spaces, stores and office area lighting is to be fitted with presence detection controls.
3. The circulation, reception and office area lighting is to be fitted with daylight sensitive controls.
4. All fans and pumps should operate with variable speed control.
5. Mechanical ventilation with heat recovery is to be installed where balanced supply and extract ventilation is required, with a minimum heat recovery efficiency of 75% to 80%.
6. Hot water pipes, tanks and ducts should be insulated.
7. Energy metering will be in accordance with the recommendations set-out in TM31.

6.1.3 Overheating and Cooling

Policy SI 4 Managing heat risk of the London Plan states new development should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure. In addition, it also states that major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with cooling hierarchy.

Below are the steps of the cooling hierarchy and the proposal to demonstrate compliance:

1. Minimise internal heat generation through energy efficient design.
   - Heat generation will be minimised through the specification of energy efficient ventilation systems, and low energy lighting.

2. Reduce the amount of heat entering a building in summer through orientation, shading, fenestration, albedo and insulation. The amount of heat entering the building will be reduced by:
   - A glazing shading coefficient carefully selected to minimise solar gain in the summer, but also to maximise solar gain in winter.

6. Proposed Development

3. Manage the heat within the building through exposed internal thermal mass and high ceilings.
   - Ceiling height has been maximised within the constraints of the overall building heights and massing.
4. Passive Ventilation.
5. Mechanical Ventilation.
   - Ventilation will be provided by Mechanical Ventilation with Heat Recovery (MVHR) units. These units will incorporate a summer by-pass, which will allow the unit to supply fresh air without heat being transferred from the extract air into this supply air.
6. Active Cooling Systems.
   - Active cooling is proposed to the occupied spaces. However, the active cooling demand has been minimised in line with the cooling hierarchy.

6.1.3.1 Proposed Development Active Cooling

The Proposed Development will be designed with comfort cooling to the occupied reception, open plan office, and lobby areas. Table 6.2 below confirms actual building cooling demand is lower than of the notional building cooling demand. These actual and notional cooling demands have been extracted from the BRUKL output document, please refer to Appendix B and C for figures.

Table 6.2 – Actual vs Notional area weighted average cooling demand

	Area Weighted Avg Building Cooling Demand (MJ/sq.m)	
	Unit 1	**Unit 2**
Actual	90.2	132.0
Notional	102.2	163.9

6.2 Be Clean

"Be Clean" measures are those which serve to reduce the overall emissions of the development through the inclusion of low-carbon technologies such as Combined Heat and Power (CHP) engines.

6.2.1 Connection to a District Heating Network

Consideration was given to the possible connection to an existing or proposed area wide decentralised energy network. The UK CHP Development Map is an interactive tool, using an interactive GIS system, which allows users to identify opportunities for decentralised energy projects in the UK. This tool details the existing major heat loads and supplies within the UK as well as existing heat distribution networks. As shown in Figure 6.1, there is no heat network in the vicinity of the development.

However, it is recommended to future proof the Mechanical, Electrical, and Public Health (MEP) design to allow connectivity to an area wide heating/cooling network if one become available in the future.

Figure 6.1 – District Heating Network around the site.

6.3 Be Green

The final step of the energy hierarchy explores the feasibility of Low and Zero Carbon (LZC) technologies to allow for the production of renewable energy onsite in order to deliver further reduction in carbon emissions.

6.3.1 Proposed systems

VRF (heat pump) to provide spaces heating and cooling have been proposed. In addition, approx. 365 sq.m of PV panels (Unit 1 includes 135 sq.m and Unit 2 includes 230 sq.m) have been included.

The systems reported in Table 6.3 have been assessed for the purpose of this energy strategy. The efficiencies of the proposed systems are shown in Table 6.4. Full inputs are found in Appendix A.

Table 6.3 – Overview of proposed systems.

	Efficiencies used for HVAC system
Heating	3.60
Cooling	5.50
Ventilation Specific Fan Power (SFP)	1.40- 1.6 W/l/s
Ventilation Heat Recovery	75 - 80%
Domestic Hot Water	1.0
PV	21%
Lighting Efficacy	120 lm/W

Table 6.4 – Efficiencies used for the HVAC systems.

	HVAC and DHW Proposed Systems
Warehouse	
Heating	None
Cooling	None
Ventilation	Natural Ventilation
Domestic Hot Water	Point of Use (Electric)
Office / Reception	
Heating	VRF
Cooling	VRF
Ventilation	Mechanical Ventilation Heat Recovery (MVHR)
Domestic Hot Water	Point of Use (Electric)

7. Results, Conclusions and Recommendations

The proposed energy strategy adopts Variable Refrigerant Flow (VRF) for space heating and cooling demand to office, reception and lobby areas, VRF space heating to staircases, direct electric radiators for space heating demand to toilets and cleaner's cupboards.

The energy strategy presented in this report demonstrates a comprehensive approach to reducing carbon emissions associated with the Proposed Development according to the methodology and approach set out by the London Plan and the GLA Guidance on Energy Assessments (June 2022).

Part L 2021 has been used to assess the Proposed Development's carbon emission reduction performance. The energy hierarchy results are presented in the following tables and figures, and the conclusions are shown below:

Be Lean

The Proposed Development passes the baseline scheme (Part L 2021 compliant development) prior to the consideration of any Low Zero Carbon (LZC) technologies. Following incorporation of passive design and energy efficient measures, the Proposed Development is anticipated to achieve 6.4% reduction in carbon emissions beyond the Baseline Part L 2021 scheme.

Be Clean

The potential connection to an existing or planned heat distribution network has been investigated and no connection opportunities to existing district heating networks in the vicinity of the site have been identified. CHP is not proposed due to poor carbon reduction and adverse air quality impacts. However, the proposed site wide energy centre will be future proofed to allow connectivity to an area wide heating network if one become available in the future. Therefore, no further carbon reductions are envisaged for the Be Clean stage of the energy hierarchy.

Be Green

A number of renewable technologies have been appraised in terms of their technical, physical and financial feasibility, as potential renewable systems to use on the project. It was deemed that heat pump (VRF) and Photovoltaic Panels were considered the most appropriate technologies.

Following the adoption of heat pump and approximately 365 sq.m of PV panels, the Proposed Development is anticipated to achieve a further 94.7% reduction in carbon emissions when compared to the Be Lean scheme.

Proposed Carbon Emissions Reduction

Overall, it is anticipated that the Proposed Development can achieve 101.1% reduction in CO2 emissions beyond the Baseline Part L 2021 scheme, therefore a zero-carbon development is attained.

A zero-carbon development is proposed which is in line with the zero-carbon emission target (100% reduction in regulated carbon emissions against Part L 2021 Baseline) within the London Plan Policy SI 2 for all major development.

Please refer to Table 7.1, Table 7.2 and Figure 7.1 for Part L regulated carbon emission savings for the Proposed Development.

Table 7.1: Regulated carbon emissions savings for the Proposed Development

Part L 2021 regulated carbon emissions savings after each stage of the energy hierarchy

	Carbon Emissions [Tonnes CO_2/annum]	
	Regulated	**Unregulated**
Part L 2021 Compliant Development	8.2	26
After Be Lean	7.7	26
After Be Clean	7.7	26
After BE Green	-0.1	26

In addition, the Proposed Development achieves 9no Ene 01 credits under BREEAM UK New Construction V6.1 scheme, exceeding the minimum Ene 01 requirement for BREEAM Excellent rating.

Table 7.2: Regulated carbon emissions savings for the Proposed Development

Part L 2021 regulated carbon emissions savings from each stage of the energy hierarchy

	Total Regulated Carbon Emissions Savings	
	[Tonnes CO_2/annum]	**%**
Be Lean: Savings from energy demand reduction	0.5	6.4%
Be Clean: Savings from heat network	0.0	0.0%
Be Green: Savings from renewable energy	7.8	94.7%
Cumulative on-site savings	8.3	101.1%

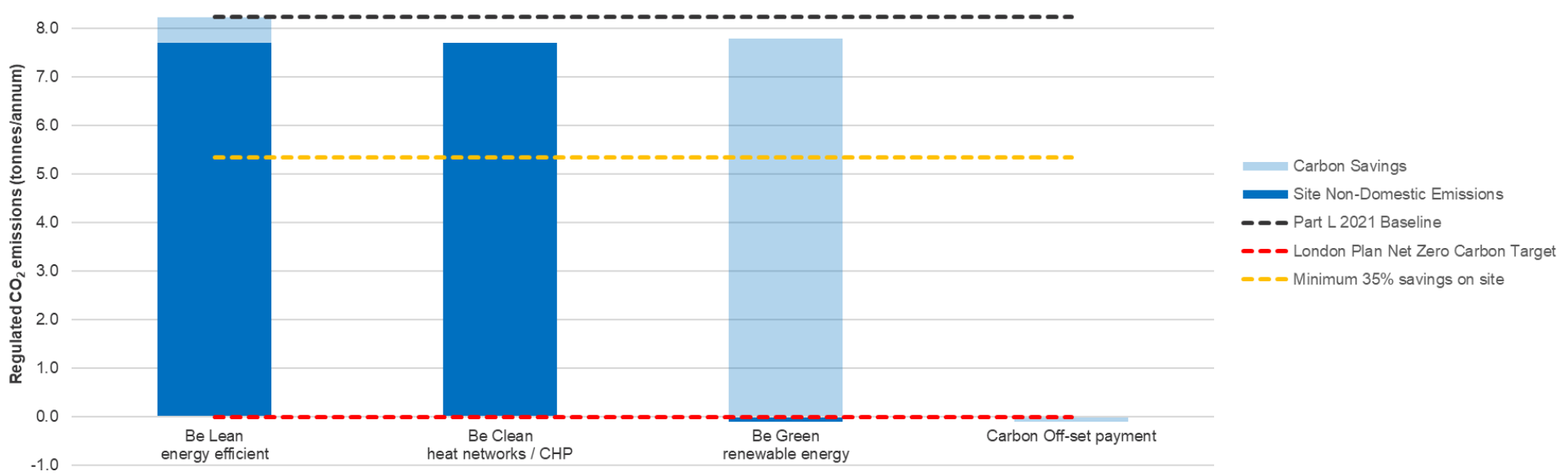

Figure 1.1: Sitewide summary Part L 2021 regulated carbon emission for the Proposed Development

Appendix A

Inputs at Be Green – Unit 1

BUILDING SERVICES - SYSTEMS						
Typical Rooms Served	**Main Warehouse**	**Office, Reception, Amenity areas**	**WC**	**Store**	**Circulation**	
IES System Name	**HVAC01-Warehouse**	**HVAC02-Office**	**HVAC03-WC**	**HVAC04-Store**	**HVAC05-Circulation**	None
System Type	None	Variable refrigerant Flow	Radiators	Radiators	Radiators	
Heating Fuel Source	None	Heat Pump (Electric): air source	Direct electric	Heat Pump (Electric): air source	Direct electric	
Heating Efficiency - COP/SCOP	-	3.6	1	1	3.6	
Delivery Efficiency						
Cooling Fuel Source		Heat Pump (Electric)				
Cooling Efficiency - EER/SEER		5.00				
Does the System have provision for metering?	-	Yes it does	Yes it does	Yes it does	Yes it does	
Does the metering warn 'out of range' values?	-	Yes it does	Yes it does	Yes it does	Yes it does	
Does equipment qualify for ECA's?	-	ECA list (after 2001)	-	-	-	
Has the ductwork been leakage tested?	-	Class A	-	-	-	
Does the AHU meet CEN leakage Standards	-	Class L2	-	-	-	
Ventilation Type	-	Mechanical Supply & Extract	Extract Only	Extract Only	Natural ventilation	
Specific Fan power (W/l/s)	-	1.60	0.40	0.40	0.40	
Terminal Fan power (W/l/s)	-	-	-	-	-	
Fuel Source	-	Heat pump	Heat pump	Heat pump	Heat pump	
Heat Recovery Efficiency (%)	-	75%	-	-	-	
Heat Recovery Type	-	Thermal Wheel	-	-	-	
DOMESTIC HOT WATER SYSTEM						
Room Served	**Unit 1**	**Unit 2**				
Type	Point of Use	Point of Use				
Fuel Source	Electric	Electric				
Seasonal Efficiency	1	1				
Total Storage Volume (litres)						
Insulation type						
Insulation thickness	-	-				
Storage Losses (kWh/l.day)	Default	Default				
Delivery Efficiency	100%	100%				
Av. DHW pipe size (for pipework heat loss calcs)	-	-				
Used in conjunction with Heat Pump?	-	-				
Electric Power Factor	**Power Factor Correction**					
Power Factor	Between 0.90-0.95					
BUILDING SERVICES - RENEWABLES						
	Unit 1	**Unit 2**				
PV Type	Monocrystalline Sylicon	Monocrystalline Sylicon				
Orientation (clockwise from north)	180	180				
Inclination (degree tilt)						
Area (m2)	135	400				

LIGHTING AND CONTROL	Type	PIR	Daylight Dimming?	Occupancy sensors	lux	Display Lighting Efficacy (lm/w)
Warehouse	LED	PD	No	auto-on-off	100	120
Office	LED	PD	Yes	manual on-off	100	120
Toilet/WC	LED	PD	No	auto-on-off	100	120
Store	LED	PD	Yes	manual on-off	300	120

Appendix A (continue)

Inputs at Be Green – Unit 2

BUILDING SERVICES - SYSTEMS						
Typical Rooms Served	**Main Warehouse**	**Office, Reception, Amenity areas**	**WC**	**Store**	**Circulation**	
IES System Name	**HVAC01-Warehouse**	**HVAC02-Office**	**HVAC03-WC**	**HVAC04-Store**	**HVAC05-Circulation**	None
System Type	None	Variable refrigerant Flow	Radiators	Radiators	Radiators	
Heating Fuel Source	None	Heat Pump (Electric): air source	Direct electric	Heat Pump (Electric): air source	Direct electric	
Heating Efficiency - COP/SCOP	-	3.6	1	1	3.6	
Delivery Efficiency						
Cooling Fuel Source		Heat Pump (Electric)				
Cooling Efficiency - EER/SEER		5.00				
Does the System have provision for metering?	-	Yes it does	Yes it does	Yes it does	Yes it does	
Does the metering warn 'out of range' values?	-	Yes it does	Yes it does	Yes it does	Yes it does	
Does equipment qualify for ECA's?	-	ECA list (after 2001)	-	-	-	
Has the ductwork been leakage tested?	-	Class A	-	-	-	
Does the AHU meet CEN leakage Standards	-	Class L2	-	-	-	
Ventilation Type	-	Mechanical Supply & Extract	Extract Only	Extract Only	Natural ventilation	
Specific Fan power (W/l/s)	-	1.60	0.40	0.40	0.40	
Terminal Fan power (W/l/s)	-	-	-	-	-	
Fuel Source	-	Heat pump	Heat pump	Heat pump	Heat pump	
Heat Recovery Efficiency (%)	-	75%	-	-	-	
Heat Recovery Type	-	Thermal Wheel	-	-	-	
DOMESTIC HOT WATER SYSTEM						
Room Served	**Unit 1**	**Unit 2**				
Type	Point of Use	Point of Use				
Fuel Source	Electric	Electric				
Seasonal Efficiency	1	1				
Total Storage Volume (litres)						
Insulation type						
Insulation thickness	-	-				
Storage Losses (kWh/l.day)	Default	Default				
Delivery Efficiency	100%	100%				
Av. DHW pipe size (for pipework heat loss calcs)	-	-				
Used in conjunction with Heat Pump?	-	-				
Electric Power Factor	**Power Factor Correction**					
Power Factor	Between 0.90-0.95					
BUILDING SERVICES - RENEWABLES						
	Unit 1	**Unit 2**				
PV Type	Monocrystalline Sylicon	Monocrystalline Sylicon				
Orientation (clockwise from north)	180	180				
Inclination (degree tilt)						
Area (m2)	230	400				

LIGHTING AND CONTROL	Type	PIR	Daylight Dimming?	Occupancy sensors	lux	Display Lighting Efficacy (lm/w)
Warehouse	LED	PD	No	auto-on-off	100	120
Office	LED	PD	Yes	manual on-off	100	120
Toilet/WC	LED	PD	No	auto-on-off	100	120
Store	LED	PD	Yes	manual on-off	300	120

Appendix B

BRUKL Output Document - Be Lean: Unit 1

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Le Masurier Unit 1 (BE LEAN) As built

Date: Thu May 22 17:01:44 2025

Administrative information

Building Details

Address: Address 1, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.28

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.28

BRUKL compliance module version: v6.1.e.1

Foundation area [m^2]: 118.41

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	2.94	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	2.73	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	31.45	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	29.05	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.18	0.18	L0000000:Surf[3]
Floors	0.18	0.15	0.15	L0000000:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.15	0.15	L0000006:Surf[13]
Windows** and roof windows	1.6	1.4	1.4	L0000006:Surf[0]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.4	1.4	L0000005:Surf[2]
Vehicle access & similar large doors	1.3	1.3	1.3	L0000005:Surf[5]
High usage entrance doors	3	1.4	1.4	L0000014:Surf[10]

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]
* 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. *** Values for rooflights refer to the horizontal position.
^ For fire doors, limiting U-value is 1.8 W/m^2K
NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	3

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	1087.6	1087.6
External area [m^2]	3084.2	3084.2
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	4
Average conductance [W/K]	690.16	729.26
Average U-value [W/m^2K]	0.22	0.24
Alpha value* [%]	28.93	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
100	**Storage or Distribution**
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	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	7.28	5.42
Cooling	0.5	0.48
Auxiliary	1.2	2.91
Lighting	6.54	9
Hot water	3.92	3.69
Equipment*	29.24	29.24
TOTAL**	**19.45**	**21.49**

* 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	0.35
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*0.35*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	71.61	59.04
Primary energy [kWh_{PE}/m^2]	29.05	31.45
Total emissions [kg/m^2]	2.73	2.94

Appendix B (continue)

BRUKL Output Document - Be Lean: Unit 1

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] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	283.2	31.6	29.3	2.3	6.3	2.68	3.77	2.64	5.5
	Notional	236	40.2	23.6	2.4	17.6	2.78	4.63	----	----
[ST] Central heating using water: radiators, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	217.7	0	48	0	8.3	1.26	0	1.34	0
	Notional	193.8	0	38.2	0	5.6	1.41	0	----	----
[ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	394.4	0	44.2	0	2.1	2.48	0	2.64	0
	Notional	351.5	0	35.1	0	1.2	2.78	0	----	----
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	281	58.6	29.5	4.3	5.6	2.65	3.81	2.64	5.5
	Notional	172.9	62	17.3	3.7	16.2	2.78	4.63	----	----
[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

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Appendix B (continue)

BRUKL Output Document - Be Lean: Unit 2

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Le Masurier Unit 2 (BE LEAN) As designed

Date: Fri May 23 14:38:35 2025

Administrative information

Building Details

Address: Address 1, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.28

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.28

BRUKL compliance module version: v6.1.e.1

Foundation area [m^2]: 172.9

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	2.5	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	2.35	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	26.92	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	25.2	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.18	0.18	L0000000:Surf[3]
Floors	0.18	0.15	0.15	L0000000:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.15	0.15	L0000006:Surf[2]
Windows** and roof windows	1.6	1.4	1.4	L0000000:Surf[4]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.4	1.4	L0000003:Surf[1]
Vehicle access & similar large doors	1.3	1.3	1.3	L0000004:Surf[6]
High usage entrance doors	3	1.4	1.4	L0000000:Surf[8]

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

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

* 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. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	3

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	2106.2	2106.2
External area [m^2]	5612.8	5612.8
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	4
Average conductance [W/K]	1140.19	1216.16
Average U-value [W/m^2K]	0.2	0.22
Alpha value* [%]	27.07	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
100	**Storage or Distribution**
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	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	4.47	3.08
Cooling	0.53	0.55
Auxiliary	0.89	1.91
Lighting	7.02	9.02
Hot water	4.01	3.79
Equipment*	29.73	29.73
TOTAL**	**16.93**	**18.35**

* 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	0.21
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*0.21*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	46.56	38.72
Primary energy [kWh_{PE}/m^2]	25.2	26.92
Total emissions [kg/m^2]	2.35	2.5

Appendix B (continue)

BRUKL Output Document - Be Lean: Unit 2

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] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	174.7	50.8	18.1	3.7	6.3	2.68	3.77	2.64	5.5
	Notional	136.5	65	13.6	3.9	14	2.78	4.63	----	----
[ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	399.6	0	47.1	0	2.2	2.36	0	2.64	0
	Notional	335.7	0	33.6	0	1.2	2.78	0	----	----
[ST] Central heating using water: radiators, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	184.9	0	40.8	0	8.6	1.26	0	1.34	0
	Notional	135.3	0	26.7	0	5.8	1.41	0	----	----
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	249.2	81.2	26.1	5.9	5.6	2.65	3.81	2.64	5.5
	Notional	145.5	98.9	14.5	5.9	17.4	2.78	4.63	----	----
[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

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Appendix C

BRUKL Output Document - Be Green: Unit 1

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Le Masurier Unit 1 (BE GREEN) As designed

Date: Fri May 23 15:06:50 2025

Administrative information

Building Details

Address: Address 1, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.28

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.28

BRUKL compliance module version: v6.1.e.1

Foundation area [m^2]: 118.41

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	2.94	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	-0.03	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	31.45	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	-2.8	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.18	0.18	L0000000:Surf[3]
Floors	0.18	0.15	0.15	L0000000:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.15	0.15	L0000006:Surf[13]
Windows** and roof windows	1.6	1.4	1.4	L0000006:Surf[0]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.4	1.4	L0000005:Surf[2]
Vehicle access & similar large doors	1.3	1.3	1.3	L0000005:Surf[5]
High usage entrance doors	3	1.4	1.4	L0000014:Surf[10]

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

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

* 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. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	3

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	1087.6	1087.6
External area [m^2]	3084.2	3084.2
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	4
Average conductance [W/K]	690.16	729.26
Average U-value [W/m^2K]	0.22	0.24
Alpha value* [%]	28.93	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
100	**Storage or Distribution**
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	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	5.82	5.42
Cooling	0.5	0.48
Auxiliary	1.2	2.91
Lighting	6.54	9
Hot water	3.92	3.69
Equipment*	29.24	29.24
TOTAL**	**17.99**	**21.49**

* 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	20.29	0.35
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*20.29*	*0.35*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	71.61	59.04
Primary energy [kWh_{PE}/m^2]	-2.8	31.45
Total emissions [kg/m^2]	-0.03	2.94

Appendix C (continue)

BRUKL Output Document - Be Green: Unit 1

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] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	283.2	31.6	21.5	2.3	6.3	3.66	3.77	3.6	5.5
	Notional	236	40.2	23.6	2.4	17.6	2.78	4.63	----	----
[ST] Central heating using water: radiators, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	217.7	0	64.4	0	8.3	0.94	0	1	0
	Notional	193.8	0	38.2	0	5.6	1.41	0	----	----
[ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	394.4	0	32.4	0	2.1	3.38	0	3.6	0
	Notional	351.5	0	35.1	0	1.2	2.78	0	----	----
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	281	58.6	21.6	4.3	5.6	3.61	3.81	3.6	5.5
	Notional	172.9	62	17.3	3.7	16.2	2.78	4.63	----	----
[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

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Appendix C (continue)

BRUKL Output Document - Be Green: Unit 2

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Le Masurier Unit 2 (BE GREEN) — As designed

Date: Fri May 23 15:00:47 2025

Administrative information

Building Details

Address: Address 1, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.28

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.28

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 172.9

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	2.5	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	-0.03	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	26.92	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	-2.35	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.18	0.18	L0000000:Surf[3]
Floors	0.18	0.15	0.15	L0000000:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.15	0.15	L0000006:Surf[2]
Windows** and roof windows	1.6	1.4	1.4	L0000000:Surf[4]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.4	1.4	L0000003:Surf[1]
Vehicle access & similar large doors	1.3	1.3	1.3	L0000004:Surf[6]
High usage entrance doors	3	1.4	1.4	L0000000:Surf[8]

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

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]

* 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. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m²K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
m³/(h.m²) at 50 Pa	8	3

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Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	2106.2	2106.2
External area [m²]	5612.8	5612.8
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	4
Average conductance [W/K]	1140.19	1216.16
Average U-value [W/m²K]	0.2	0.22
Alpha value* [%]	27.07	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
100	**Storage or Distribution**
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	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	3.5	3.08
Cooling	0.53	0.55
Auxiliary	0.89	1.91
Lighting	7.02	9.02
Hot water	4.01	3.79
Equipment*	29.73	29.73
TOTAL**	**15.96**	**18.35**

* 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	17.85	0.21
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*17.85*	*0.21*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	46.56	38.72
Primary energy [kWh_{PE}/m^2]	-2.35	26.92
Total emissions [kg/m^2]	-0.03	2.5

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Appendix C (continue)

BRUKL Output Document - Be Green: Unit 2

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] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	174.7	50.8	13.3	3.7	6.3	3.66	3.77	3.6	5.5
	Notional	136.5	65	13.6	3.9	14	2.78	4.63	----	----
[ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	399.6	0	34.6	0	2.2	3.21	0	3.6	0
	Notional	335.7	0	33.6	0	1.2	2.78	0	----	----
[ST] Central heating using water: radiators, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	184.9	0	54.7	0	8.6	0.94	0	1	0
	Notional	135.3	0	26.7	0	5.8	1.41	0	----	----
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	249.2	81.2	19.2	5.9	5.6	3.61	3.81	3.6	5.5
	Notional	145.5	98.9	14.5	5.9	17.4	2.78	4.63	----	----
[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
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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

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Appendix D

Site layout indicating solar PV area

Bright
ideas.
Sustainable
change.

RAMBØLL