PROPOSED LIDL FOOD STORE

ICKENHAM ROAD, RUISLIP

ENERGY USAGE & SUSTAINABILITY STATEMENT

Client:

Lidl Great Britain Ltd

Revision	**0**	**A**	**B**	**C**
Remarks	First Issue.	Fig 1 updated to include the latest site plan 4478-0105-P12.	Statement updated based on the latest site plan 4478-0105-P13-Site Plan as Proposed - Option C	
Date	17-06-2024	07-01-2025	27-01-2025	
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Project number	24-4571	24-4571	24-4571	
File Location	Dave Dickinson & Associates\Regions - Documents\WEM\Ruislip 24-4571\K Reports			

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1.00 EXECUTIVE SUMMARY

DDA Consultant Engineers Ltd have been commissioned by Lidl Great Britain Ltd to prepare an energy statement in support of their planning application for the proposed food store at Ickenham Road, Ruislip.

The proposed development is required to demonstrate:

- How the incorporation of passive design and energy efficient measures can contribute towards mitigating and adapting to climate change and reducing the development's carbon emissions and energy consumption.
- How the incorporation of good building design with a holistic approach to sustainability can enhance the development's sustainable credentials.
- How the incorporation of good building design with a holistic approach to sustainability can reduce the energy demand, carbon emissions and running costs.
- How the incorporation of passive and active design strategies can reduce the development's regulated emissions to the highest of standards, exceeding the minimum requirements of Part L Volume 2 2021 of the Building Regulations, through the most technically, feasible and financially viable environmental standards.
- How the incorporation of low and / or zero carbon technologies can contribute towards achieving a zero-carbon development in-line with both; The London Plan Policy SI2, and Hillingdon's Local Plan: Part 1, Policy EM1.
- How carbon dioxide emissions associated with energy demand can be reduced in accordance with the energy hierarchy:

    a) Minimising energy requirements.
    b) Incorporating high efficiency systems and controls.
    c) Incorporating low or zero carbon energy sources.

- How heating and cooling systems have been selected in accordance with the heat hierarchy:
    a) Connections to local existing or planned heat networks.
    b) Use zero-emission and/or local secondary heat sources.
    c) Use low-emission Combined Heat and Power (CHP).
    d) Use ultra-low NOx gas boilers.
- TM54 operational energy calculations have been carried out to offer a more realistic operational energy consumption, in line with the Governments London Plan 2021, Be Seen Policy. Furthermore, the

development will be provided with energy monitoring to ensure actual consumption data can be monitored, recorded and reported to Lidl's central control system, known as GLT.

- How overheating potentials have been examined and the cooling hierarchy carried out to reduce the overheating risks.
- How the design of the building and construction methods throughout the building programme will ensure sustainable development with minimal impact to the existing ecological, environmental and flood risk credentials.

This statement will aim to shows that:

The incorporation of 'passive' design strategies will take advantage of:

- Natural daylighting, thus, reducing dependency on electric lighting and the associated running costs and carbon emissions through natural contribution towards internal lighting requirements.
- Enhanced fabric efficiencies and thermal mass to stabilise any temperature fluctuations within the building, helping to reduce heat gains and/or losses.
- Cooling hierarchy has been followed with overheating potential being reduced through the incorporation of high thermal mass parameters, high-performance glazing with solar heat gain reducing capabilities and external shading, alongside suitable mechanical design strategies to provide a combined active and passive solution.

The incorporation of 'active' design strategies will take advantage of:

- Heat recovery ventilation to pre-heat incoming fresh air.
- Separate sub-metering to allow for all energy consumed to be monitored and any discrepancies to be easily identified and fixed thus minimising wasted energy.
- Low energy lighting with energy efficient controls.
- Building energy management system (BEMS) to manage all systems effectively, ensuring efficiencies are achieved and maintained.

Heating systems have been selected in-line with the Heat Hierarchy, however, all District Energy Networks (DEN), Secondary Waste Heat Sources, CHP and Low NOX gas boilers have been deemed un-suitable for this development and as such have been discounted.

Alternative Low or Zero Carbon (LZC) technologies have been reviewed with the following deemed to be both viable:

- Air Source Heat Pumps, or Aero-thermal Heat Pumps.
- Photovoltaic Panels
    - **Annual Output –** 103,641.00kWh/annum

The Energy Assessment Guidance confirms the regulated carbon dioxide emissions reduction target for major domestic and non-domestic development is net zero carbon, with at least a 35% on-site reduction beyond Part L 2021 of the Building Regulations. These are to be assessed and converted using the GLA Carbon Emission Reporting Spreadsheet Tool, as detailed in section 1.7 of the Energy Assessment Guidance. Furthermore, a minimum 15% carbon dioxide reduction must be achieved through energy efficient means alone.

Due to the nature of the development, it has not been possible to achieve a 15% reduction through passive strategies. However, Lidl and the design team are committed to reducing emissions and as such, the P.V. proposal will ensure that >100% of the stores Part L regulated emissions will be off set through on-site generation. This complies with the minimum zero carbon requirements. In addition to this, all off-sets shall be achieved on-site with no cash in lieu contribution being required.

The tables below, from the GLA Carbon Emission Reporting Spreadsheet tool demonstrate a site wide carbon dioxide reduction of **161%**, which **2%** is through energy efficient means.

	Regulated non-residential carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Be lean: savings from energy demand reduction	0.2	2%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	12.9	159%
Total Cumulative Savings	**13.1**	**161%**
Annual savings from off-set payment	-5.0	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**-150**	-
Cash in-lieu contribution (£)	**-14,233**	

Figure 1 - Carbon Dioxide Emissions After Each stage of the Energy Hierarchy

As can be seen by the summary table above, the high services performance specification offers a significant carbon dioxide reduction. As such, there is no cash in lieu payment required for the proposed food store.

2.00 INTRODUCTION

DDA Consultant Engineers Ltd have been commissioned by Lidl Great Britain Ltd to prepare an energy statement in support of their planning application for the proposed food store at Ickenham Road, Ruislip.

The energy statement will demonstrate how the development will provide heating and power and meet the energy / carbon emission target set by national and local policy. The energy statement will demonstrate the design teams commitments to sustainable development and how they intend to reduce their annual carbon emissions and energy consumption through the utilisation of; good practice engineering, passive, and active strategies and Low or Zero Carbon (LZC) technologies.

The energy statement will demonstrate commitment to go above and beyond the requirements of Part L 2021 minimum standards to ensure a high carbon reduction/off-set is achieved, as well as supply LZC technologies to contribute towards annual regulated energy consumption.

2.01 Energy Statement Requirements

The objective of this statement is to define and outline how the incorporation of sustainable building design, coupled with the incorporation of LZC technologies at an early stage of the design process, can ensure compliance with relevant local and national planning policies, achieve Building Regulation compliance to a high standard, reduce energy consumption and associated carbon emissions and running costs of the building. The core design principals outlined within this statement will:

- Reduce energy demand through the implementation of the energy hierarchy.
- Meet end-use energy demands efficiently and effectively.
- Supply LZC technologies to further reduce the development's energy demand, associated carbon emissions and utility costs.
- Enable effective energy management to ensure installed systems work to their maximum efficiencies.

The statement will compare the energy usage and CO_2 emissions from a Building Regulations compliant Notional Building, to that of the proposed building, including energy efficiency measures, decentralised energy and renewable energy systems (where appropriate).

3.00 SITE LOCATION AND DESCRIPTION

The development shall comprise of the erection of a food store (Use Class E) with associated access, parking, servicing area and landscaping.

As shown in Fig 2, the store is orientated with a heavily glazed façade facing south-east. The emphasis on the southern orientation offers the advantage of natural daylighting contributions within the store. However, it could cause a potential overheating risk if the solar gains are not suitably managed. Solar shading and enhanced glazing specifications will ensure the solar gains are managed and the mechanical cooling loads are not oversized. This reduces the dependency on electric lighting through the natural contribution towards internal lighting levels, whilst ensuring cooling loads are minimised and carbon dioxide and energy consumption reduced.

The site receives little over shading or overlooking offering privacy to the store and maintaining privacy to the residential housing and commercial units surrounding the site through careful landscaping.

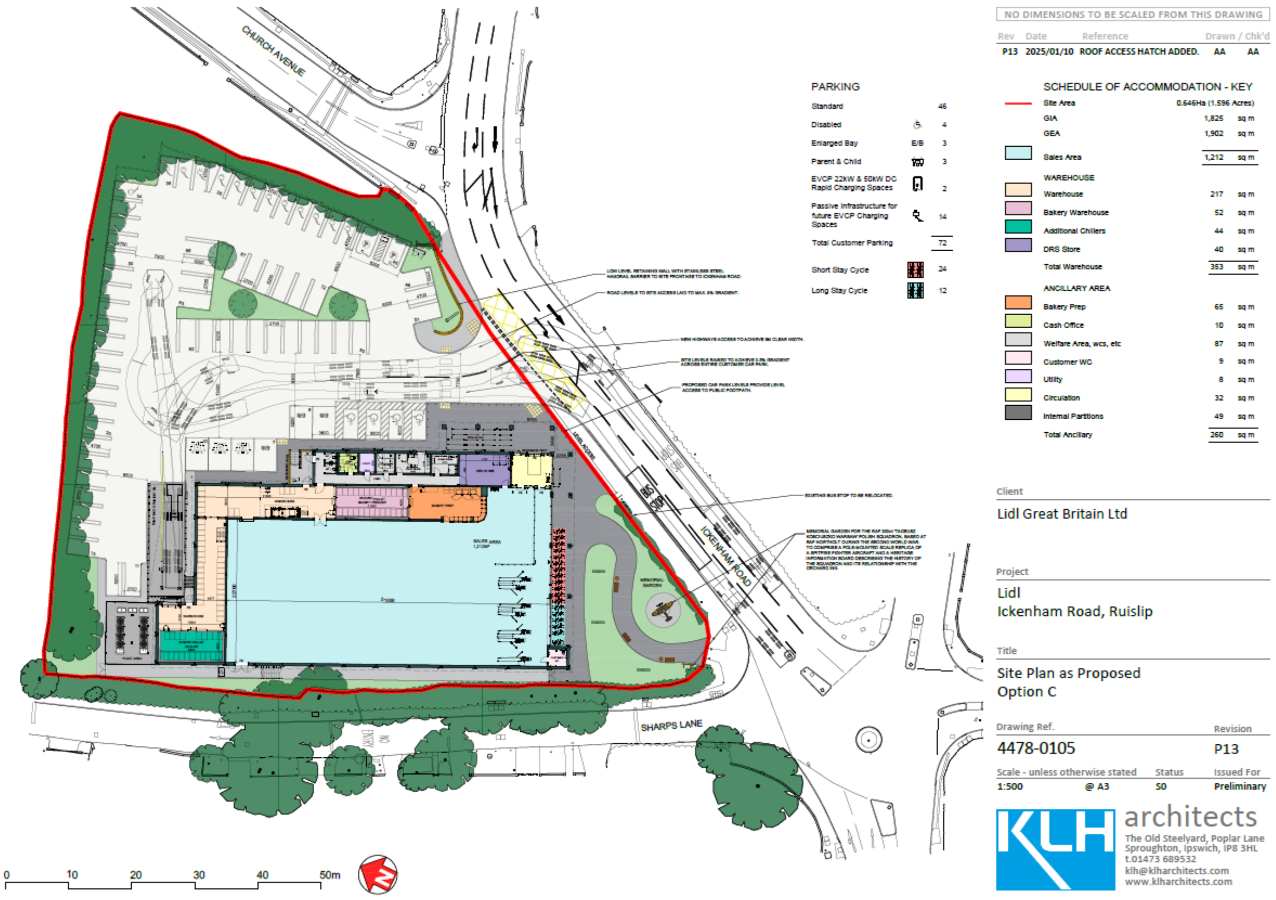


Figure 2 - Site Context

4.00 PLANNING POLICIES & REFERENCE DOCUMENTS

The following documents offer a review of the necessary planning policies and requirements to be adhered to, to ensure sustainable design standards are met and the relevant targets set by local and national authorities are understood.

4.01 Part L Volume 2, Conservation of Fuel & Power 2021

Part L of the current Building Regulations (2021) considers the reduction of carbon emissions in new and existing buildings. As the proposed development consist of the creation of new non-domestic building, it falls under Part L Volume 2 of the Regulations.

The overall structure of compliance with the 2021 Building Regulations for new buildings includes the following criteria to comply with:

- The Building Emission Rate (BER) should be better than the Target Emission Rate (TER) and the Building Primary Energy Rate (BPER) should be better than the Target Primary Energy Rate (TPER).
- Limit on design flexibility.
- Limiting effects of heat gain in summer.

The energy strategy for the scheme has been developed to ensure the scheme meets the relevant requirements of the Building Regulations.

4.02 National Planning Policy Framework (NPPF 2024)

The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. Taken together, these policies articulate the Government's vision of sustainable development, which should be interpreted and applied locally to meet local aspirations. The ministerial foreword of this NPPF highlights that 'the purpose of planning is to contribute to the achievement of sustainable development' and that at the heart of the framework is a presumption in favour of sustainable development.

Sustainable development is defined in the NPPF as comprising developments "meeting the needs of the present without compromising the ability of future generations to meet their own needs" in line with the definition of the Brundtland Commission ('Our Common Future', 1987). The NPPF also refers to the three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways – an economic objective, a social objective and an environmental objective.

4.03 Hillingdon Strategic Policies (Adopted November 2012)

Policy EM1: Climate Change Adaptation and Mitigation

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.

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

10. Locating and designing development to minimise the probability and impacts of flooding.
11. Requiring major development proposals to consider the whole water cycle impact which includes flood risk management, foul and surface water drainage and water consumption.
12. Giving preference to development of previously developed land to avoid the loss of further green areas.
13. Promoting the use of living walls and roofs, alongside sustainable forms of drainage to manage surface water run-off and increase the amount of carbon sinks[40].
14. Promoting the inclusion of passive design[41] measures to reduce the impacts of urban heat effects.

4.04 The London Plan – March 2021

4.04.1 Policy SI 2 Minimising Greenhouse Gas Emissions

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

  a. Be Lean: use less energy and manage demand during operation.

  b. Be Clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly.

  c. Be Green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site.

  d. Be Seen: monitor, verify and report on energy performance.

B. Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.

C. A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:

  a. Through a cash in lieu contribution to the borough's carbon offset fund, or

  b. Off-site provided that an alternative proposal is identified and delivery is certain.

D. Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver carbon reductions. The operation of offset funds should be monitored and reported on annually.

E. Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.

F. Development proposals referable to the Mayor should calculate whole lifecycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

4.05 Energy Assessment Guidance

In line with the London Plan, major developments are expected to achieve net zero-carbon by following the energy hierarchy (see Figure 1):

- *Be Lean: use less energy and manage demand during operation through fabric and servicing improvements and the incorporation of flexibility measures.*
- *Be Clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly by connecting to district heating networks.*
- *Be Green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site.*
- *Be Seen: monitor, verify and report on energy performance through the Mayor's post construction monitoring platform.*

Establishing CO2 Emissions

6.1 The energy assessment must clearly identify the carbon footprint of the development after each stage of the energy hierarchy:

- *Baseline: Part L 2021 of the Building Regulations Compliant Development 11.*
- *After energy demand reduction (Be Lean).*
- *After heat network connection (Be Clean).*
- *After renewable energy (Be Breen).*

6.2 The GLA's carbon emissions reporting spreadsheet should be completed by planning applicants and submitted in Excel alongside the energy assessment, with results presented separately for residential uses, non-residential uses and the entire site, to demonstrate compliance with the energy hierarchy and the carbon targets set out in Policy SI 2.

6.3 Once applicants have entered the necessary data, the spreadsheet will automatically populate the regulated CO2 emission performance at each stage of the energy hierarchy and the associated charts and tables required for demonstrating compliance with the energy hierarchy and the carbon targets. The calculation of unregulated carbon emissions should be done as part of the compliance with the 'Be Seen' policy and associated guidance.

Calculating Regulated CO2 Emissions for a Part L 2021 of the Building Regulations Compliant Development

6.8 To determine the CO2 emissions baseline, applicants should use the Target Emission Rate (TER) from the final proposed building specification, i.e. the rate from the modelling results of the 'Be Green' stage of the energy hierarchy. In some cases, the TER may include low carbon or renewable energy generation. The carbon emissions reporting spreadsheet enables the CO2 emission savings over the baseline to be accounted for at each stage of the energy hierarchy.

Heating and Hot Water Assumptions

7.9 It is expected that, through following the heat hierarchy, the final proposed heating strategy will include low carbon and/or renewable technologies. The CO2 emission improvements from these technologies are to be accounted for in the 'Be Clean' and 'Be Green' stages of the energy hierarchy. For the purposes of demonstrating CO2 emission improvements in the 'Be Lean' stage of the energy hierarchy, applicants should use the notional building system type and performance values specified in the Part L 2021 baseline as determined by the final proposed building specification. In this way, CO2 emission improvements from the proposed space heating and hot water demand reduction measures can be compared against the Part L 2021 baseline, for example through improvements in performance of building fabric, heat recovery or water efficient fittings.

5.00 ENERGY HIERACHY

In response to this guidance and recent shifts within the industry, a passive and active design strategy has been proposed, which will primarily adhere to the principles of the Governmental Energy Hierarchy:

- **Be Lean** – reduce the need for energy.
- **Be Clean** – supply and use energy in the most efficient manner.
- **Be Green** – supply energy from renewable sources.
- **Be Seen** – provide energy metering throughout the development.

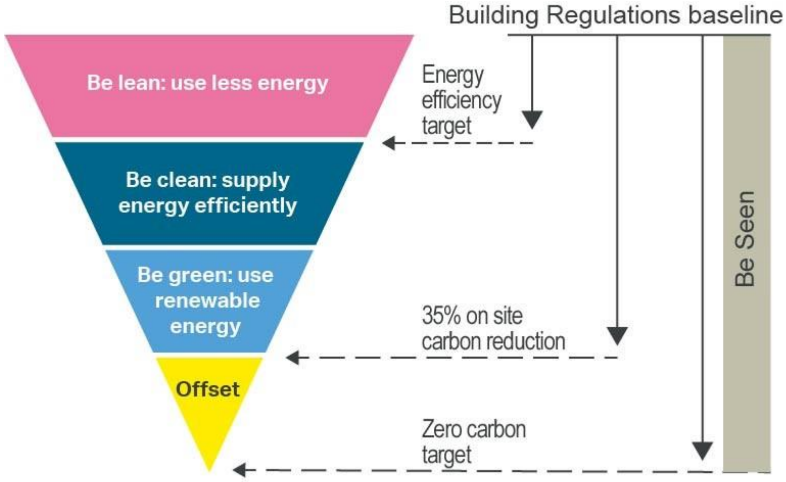


Figure 3 - Energy Hierarchy

Adhering to the principles of the Energy Hierarchy has several benefits:

- By reducing the energy requirement of the building, the potential renewable requirement shrinks in proportion. This has obvious cost benefits and will help reduce the building's energy requirements and carbon emissions for the lifespan of the development.
- The sustainable credentials of each development are enhanced and are not validated by simply bolting on expensive renewable equipment. By focusing on fabric performance and the provision of efficient heating systems each building is intrinsically "green".
- Provides reassurance to the end user the building is performing to its highest potential and all systems are working to their maximum efficiencies with minimal energy waste, thus reducing dependencies on natural resources (gas & electric) as well as minimising running costs.
- The incorporation of energy efficiency measures and a holistic approach to building design will ensure that the carbon emission from the building will be kept to a minimum.

6.00 ASSESSMENT METHODOLOGY & DYNAMIC SIMULATION SOFTWARE

6.01 Calculation Process

To detail the benefits of adhering to the energy hierarchy, we must first create a baseline to compare against. This is done using a Dynamic Simulation Modelling software tool which follows a set methodology for calculating the buildings carbon emissions and associated energy use. Dynamic Simulation Modelling (DSM), as used for Part L Building Regulations compliance, has been carried out using the EDSL TAS software, Version 9.5.6, in accordance with CIBSE AM11.

The TAS software has been deemed appropriate for this project, as it allows a single model to be used for all required analysis relating to the building energy performance regarding passive and active strategies, energy efficient mechanical and electrical systems, and LZC technologies.

The baseline building has been determined in accordance with the Energy Assessment Guidance and the London Plan March 2021, with the TER from the Be Green assessment representing the developments baseline performance. The Be Lean strategy has been carried out in line with the Energy Assessment Guidance with the efficiencies associated with the space and water heating being the same as the notional specification for a heating system of the same type.

6.02 TAS Software

TAS is a governmentally approved software package capable of analysing multiple environmental credentials of a building. By creating a virtual environment where, geometric form, thermal mass, interaction with local weather & climate, fabric performance, energy consumption and carbon emissions are analysed, different design strategy characteristics and benefits can be assessed and discounted (where necessary).

The TAS software package analyses two buildings in parallel with each other, the first representing the notional building as defined by the National Calculation Method (NCM), and the second the building as proposed. The difference in CO_2 emissions and energy consumption between the models represents the CO_2 reduction achieved by the proposed low energy and low carbon design.

By modelling each area to be analysed, and inputting a series of parameters, the software can give projected annual loadings for heating and cooling requirements, carry out part L compliance checks through the SBEM tool as well as multiple other dynamic simulations.

6.03 National Calculation Methodology

The National Calculation Method (NCM) is the methodology used for demonstrating compliance with Part L of the Building Regulations for buildings other than dwellings. Annual energy use and associated emissions for a proposed building are calculated and compared with the energy use and emissions of a comparable notional building. Both calculations make use of standard sets of data for different activity areas (internal conditions) and common databases are used to calculate emission factors, weather data, and set variables of construction and service elements.

The NCM allows the actual calculation to be carried out either by an approved simulation software or by a simplified tool. For this report, the building has been assessed using the Dynamic Simulation Software, TAS.

6.03.1 Weather Data

External weather conditions and variables must be considered within the Dynamic Simulation software.

The UK Meteorological Office (MO) collects and analyses weather data across the UK. They account for multiple climate variables such as wind speed and direction, air pressure, relative humidity, air temperature etc. across 14 locations. The weather data variables are broken into two types of weather files: Design Summer Year (DSY) and Test Reference Year (TRY).

Design Summer Year (DSY): This set of data represents a warmer than typical year and is used when calculating maximum resultant temperatures, cooling loads, TM52 calculations etc. as it will give a worst-case scenario with regards to UK temperatures.

Test Reference Year (TRY): This set of data represents a typical/average year and is used for calculating average energy uses within buildings for steady state calculations and for Part L compliance.

For the purposes of this report, the Test Reference Year (TRY) has been used to calculate the development's energy and carbon emissions and compliance with Part L.

6.03.2 Internal Conditions

To determine the energy requirement of each zone, internal conditions are assigned to all relevant areas. An internal condition details the conditions to which each zone will be maintained and accounts for parameters such as occupancy gains, equipment gains, lighting, infiltration and ventilation, upper and lower temperatures.

The NCM calculation methodology has pre-defined internal conditions which must be used to ensure consistent Part L calculations.

6.04 Building Geometry

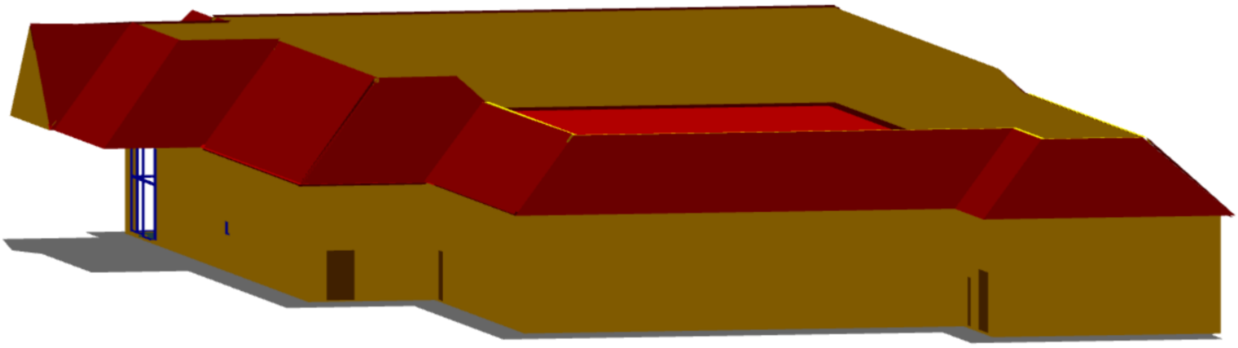


Figure 4 - North View

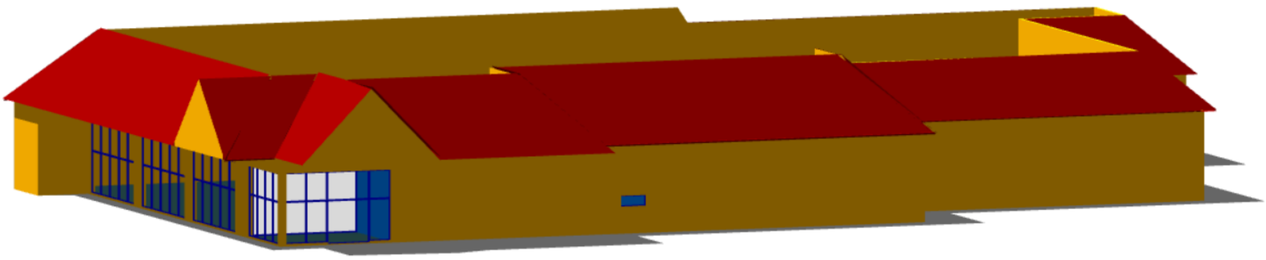


Figure 5 - East View

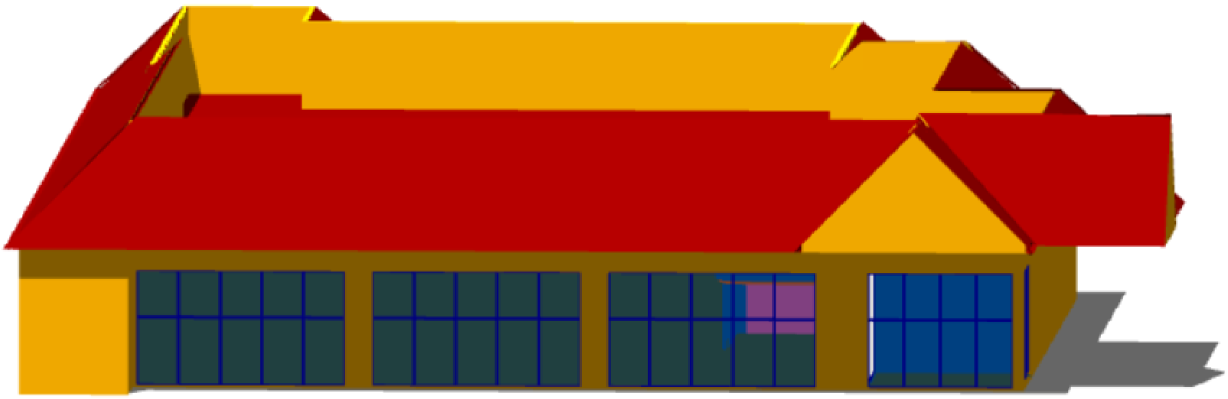


Figure 6 - South View

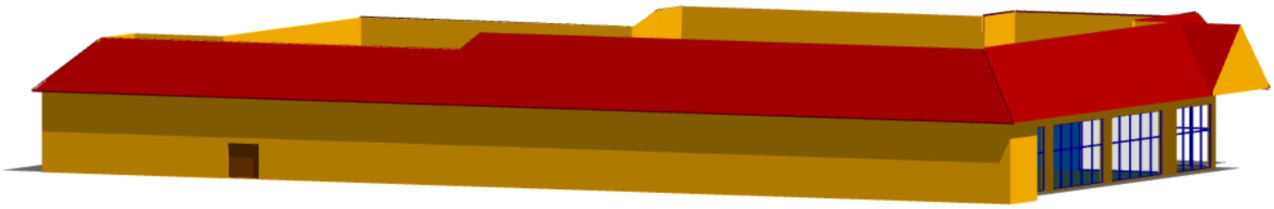


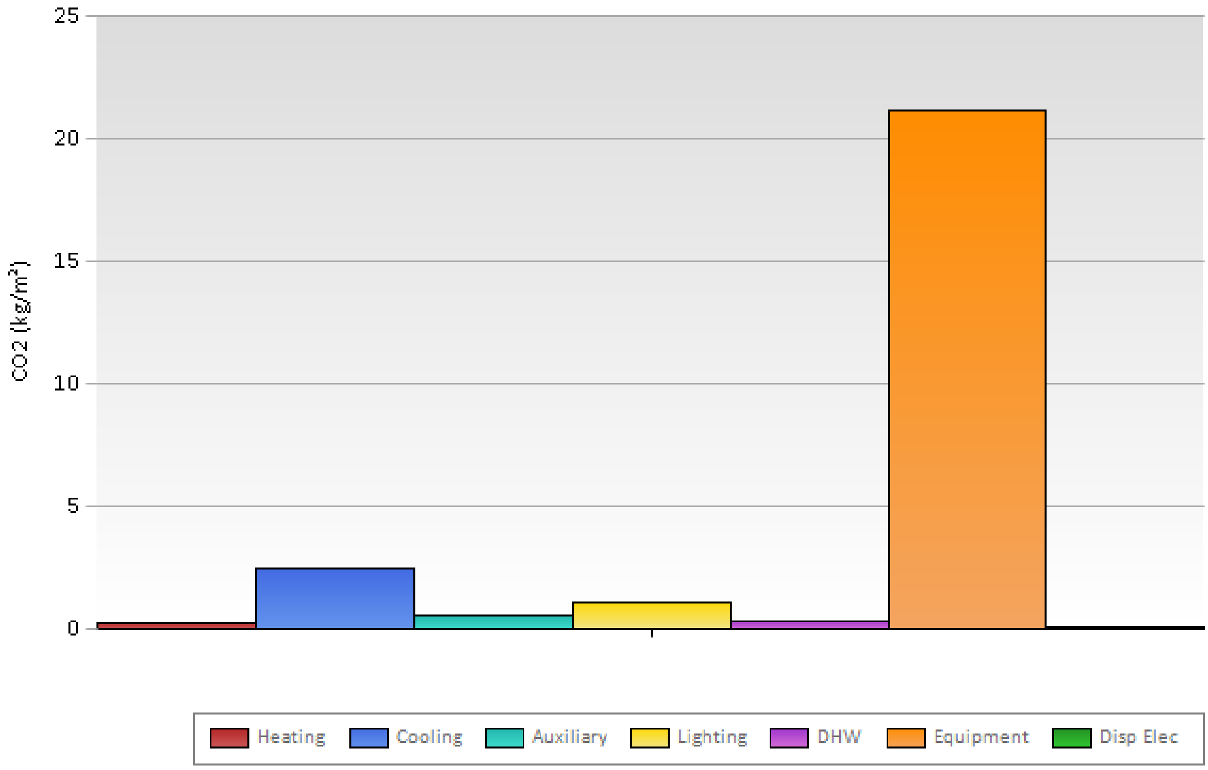
Figure 7 - West View

7.00 'PART L' – BASELINE PREDICTED ENERGY USAGE

The baseline against which each step of the energy hierarchy will be compared is the 'yard stick' determined by the Part L 2021 notional building.

The baseline building has been determined in accordance with the Energy Assessment Guidance and the London Plan March 2021.

7.01 Annual Carbon Dioxide Emissions of the Baseline Building



	Heating	*Cooling*	*Auxiliary*	*Lighting*	*DHW*	*Equipment*	*Displaced Electricity*
CO_2 (kg/m²)	0.27	2.44	0.53	1.06	0.34	21.19	0.09

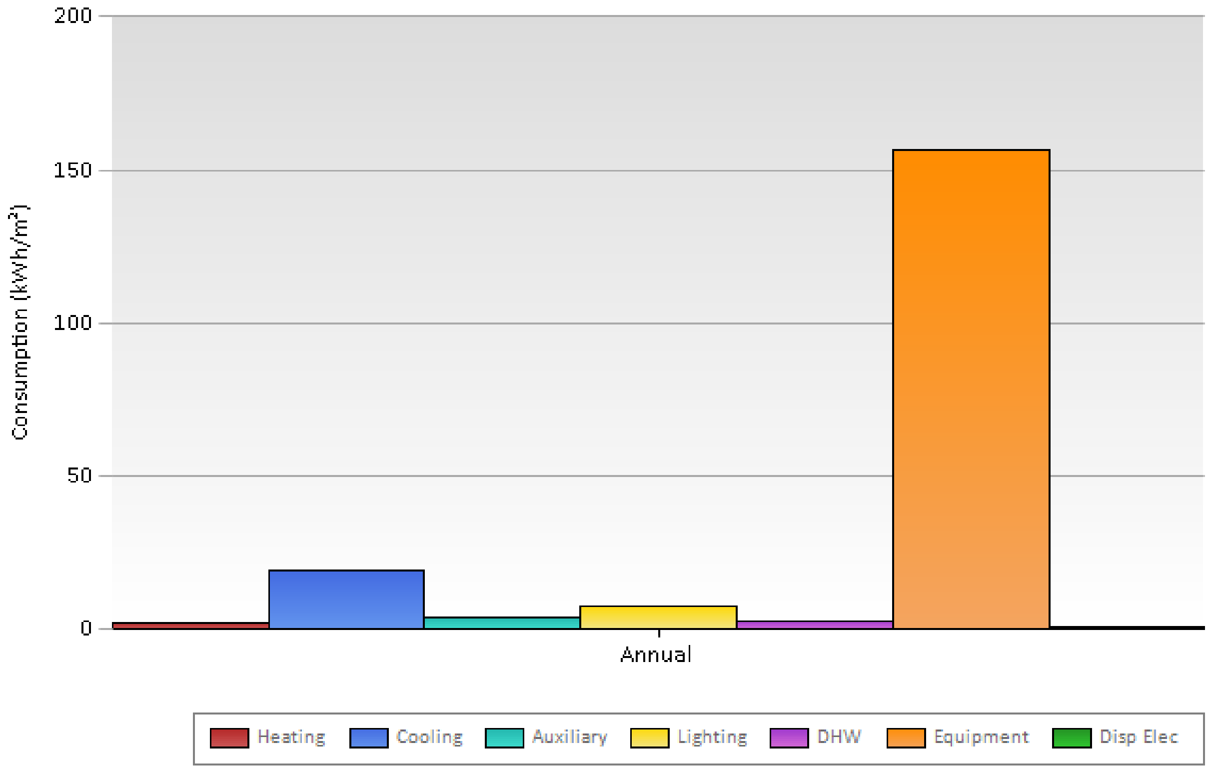
Figure 8 – Annual Carbon Emissions - Baseline

Fig 8 above shows an annual baseline CO_2 emissions rate of 8,144.50kgCO_2/year of regulated emissions and 46,074.60kgCO_2/year inclusive of unregulated emissions. The table below summarises further the breakdown of regulated and unregulated carbon dioxide emission for the baseline model.

Baseline Carbon Dioxide Emission Summary (kgCO_2/year)		
	Regulated Emissions	**Un-Regulated Emissions**
Heating	483.30 kgCO_2/year	83.30 kgCO_2/year
Cooling	4,367.60 kgCO_2/year	4,367.60 kgCO_2/year
Auxiliary	948.70 kgCO_2/year	948.70 kgCO_2/year
Lighting	1,897.40 kgCO_2/year	1,897.40 kgCO_2/year
Hot Water	608.60 kgCO_2/year	608.60 kgCO_2/year
Equipment	Not Applicable	37,930.10 kgCO_2/year
Photovoltaic (PV) Contribution	-161.10 kgCO_2/year	-161.10 kgCO_2/year
Total	**8,144.50 kgCO_2/year**	**46,074.60 kgCO_2/year**

Figure 9 - Baseline Carbon Dioxide Emission Summary

7.02 Annual Energy Consumption of the Baseline Building



	Heating	Cooling	Auxiliary	Lighting	DHW	Equipment	Displaced Electricity
Consumption (kWh/m²)	1.76	19.14	3.92	7.66	2.54	156.69	0.69

Figure 10 - Annual Energy Consumption – Baseline

Figure 10 above shows an annual baseline energy consumption rate of 61,450.70kWh/year of regulated energy and 341,925.80kWh/year inclusive of unregulated emissions. The table below summarises further the breakdown of regulated and unregulated energy consumption for the baseline model.

Baseline Energy Consumption Summary (kWh/year)		
	Regulated Emissions	**Un-Regulated Emissions**
Heating	3,150.40 kWh/year	3,150.40 kWh/year
Cooling	34,260.60 kWh/year	34,260.60 kWh/year
Auxiliary	7,016.80 kWh/year	7,016.80 kWh/year
Lighting	13,711.40 kWh/year	13,711.40 kWh/year
Hot Water	4,546.60 kWh/year	4,546.60 kWh/year
Equipment	Not Applicable	280,475.10 kWh/year
Photovoltaic (PV) Contribution	1,235.10 kWh/year	1,235.10 kWh/year
Total	**61,450.70 kWh/year**	**341,925.80 kWh/year**

Figure 11 - Baseline Energy Consumption Summary

The tables above represent the baseline energy consumption and carbon emissions summary. These offer the benchmark to which the proposed development and associated energy efficient measures will be assessed against.

8.00 'BE LEAN' – PASSIVE & ACTIVE DESIGN STRATEGIES

This section of the statement describes the passive and active energy reduction features, which have been considered and incorporated into the design. These constitute the 'Be Lean' measures and the associated BRUKL output document can be found in Appendix A.

8.01 Orientation and Site Location

The proposed site is located at Ickenham Road, Ruislip.

The store is orientated with a heavily glazed side façade facing south-east. The emphasis on the southern orientation offers the advantage of high levels of natural daylighting within the store, thus reducing dependency on electric lighting through the natural contribution towards lux levels. However, if left unmanaged, can lead to excess solar gains entering the store which could lead to overheating and/or excessive mechanical cooling loads. The design team have identified this risk and propose the introduction of solar shading and enhanced glazing specifications. This reduces solar gains, thus reduces the stores mechanical cooling load, energy consumption and associated carbon dioxide emissions.

The site receives little over shading or overlooking offering privacy to the store and maintaining privacy to the commercial units surrounding the site with the utilisation of natural and ecological features. The development has good local transport links and is near residential properties, ensuring transport associated carbon emissions can be reduced.

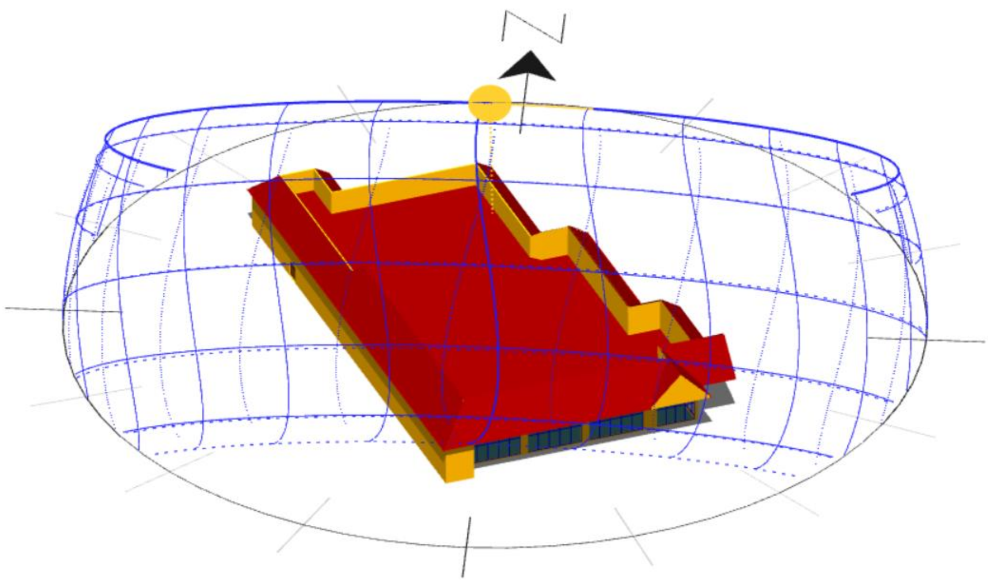


Figure 12 - Orientation & Sun Path Image

8.02 Fabric Performance and Thermal Mass

Focusing on the fabric thermal performance, ensures the building has reduced conductive heat loss during winter months and reduced conductive heat gains during summer months. This allows the internal environmental conditions to be better managed with reduced reliance on mechanical systems. This will in turn reduce energy demand, running cost and emissions whilst offering enhanced occupancy satisfaction.

With enhanced glazing properties, solar penetration is controlled reducing the potential for excess solar gains, as well as excessive levels of heat loss during winter months. Lidl have specified a high-performance glazing system which significantly betters the minimum standards of Part L to minimise the heat loss and enhance the insulation properties, whilst minimising solar gains to avoid overheating. Automatic internal sun blinds will also be installed, to mitigate against the solar penetration and potential glare risk within the checkout zone.

The following table details the anticipated fabric efficiency standards to be incorporated into the design.

Exposed element	New Part L2 2021 Minimum Standards	Lidl Store Proposed U-values	Improvement over Part L2
Flat Roofs	0.18 W/m^{2}K	0.16 W/m^{2}K	10.0%
Walls	0.26 W/m^{2}K	0.25 W/m^{2}K	3.8%
Ground Floors	0.18 W/m^{2}K	0.18 W/m^{2}K	0.0%
Curtain-walling	1.60 W/m^{2}K	1.31 W/m^{2}K (g-value = 0.395)	18.1%
Staff Room Window	1.60 W/m^{2}K	1.43 W/m^{2}K (g-value = 0.395)	10.6%
Vehicle access and similar large doors	1.30 W/m^{2}K	1.30 W/m^{2}K	0.0%
Pedestrian doors	1.6 W/m^{2}K	1.6 W/m^{2}K	0.0%
High usage entrance door	3.0 W/m^{2}K	1.7 W/m^{2}K	43.0%
Air Tightness Testing	8 m^3/(h.m^2)@50Pa	4 m^3/(h.m^2)@50Pa	50.0%

Figure 13 - U-value Comparison

As can be seen in the table above, the targeted ‘U’ values demonstrate a significant betterment over the minimum standards as detailed in the *Approved Document Part L Volume 2, Table 4.1, Limiting U-values for new or replacement elements in new and existing buildings and air permeability in new buildings* of the Building

Regulations. This demonstrates the design team's commitment to going above and beyond to ensure a sustainable development.

8.03 Thermal Mass

The concrete floor slab of the proposed Lidl Store has been specified to give a relatively high thermal mass which will assist in reducing internal temperature fluctuations due to external temperature variations, to give a more easily controlled environment inside the building. The building would be considered to have low to medium thermal mass.

8.04 Natural Ventilation

Due to the deep floor plans, a natural ventilation strategy has not been adopted to the Sales Area. However, the mechanical ventilation strategy allows heat to be recovered from the stale air when it is extracted, thus tempering the fresh incoming air to reduce the heating coil loads. This is not something usually achievable with naturally ventilated strategies so advantages over passive strategies can be gained.

8.05 Mechanical Ventilation

The Sales Area will be heated, cooled, and ventilated through the incorporation of a centralised air handling unit with heat recovery, with an efficiency more than 80%. Energy efficient EC fans will be specified to reduce auxiliary loads and staged direct-expansion (DX) heating and cooling changeover coils, fed via Air Source Heat Pumps (an LZC technology) will provide the air distribution, heating, and cooling requirements.

All toilets shall be provided with extract ventilation. This will comprise of a mix between extract only, and mechanical ventilation with heat recovery (MVHR) units. Where extract only fans are provided, infra-red motion detectors will be installed ensuring they operate only when occupancy is detected. This reduces running time and ensures the fans are only used when necessary.

Where mechanical supply and extract is required, a MVHR unit will be installed. This ensures any fresh air entering the space is pre-treated by extracted air bringing it closer to the internal design temperature. This reduces the load on the heating/cooling system whilst still maintaining the necessary fresh air rates. This will also be controlled by PIR occupancy detectors.

8.05.1 Low Energy Fans

Low energy fans will be used with specific fan powers as good as or better than the limiting efficiencies detailed in *Approved Document Part L2, Table 6.9, Maximum specific fan power (SFP) in air distribution systems in new and existing buildings.*

8.05.2 Variable Speed Drives

Variable speed drives will be used to ensure fans operate no faster than required, thereby reducing energy consumption.

8.06 Sub-Metering

Separate sub-metering will be installed. This has obvious financial and sustainable benefits, allowing for financial verification with regards to consumption vs cost as well as allowing for consumption figures to be monitored and any out-of-range values easily identified, and energy wastage eliminated.

8.07 Low Energy Lighting and Controls

A high proportion of glazing will significantly reduce the dependences and output requirements on electric lighting offering reduced energy demand and carbon emissions and enhanced occupancy comfort.

LED lamps will be provided throughout, both for internal spaces and the external car park. LED lamps have a very low energy consumption and have a life expectancy exceeding that of conventional light bulbs. This reduces both energy use and waste.

The sales area lighting shall be controlled based on the following controls strategy:

- Once the store is opened and the intruder alarm unset, the 1/3 lighting will turn ON.
- 15-minutes before store opening, the store lighting will switch to 100% i.e. 1/3 and 2/3 lighting. For Sunday “Browsing Time” 2/3 lighting should be activated 30-minutes before store opening.
- The lighting will remain at 100% for the duration of store opening.
- 30-minutes after the store is closed, lighting will switch back to 1/3.
- Once the store is closed and the intruder alarm is set, all the lights will switch off after a delay of 10-seconds, except for one single light in the main entrance.
- Upon activation of the confirmed intruder alarm signal, the lighting will turn on to 100%.
- Once the activation has been cleared, the lighting will turn off.

In addition to the above, the main entrance, store entrance and checkout lighting shall be photo-electric controlled (dynamic dimming). The rest of the sales area lighting will be dimmed down (static dimming) to a pre-set level.

Infra-red motion sensor will be provided throughout the Warehouse and all Side Rooms, so that lights are only turned on when the rooms are occupied.

8.08 Building Energy Management System

A full building management system will be incorporated to ensure plant is controlled and operated efficiently.

8.09 Building Energy Performance

All the above systems will be designed in accordance with the 'Non-Domestic Building Services Compliance Guide', CIBSE recommendations and relevant British Standards. The incorporation of 'Good Practice' engineering design coupled with the provision of renewable systems (described below) will ensure that an energy efficient store is achieved, minimising the energy consumption and associated CO2 emissions through its life cycle.

8.10 Water Efficiency

Water is becoming an increasingly scarce resource, with new development generating a growing demand. To meet increased demand new water sources and associated infrastructure need to be in place.

Main cold-water consumption for the store will be reduced through water efficiency.

This will be achieved through the provision of efficient water fittings throughout the store, including services valves complete with flow restrictors, (also helping to reduce hot water demand), dual flush toilets, and low water consumption appliances where provided, as outlined below:

Fittings	Flow rate
Wash Hand Basin	0.048 litres/second
Sink (Kitchenette)	0.08 litres/second
Sink (Bakery, Sluice, Cleaners)	0.12 litres/second
Urinal	2 litres/bowl/hour
WC	4 litres
Dishwasher	12 litres/cycle

Figure 14 - Water Efficiency Table

The store will incorporate water efficient fittings in line with equivalent BREEAM standards to reduce water consumption.

The incoming mains cold water supply will be separately metered, using a smart meter to allow Lidl and the local water authority to easily monitor water consumption. There will also be a water sub-meter in the utility room, which will be connected to the store building management system and will record and monitor store consumption. The water consumption will be monitored by Lidl on a regular basis, via their central control system, known as GLT.

9.00 'BE CLEAN' – DECENTRALISED LOW CARBON TECHNOLOGIES

To comply with The London Plan, developments in Heat Network Priority Areas (HNPAs) should, where feasible, have a communal low-temperature heating system, which has been selected in-line with the heat hierarchy. A series of centralised and decentralised systems have been analysed in-line with the heating hierarchy and viability stated to offer justification for use or omission.

9.01 Decentralised Energy Networks (DEN)

Based on searches with the London Heat Map, there are no existing heat networks within the Hillingdon District. Further research, however, suggests there is a Heat Network run by Metropolitan within the Uxbridge area. This heat network consists of a 600kW CHP engine serving 650+ residential properties plus 30,000m² of commercial premises.

9.01.1 Viability

Connection to a district heating network would have benefits to a development with high hot water and space heating demands. Unfortunately, due to the nature of this development, the hot water demand is very low. This low demand does not correlate with the use of a district heat network.

Furthermore, space cooling is provided in the store, which cannot be provided by the district heat network. This is provided by energy efficient reverse cycle Air Source Heat Pumps (ASHP's), which also provides heating and further reduces the heated floor area, which could be served by a district heat network. It is considered unfeasible, un-economical and unsustainable to install a separate heating system and separate cooling system to serve a single space. It would have high-cost implications, more services to install which could lead to higher on-site waste, higher distribution losses and a lower overall efficiency. The requirement of heating and cooling is not compatible with a heating only district heat network.

The decarbonisation of the electrical grid should also be considered. This works in unison with the all-electric building services strategy adopted for this development, as the actual Governmentally published carbon factors associated with electricity are lower than gas. This means an all-electric building will have lower associated emissions to any gas heated source.

It should be further noted that the current existing heat network in Uxbridge is some distance from the site and connection to this network would be costly, disruptive and potentially mean significant distribution losses due to the significant pipe runs. This would reduce the overall efficiency of the heating system and bring into question the real-world efficiency of it associated with this development.

The site will not be futureproofed for a future district heating connection, as the sustainable heating system proposed i.e. ASHP's is not compatible with district heating networks. If a district heating network is provided at a later date, to make any connection would mean replacing the store's heating system in its entirety and installing additional chiller plant, which would take up valuable external space (and in itself be an unsustainable use of building materials etc.). Lidl's standard model approach is to utilise energy efficient air source heat pumps for heating their stores, which maintains consistency and reliability across the estate.

Photovoltaic (PV) panels will be proposed, which further justifies the all-electric building services design philosophy for this development. The electrical energy generated on-site will be consumed by the store. Where the generation profile exceeds the consumption profile, electrical energy generated through the renewable technology can be exported back to the grid. This contributes to the ever expanding 'Greening' of the electrical grid, allowing for associated carbon factors with electrical generation to be justifiably reduced.

9.02 Zero-Emission or Local Secondary Heat Sources

This section of the heating hierarchy encourages the exploitation of local energy opportunities to maximise the use of locally available energy sources, whilst minimising primary energy demand and carbon emissions. Secondary heat sources should be used before renewable energy sources but can also be used in conjunction with them, to minimise the carbon intensity of the heat network.

9.02.1 Viability

Waste heat sources on or adjacent to the site have been investigated to ascertain the feasibility of connection to and utilisation of waste fuel sources to provide space heating.

The store will have refrigeration dry coolers providing waste heat through certain times of the year. However, Lidl's internal refrigeration cabinets have doors which significantly reduces the cooling loss from the case, and as such reduces the cooling plant size for refrigeration. This being the case, the actual usable heat rejection is minimal and unlikely to meet the stores heat demand through most of the year.

Furthermore, space cooling is provided throughout, which cannot be provided by a waste heat fuel source. The ASHP's provide space heating and cooling at a high efficiency and further reduces the heated floor area which could be served by a waste heat fuel source. It is considered unfeasible, un-economical and unsustainable to install a separate heating system and separate cooling system to serve a single space.

For this reason, Zero Emission or Local Secondary Heat Sources cannot be utilised on site and have been discounted from the building services design strategy.

9.03 Combined Heat And Power (CHP)

Combined Heat and Power (CHP) is the on-site generation of electricity, and the recovery of the normally wasted heat produced during this process.

- The operation of CHP plant can offer significant CO_2 emission rate reductions when compared to conventional methods of energy generation and use.
- Most large conventional power stations currently generate electricity at 30-50% efficiency (due to waste heat and transmission/distribution loss).
- 'Good quality' CHP schemes achieve overall efficiencies of 70-85% by making use of waste heat and eliminating transmission losses.

The efficient use of CHP typically depends on finding a use for the heat generated by the process. Issues to consider include:

- If heat is not used, then the system is effectively just an electricity generator and electricity will be greener and cheaper if sourced from the national grid.
- If excess electricity is generated on site this can be exported (sold) back to the grid whereas excess heat needs to be rejected (wasted). Exported electricity can count towards reducing the site's CO_2 emissions.
- Exported electricity will typically not be financially attractive as exports tend to coincide with low demand periods on the national grid. The cost of producing the electricity on site can be less than the prices received for the exported electricity.

9.03.1 Viability

The introduction of a CHP unit has the potential to reduce running costs and carbon dioxide emissions associated with the operation of the building when compared to employing a conventional generator and/or boiler. However, the CHP plant should always operate as the lead heat source to maximise savings.

CHP systems require steady, constant loads all year round for best performance, with high running hours. This type of running schedule will usually be found in applications with high domestic hot water loads such as hotels, hospitals, care homes etc. A development of this type will have an inherently low hot water demand

and therefore a CHP plant would not be deemed viable due to the lengthy amount of the year where the CHP engine would be sitting idle due to lack of thermal demand.

It can therefore be concluded that the possibility of introducing a combined heat and power system is both un-sustainable and un-economically viable on this project.

It should also be noted that there will be no gas infrastructure being installed on this development.

9.04 Ultra-Low NOx Gas Boilers

A heating strategy led by ultra-low NOx gas boilers should only be considered when it has been clearly demonstrated that all of the above options have been fully investigated and ruled out. It has been demonstrated that the above energy hierarchy strategies are unfeasible for this development, and as such, ultra-low NOx boilers have been assessed for viability.

9.04.1 Viability

It is not deemed suitable to provide ultra-low NOx boilers as they do not lend themselves to this development. Certain areas within the building will require space cooling to ensure occupancy satisfaction and comfort levels. Even after the extensive works carried out in-line with the cooling hierarchy. For this reason, it is not deemed sensible or economically feasible to provide space heating via a gas boiler and space cooling via an ASHP. The ASHP can provide both space heating and cooling at a significantly higher efficiency, with lower associated emissions. As such, the introduction of low NOx gas boilers does not outweigh the benefits of an all-electric space heating, cooling and hot water strategy.

Furthermore, the decarbonisation of the electrical grid should be considered, this works in unison with the all-electric building services strategy adopted for this development, as the actual Governmentally published carbon factors associated with electricity are lower than gas. This means an all-electric building will have lower associated emissions to any gas heated source. P.V. panels will also be proposed which further justifies the all-electric building services design philosophy for this development.

It should also be noted that there will be no gas infrastructure being installed on this development.

10.00 'BE GREEN' – LOW OR ZERO CARBON TECHNOLOGIES

A low or zero carbon technology is defined as something which either; produces energy through an endless, renewable source with low or zero carbon emission throughout its operation, or one which uses a specific energy source i.e. electricity and provides a significantly higher output to input ratio.

Due to the unviable incorporation of District Energy Networks, secondary waste heat sources, combined heat and power (CHP) or low NOx gas boilers, the development will be required to incorporate "Individual building renewable systems" to ensure compliance with local and national planning requirements.

10.01 Solar Thermal

Solar thermal collectors utilise solar radiation to heat water for use in water heating of a building. The radiation is converted using a solar collector, of which there are two main types available: Flat Plate and Evacuated Tube collectors. Evacuated tube systems occupy a smaller area and are more efficient, but also generally more expensive. Flat plate systems are cheaper to install but generally less efficient.

The solar coverage indicates the percentage of the annual domestic hot water energy requirement that can be covered by a solar water heating system. The higher the solar coverage, the more conventional energy usage can be offset, but this can cause excess heat generation in the peak summer months and generally lower the average collector efficiency. Therefore, solar coverages of 40-70% are recommended for domestic applications and up to 40% in non-domestic buildings.

Solar thermal systems in the UK normally operate with a backup fuel source, such as gas or electricity. The solar system pre-heats the water up to a maximum hot water temperature. If there is not enough solar power available to fully meet the required hot water load, then the backup fuel system fires up to meet this short fall.

The optimum orientation for a solar collector in the UK is a south facing surface, tilted at an angle of 30º from the horizontal.

For the solar water heating system to run safely and efficiently, a series of temperature sensors are connected to a digital solar controller to switch the system on or off according to the solar energy available.

10.01.1 Viability

Solar thermal panels are suited to buildings with a high and consistent hot water demand. Buildings of this type inherently have a low hot water demand and therefore, a solar thermal array would not be deemed viable or cost effective.

10.02 Photovoltaics (PV)

Photovoltaic solar cells convert solar energy directly into electricity. The cells consist of two layers of silicon with a chemical layer between. The incoming solar energy charges the electrons held within the chemical. The energised electrons move through the cell into a wire creating an electrical current.

A range of Photovoltaic products and colours are available, varying in efficiency and cost. These include Monocrystalline, Polycrystalline, Thin Film and Hybrid Panels. Hybrid Panels are the most energy efficient and Thin Film the least.

All the above technologies can be installed in roof and wall mounted arrays or as integrated building members, giving the additional benefit of offsetting the cost of other construction materials, such as weatherproof roof membranes or integrated into glazed wall constructions.

10.02.1 Viability

Photovoltaic panels have been proposed for this development and will be incorporated into the building services design strategy.

- **Lidl Food Store Annual Electrical Generation –** 103,641.00kWh/annum

The actual array size and electrical generation will be developed throughout the detailed design stage to ensure any design changes, which could affect the developments associated regulated emissions detailed within this report, are off-set and all national and local guidance requirements met.

10.03 Air Source Heat Pump (ASHP)

Air source heat pumps exchange heat between the outside air and a building to provide space heating in winter and cooling in the summer months. The efficiency of these systems is inherently linked to the ambient air temperatures. Air source heat pumps operate best in environments with long, mild, mid-season periods, as the heating efficiency drops at lower ambient temperature in winter.

Unlike some other sources of renewable energy, heat pumps do require electricity to pump and compress refrigerants through the system. However, heat pumps supply more energy than they consume, by extracting heat from their surroundings. Heat pump systems can supply as much as 4kW of thermal energy for just 1kW of electrical energy input, which is why they are recognised as a renewable technology under the Renewable Energy Directive 2009/28/EU.

10.03.1 Viability

ASHP's have been deemed a suitable way of offering space heating to the Sales Area, Warehouse and Side Rooms.

The Sales Area will be conditioned using an internal centralised intelligent AHU, with staged direct expansion heating and cooling changeover coils, fed via a two pipe VRF system.

For the Warehouse and Side Rooms, a two pipe VRF system will be utilised, which will work with ceiling mounted cassettes, or wall mounted units.

- Seasonal Coefficient of Performance: ≥3.5
- Seasonal Energy Efficiency Ratio: ≥4.5

11.00 'BE LEAN', 'BE CLEAN' AND 'BE GREEN' – PREDICTED ENERGY USAGE

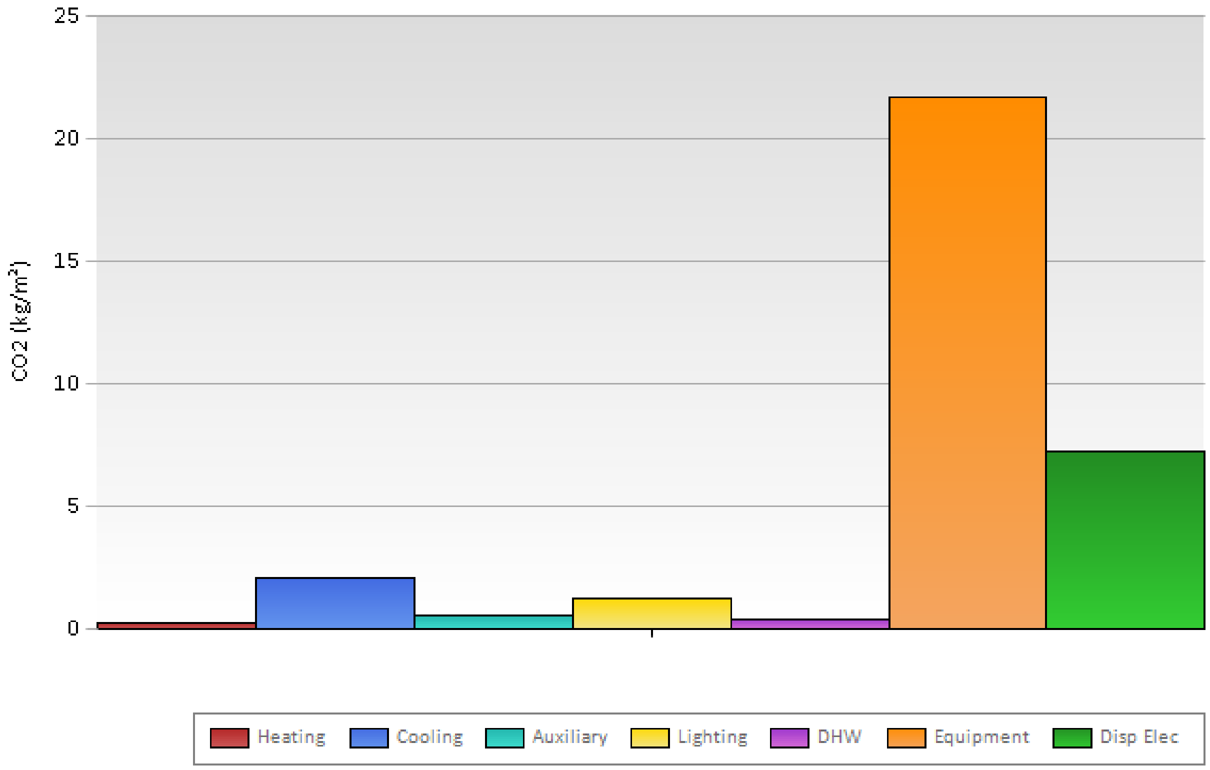
With the above passive, active and LZC strategy being incorporated into the building services design, the anticipated proposed energy and carbon dioxide emission performance, as assessed to Part L 2021 can be expected:

	Regulated non-residential carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be lean: savings from energy demand reduction	0.2	2%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	12.9	159%
Total Cumulative Savings	**13.1**	**161%**
Annual savings from off-set payment	-5.0	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**-150**	-
Cash in-lieu contribution (£)	**-14,233**	

Figure 15 - Carbon Dioxide Emissions After Each stage of the Energy Hierarchy

The Energy Assessment Guidance confirms the regulated carbon dioxide emissions reduction target for major domestic and non-domestic development is net zero carbon, with at least a 35% on-site reduction beyond Part L 2021 of the Building Regulations. The table above, from the GLA Carbon Emission Reporting Spreadsheet Tool confirms all requirements have been met, with a site wide carbon dioxide reduction of **161%**, which **2%** is through energy efficient means.

11.01 Predicted Annual Carbon Dioxide Emissions of the Actual Building



	Heating	*Cooling*	*Auxiliary*	*Lighting*	*DHW*	*Equipment*	*Displaced Electricity*
CO2 (kg/m²)	0.20	2.04	0.57	1.25	0.39	21.74	7.24

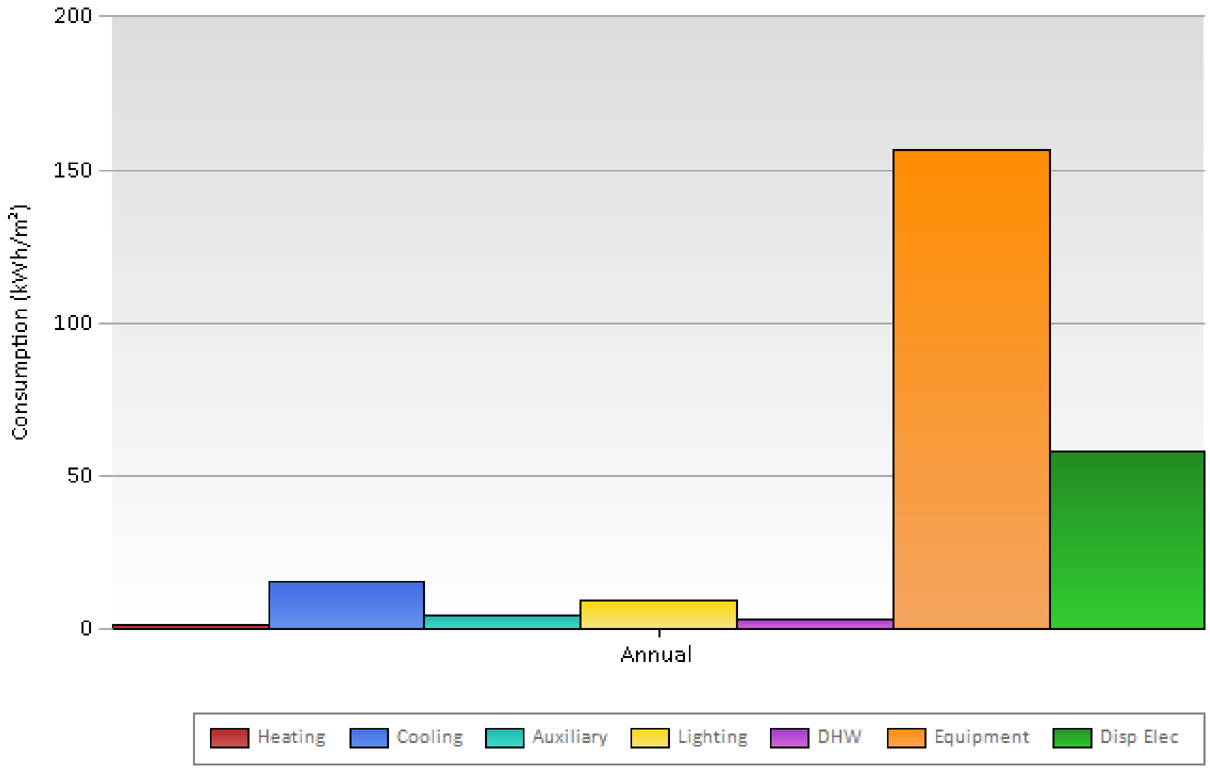
Figure 16 - Annual Carbon Dioxide Emissions - Be Green

Figure 16 shows an annual CO_2 emissions rate of -4,994.10kgCO_2/year of regulated emissions and 33,920.50kgCO_2/year inclusive of unregulated emissions. This represents a **161.32%** and **26.38%** carbon dioxide reduction respectively over the 2021 baseline detailed within section 7.0. The table below summarises further the breakdown of regulated and unregulated carbon dioxide emission for the actual building.

Actual Carbon Dioxide Emission Summary ($kgCO_2$/year)		
	Regulated Emissions	**Un-Regulated Emissions**
Heating	358.00 $kgCO_2$/year	358.00 $kgCO_2$/year
Cooling	3,651.60 $kgCO_2$/year	3,651.60 $kgCO_2$/year
Auxiliary	1,020.30 $kgCO_2$/year	1,020.30 $kgCO_2$/year
Lighting	2,237.50 $kgCO_2$/year	2,237.50 $kgCO_2$/year
Hot Water	698.10 $kgCO_2$/year	698.10 $kgCO_2$/year
Equipment	Not Applicable	38,941.60 $kgCO_2$/year
Photovoltaic (PV) Contribution	-12,959.60 $kgCO_2$/year	-12,959.60 $kgCO_2$/year
Total	**-4,994.10 $kgCO_2$/year**	**33,920.50 $kgCO_2$/year**
Percentage Improvement	**161.32%**	**26.38%**

Figure 17 - Actual Carbon Dioxide Emission Summary

11.02 Predicted Annual Energy Consumption of the Actual Building



	Heating	*Cooling*	*Auxiliary*	*Lighting*	*DHW*	*Equipment*	*Displaced Electricity*
Consumption (kWh/m²)	1.25	15.47	4.11	8.98	2.78	156.69	57.90

Figure 18 - Annual Energy Consumption - Be Green

Figure 18 above shows an annual energy consumption requirement of -45,304.90kWh/year of regulated energy and 235,170.20kWh/year inclusive of unregulated energy. This shows an annual energy consumption reduction of **173.73%** and **31.22%** respectively over the 2021 baseline detailed within section 7.0. The table below summarises further the breakdown of regulated and unregulated energy consumption for the actual building.

Actual Energy Consumption Summary (kWh/year)		
	Regulated Emissions	**Un-Regulated Emissions**
Heating	2,237.50 kWh/year	2,237.50 kWh/year
Cooling	27,691.30 kWh/year	27,691.30 kWh/year
Auxiliary	7,356.90 kWh/year	7,356.90 kWh/year
Lighting	16,074.20 kWh/year	16,074.20 kWh/year
Hot Water	4,976.20 kWh/year	4,976.20 kWh/year
Equipment	Not Applicable	280,475.10 kWh/year
Photovoltaic (PV) Contribution	-103,641.00 kWh/year	-103,641.00 kWh/year
Total	**-45,304.90 kWh/year**	**235,170.20 kWh/year**
Percentage Improvement	**173.73%**	**31.22%**

Figure 19 – Actual Energy Consumption Summary

12.00 BE SEEN

In order to achieve compliance with Policy SI-2 of The London Plan 2021, it is necessary for the development and design team to demonstrate how the buildings energy consumption will be monitored, allowing for energy verification and performance to be achieved. It is therefore necessary for the development to:

- Ensure all renewable technologies are installed by professionally certified installers, and benefit from energy metering, which will log the energy consumption and generation.
- Ensure the installation of smart meters and sub metering to allow for the accurate recording of energy consumption associated with regulated and unregulated building usage.
- To minimise peak energy demand through sensible control strategies and energy monitoring. This allows for high energy usage and energy consumption discrepancies to be identified, investigated and and action against carried out.

Furthermore, the Be Seen reporting spreadsheet for the development has been started, with all planning stage information complete. The reporting process will be followed through each necessary stage. The client will be required to ensure the process is followed through suitable legal wording.

To create data for the Be Seen reporting spreadsheet, a separate detailed analysis has been undertaken. Following the guidance of the TM54, which is published by CIBSE, the calculations are designed to provide a more realistic estimate of the site energy demand post occupation, when compared to the standard Part L model.

TM54 is an assessment aimed at evaluating the operational energy performance of a building and aims to:

- To help engineers respond to a brief where an operation energy target has been set.
- Provide a methodology that engineers can use to undertake better informed calculations of energy use in operation.
- Demonstrate that energy performance is dependent on how the building is run and maintained, as well as how it is designed and constructed.

Carrying out a TM54 assessment on a building can help give occupiers an indication of the range of energy use and running costs for the building. It can aid designers to identify how energy is likely to be used in the building and enable them to investigate design factors that will have the greatest impact on the energy usage of the building.

The graph below compares the results of the TM54 calculation and the SBEM calculation.

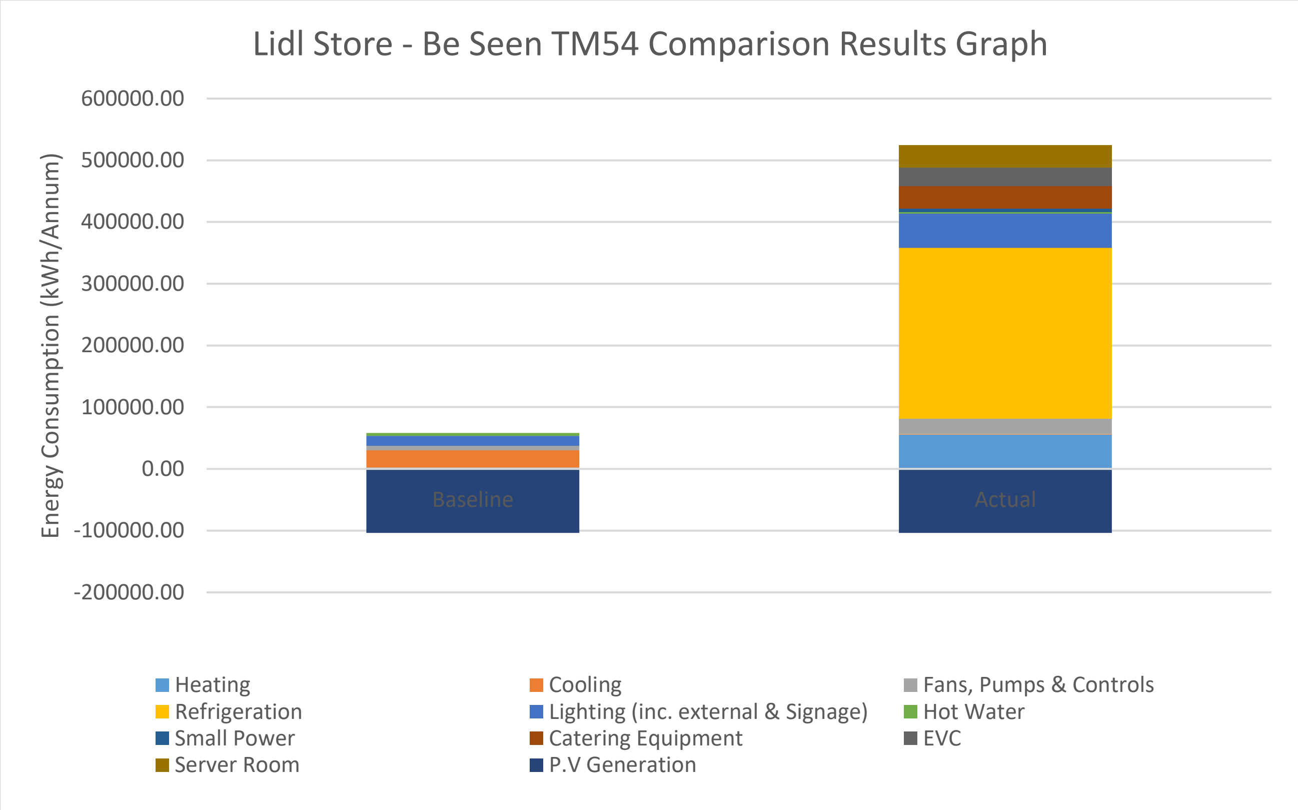


Figure 20 - Operational Energy - TM54 & Part L Comparison (Lidl Food Retail Store)

As can be seen in the comparison table above, the TM54 calculation predicts significantly more energy use compared with the SBEM calculation. The main reasons for this are:

- SBEM calculations only account for regulated energy. Therefore, operational energy consumption associated with small power, lifts, electric vehicle charging points, external lighting, refrigeration etc. are not considered. The TM54 calculation does allow for these energy consuming items.
- Occupancy profiles used within the SBEM calculation follow NCM conventions. These allow for consistent comparison between other buildings of a similar type, however, are not necessarily representative of actual occupancy profiles. For this reason, occupancy profiles need to be adjusted to represent the actual building operation and used within the TM54 calculation.

It should be noted that the TM54 calculation is still a prediction of energy consumption, however, based on more realistic occupancy profiles, with all energy consuming items accounted for. Despite the more accurate calculation process, some assumptions have had to have been made on building services performance and occupancy profiles as the detailed design has not been carried out due to the early stages the project is at.

13.00 OVERHEATING

The development will require mechanical cooling to ensure occupancy comfort levels. This will be throughout the sales area, warehouse, IT room, cash office, canteen and DRS room. To ensure the mechanical cooling equipment is as efficient as possible, the cooling hierarchy has been followed to ensure reduced plant loadings.

13.01 Cooling Hierarchy

The cooling hierarchy strategy has been carried out on this development as follows:

Minimise internal heat generation through energy efficient design

- The fabric specification has been selected to ensure the glazing has a low G-value bettering the minimum standards of part L. This will be coupled with external solar shading / overhangs. Through the utilisation of enhanced solar performance and shading, the solar penetration into a space can be reduced to prevent excess levels of solar gain which can lead to overheating. This is an area which must be carefully considered to ensure solar gains are not drastically reduced during winter months when they can be useful in contributing towards free heating. The proposed G value for the glazing is 0.395.
- LED lighting and suitable controls have been selected to ensure minimal internal heat gain is attributed to unavoidable space lighting.

Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls

- External solar shading / overhangs will be installed to further reduce excessive levels of solar gains.

Manage the heat within the building through exposed internal thermal mass and high ceilings

- The development is expected to have a medium thermal mass. This will absorb solar radiation during the day, thus reducing heat gains within a space. The heat is then re-emitted into the space when the ambient temperature is lower than the surface temperature of the structure. This has the added benefit of not only reducing internal heat gains during summer but putting heat back into the space when needed i.e. later in the day when the sun is setting, at night or winter months.

Passive ventilation

- Natural ventilation has not been deemed a suitable strategy for this development due to the nature of the build and the anticipated occupancy levels.

Mechanical ventilation

- Certain rooms will receive fresh air via means of mechanical ventilation with heat recovery (MVHR). The heat recovery element will reduce the incoming fresh air temperature during summer months to one closer to that of the design temperature. This reduces the impact of warm summer air entering the space. For example;
    1. A 70% efficient heat recovery unit will reduce fresh incoming air from 30°C, down to 25.1°C assuming the internal design temperature is 23°C during summer months. This shows a Delta T of 2.1°C with heat recovery or 7°C without heat recovery, thus confirming the relevance and suitability of an MVHR unit reducing any associated fresh air cooling loads.
- In addition to this, the mechanical ventilation has a bypass mode, allowing the fresh incoming air to bypass the heat exchanger if the external temperature is lower than the internal temperature and free cooling can be achieved.

Active cooling systems (ensuring they are the lowest carbon dioxide options)

- Heat pumps have been detailed to offer cooling to the sales floor, back of house staff areas and warehouse for the Lidl food retail store. These offer the final element of cooling required which cannot be achieved through the extensive passive and active design strategies implemented. The selected heat pumps have a very good seasonal efficiency, exceeding minimum standards ensuring a highly efficient, low energy system.

13.02 TM52 – Adaptive Overheating Dynamic Simulation

A Dynamic Simulation has been carried out to confirm the requirement for cooling in certain areas. This has been carried out to ensure all passive measures are incorporated first, and where overheating is still present, mechanical cooling can be incorporated (where deemed the most energy efficient and sustainable solution). By following this route, we ensure the design team do not specify mechanical cooling equipment either where it's not needed, or where the load can be significantly reduced, reducing the developments energy consumption and associated emissions.

CIBSE guidance on adaptive overheating can be found in *CIBSE TM52, The Limits of Thermal Comfort; Avoiding Overheating in European Buildings* technical manual. This technical manual defines a building or room as overheating where two or more of the three criteria are not met. The three Criteria defining an overheating building are:

13.02.1 Criterion 1

The first criterion sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature by 1K or more during the occupied summer hours (1 May to 30 September).

13.02.2 Criterion 2

The second criterion deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperature rise and its duration. This criterion sets a daily limit for acceptability.

13.02.3 Criterion 3

The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is acceptable.

The tables below detailed the TM52 summary results for all occupied spaces within the development:

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
Sales Area	2295	68	0	0.0	0	Pass
Canteen	2295	68	0	0.0	0	Pass
Cash Office	2295	68	0	0.0	0	Pass

Figure 21 - TM52 Overheating Output (Lidl Retail Store)

As can be seen in results table above, all occupied spaces are expected to comply with the CIBSE TM52 overheating criteria. This confirms the measures implemented to comply with cooling hierarchy are suitable for this development with cooling loads being reduced and / or mitigated.

13.03 Cooling Demand

The table below details the actual and notional cooling demand. These have been calculated using the results of the Part L2 calculation methodology.

	Lidl Store Cooling Demand (kWh/annum)	Lidl Store Cooling Consumption (kWh/annum)
Notional Building	34,260.60	158,665.60
Actual Building	27,691.30	190,008.50

Figure 22 - Notional & Actual Cooling Demand (Lidl Food Retail Store)

14.00 EXPORTATION OF HEAT AND/OR ELECTRICITY

There are several technologies on the market which have the capabilities of generating heat and/or electricity which could exceed the building demand during certain load profile scenarios i.e. Photovoltaic Panels or Combined Heat and Power. Where this is the case, the energy can be exported or sold back to the grid offering a financial benefit, helping to reduce both energy wastage and payback periods.

Unfortunately, this option is not available to us through the utilisation of air source heat pumps as the proposed system, Air Source Heat Pumps, is incapable of generating electrical energy, therefore we will not be able to export this back to the grid. We are also unable to export heat back to the grid as the infrastructure is not in place, and the technology unsuitable.

Photovoltaic panels will be incorporated into the mechanical design strategy which will be capable of exporting any excess generated electricity back to the grid. The services will be set up to ensure compatibility with grid exportation should excess electricity be produced.

15.00 CONCLUSION

The report has demonstrated the proposed Lidl food retail store located in Ickenham Road, Ruislip will:

Incorporate passive design strategies to take advantage of:

- Natural daylighting thus, reducing dependency on electric lighting and the associated running costs and carbon emissions through natural contribution towards internal lighting requirements.
- Enhanced fabric efficiencies and thermal mass stabilise any temperature fluctuations within the building reducing heat gains and/or losses.
- Cooling hierarchy has been followed with overheating potential being reduced through the incorporation of high thermal mass parameters and high-performance glazing with solar heat gain reducing capabilities and external shading, alongside suitable mechanical design strategies to provide a combined active and passive solution.

Incorporate active design strategies to reduce energy consumption by:

- Introduce heat recovery ventilation to pre-heat incoming fresh air. This will reduce the energy loads associated with fresh air heat loss/gains.
- Introduce separate sub-metering to allow for all energy consumed to be monitored and any discrepancies easily identified and fixed thus minimising wasted energy.
- Low energy lighting will be installed with suitable controls to ensure lights are not left on unnecessarily. Suitable controls will eliminate human error.

Baseline energy and carbon dioxide emission calculations have been carried out in-line with The London Plan and Energy Assessment guidance:

Actual Carbon Dioxide Emission Summary ($kgCO_2$/year)		
	Regulated Emissions	**Un-Regulated Emissions**
Heating	358.00 $kgCO_2$/year	358.00 $kgCO_2$/year
Cooling	3,651.60 $kgCO_2$/year	3,651.60 $kgCO_2$/year
Auxiliary	1,020.30 $kgCO_2$/year	1,020.30 $kgCO_2$/year
Lighting	2,237.50 $kgCO_2$/year	2,237.50 $kgCO_2$/year
Hot Water	698.10 $kgCO_2$/year	698.10 $kgCO_2$/year
Equipment	Not Applicable	38,914.60 $kgCO_2$/year
Photovoltaic (PV) Contribution	-12,959.60 $kgCO_2$/year	-12,959.60 $kgCO_2$/year
Total	**-4,994.10 $kgCO_2$/year**	**33,920.50 $kgCO_2$/year**
Percentage Improvement	**161.32%**	**26.38%**

Figure 23 – Actual Carbon Dioxide Emission Summary

Actual Energy Consumption Summary (kWh/year)		
	Regulated Emissions	**Un-Regulated Emissions**
Heating	2,237.50 kWh/year	2,237.50 kWh/year
Cooling	27,691.30 kWh/year	27,691.30 kWh/year
Auxiliary	7,356.90 kWh/year	7,356.90 kWh/year
Lighting	16,074.20 kWh/year	16,074.20 kWh/year
Hot Water	4,976.20 kWh/year	4,976.20 kWh/year
Equipment	Not Applicable	280,475.10 kWh/year
Photovoltaic (PV) Contribution	-103,641.00 kWh/year	-103,641.00 kWh/year
Total	**-45,304.90 kWh/year**	**235,170.20 kWh/year**
Percentage Improvement	**173.73%**	**31.22%**

Figure 24 - Actual Energy Consumption Summary

Heating systems have been selected in-line with the Heat Hierarchy, however all District Energy Networks (DEN, Secondary Waste Heat Sources, CHP and Low NOX gas boilers have been deemed un-suitable for this development and as such have been discounted.

Alternative Low or Zero Carbon (LZC) technologies have been analysed with the following deemed to be both viable and advisable:

- Air Source Heat Pumps, or Aero-thermal Heat Pumps.
- Photovoltaic Panels

- **Lidl Retail Unit Annual Output –** 103,641.00kWh/annum

The Energy Assessment Guidance confirms the regulated carbon dioxide emissions reduction target for major domestic and non-domestic development is net zero carbon, with at least a 35% on-site reduction beyond Part L 2021 of the Building Regulations. These are to be assessed and converted using the GLA Carbon Emission Reporting Spreadsheet Tool, as detailed in section 1.7 of the Energy Assessment Guidance. Furthermore, a minimum 15% carbon dioxide reduction must be achieved through energy efficient means alone.

Due to the nature of the development, it has not been possible to achieve a 15% reduction through passive strategies. However, Lidl and the design team are committed to reducing emissions and as such, the P.V. proposal will ensure that >100% of the stores Part L regulated emissions will be off-set through on-site generation. This complies with the minimum zero carbon requirements. In addition to this, all off-sets shall be achieved on-site with no cash in lieu contribution being required.

The tables below, from the GLA Carbon Emission Reporting Spreadsheet tool demonstrate a site wide carbon dioxide reduction of **161%**, which **2%** is through energy efficient means.

	Regulated non-residential carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Be lean: savings from energy demand reduction	0.2	2%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	12.9	159%
Total Cumulative Savings	**13.1**	**161%**
Annual savings from off-set payment	-5.0	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**-150**	-
Cash in-lieu contribution (£)	**-14,233**	

Figure 25 - Carbon Dioxide Emissions After Each stage of the Energy Hierarchy

As can be seen by the results summary table above, the high fabric and services performance specification offers a significant carbon dioxide reduction. As such, there is no cash in lieu payment required for the food store.

APPENDIX A: BE LEAN BRUKL OUTPUT DOCUMENT

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Lidl Ruislip (Be Lean)

As designed

Date: Sun Jan 26 14:02:10 2025

Administrative information

Building Details

Address: Ickenham Road, Ruislip, London,

Certifier details

Name: Stephen Ogden

Telephone number: 01924265757

Address: RCM Buisness Centre, Dewsbury Road, Ossett, Ossett, WF5 9ND

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.6"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.6

BRUKL compliance module version: v6.1.e.0

Foundation area [m²]: 1631.19

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

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	4.55	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	4.53	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	50.27	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	49.89	
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	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	First surface with maximum value
Walls*	0.26	0.25	0.25	External Wall
Floors	0.18	0.18	0.18	Ground Floor
Pitched roofs	0.16	-	-	No pitched roofs in project
Flat roofs	0.18	0.16	0.16	Roof
Windows** and roof windows	1.6	1.31	1.43	Canteen Window
Rooflights***	2.2	-	-	No rooflights in project
Personnel doors^	1.6	1.6	1.6	2120 Door
Vehicle access & similar large doors	1.3	1.3	1.3	Delivery Door
High usage entrance doors	3	1.7	1.7	Main Entrance

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

* 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	4

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Central Vent (2 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0	6.5	-	1.92	0.82
Standard value	N/A	5	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

2- MVHR (Supply + Extract) (Cloaks)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1.34	-	-	1.5	0.76
Standard value	N/A	N/A	N/A	1.5^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

3- AC Only (IT Room)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0	8	-	-	-
Standard value	N/A	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

4- AC Only (2 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.64	6.5	-	-	-
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

5- MVHR + AC (3 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.64	6.5	-	1.5	0.76
Standard value	2.5*	5	N/A	1.5^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. ^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

1- Instantaneous Water Heater

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0
Standard value	1	N/A

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
Main Entrance	162	-	-
Daylit Space	160	100	-
Sales Area	160	100	-
DRS	160	-	-
Bakery	108	-	-
Storage Warehouse	160	-	-
Delivery Warehouse	160	-	-
Welfare Corridor	105	-	-
Cloaks	107	-	-
Canteen	105	95	-
IT Room	178	-	-
Utility	178	-	-
Cash Office	140	-	-
Staff WC A	114	-	-
Staff WC B	114	-	-
FOH WC	114	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Daylit Space	YES (+154%)	NO
Sales Area	NO (-96%)	NO
DRS	N/A	N/A
Storage Warehouse	N/A	N/A
Delivery Warehouse	N/A	N/A
Canteen	NO (-89%)	NO
IT Room	N/A	N/A
Cash Office	N/A	N/A

Regulation 25A: Consideration of high efficiency 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
Floor area [m^2]	1790	1790
External area [m^2]	6109	6109
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	4	4
Average conductance [W/K]	1322	1526
Average U-value [W/m^2K]	0.22	0.25
Alpha value* [%]	23.4	8.4

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

Building Use

% Area	Building Type
99	**Retail/Financial and Professional Services**
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	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
1	**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	1.98	1.76
Cooling	15.47	19.14
Auxiliary	4.11	3.92
Lighting	8.98	7.66
Hot water	2.59	2.54
Equipment*	156.69	156.69
TOTAL**	**33.14**	**35.02**

* 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	0.69
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*0.69*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	401.72	336.6
Primary energy [kWh_{PE}/m^2]	49.89	50.27
Total emissions [kg/m^2]	4.53	4.55

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	0	546.4	0	23.4	5.4	0	6.5	0	6.5
	Notional	0	443.3	0	28	5	0	4.4	----	----
[ST] No Heating or Cooling										
	Actual	36.1	0	7.5	0	6.8	1.34	0	1.34	0
	Notional	15.2	0	3.2	0	8.9	1.34	0	----	----
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	92.3	52.3	9.7	2	0	2.64	7.29	2.64	7.29
	Notional	8.8	84.4	0.9	5.3	0	2.64	4.4	----	----
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	51.8	42.8	5.4	1.8	7.8	2.64	6.5	2.64	6.5
	Notional	28	66.4	3	4.2	7.2	2.64	4.4	----	----

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

APPENDIX B: BE GREEN BRUKL OUTPUT DOCUMENT

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Lidl Ruislip (Be Green)

As designed

Date: Sun Jan 26 13:56:39 2025

Administrative information

Building Details

Address: Ickenham Road, Ruislip, London,

Certifier details

Name: Stephen Ogden

Telephone number: 01924265757

Address: RCM Buisness Centre, Dewsbury Road, Ossett, Ossett, WF5 9ND

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.6"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.6

BRUKL compliance module version: v6.1.e.0

Foundation area [m²]: 1631.19

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

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	4.55	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	-2.79	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	50.27	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	-35.43	
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	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	First surface with maximum value
Walls*	0.26	0.25	0.25	External Wall
Floors	0.18	0.18	0.18	Ground Floor
Pitched roofs	0.16	-	-	No pitched roofs in project
Flat roofs	0.18	0.16	0.16	Roof
Windows** and roof windows	1.6	1.31	1.43	Canteen Window
Rooflights***	2.2	-	-	No rooflights in project
Personnel doors^	1.6	1.6	1.6	2120 Door
Vehicle access & similar large doors	1.3	1.3	1.3	Delivery Door
High usage entrance doors	3	1.7	1.7	Main Entrance

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

* 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	4

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Central Vent (2 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0	6.5	-	1.92	0.82
Standard value	N/A	5	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

2- MVHR (Supply + Extract) (Cloaks)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	1.5	0.76
Standard value	N/A	N/A	N/A	1.5^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

3- AC Only (IT Room)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0	8	-	-	-
Standard value	N/A	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

4- AC Only (2 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.3	6.5	-	-	-
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

5- MVHR + AC (3 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.4	6.5	-	1.5	0.76
Standard value	2.5*	5	N/A	1.5^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

1- Sluice Water Heater

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0
Standard value	N/A	N/A

2- Bakery Water Heater

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0.03
Standard value	0.91	N/A

3- Welfare Water Heater

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0.03
Standard value	1	N/A

4- Staff Water Heater

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0
Standard value	N/A	N/A

5- FOH Water Tank

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0
Standard value	N/A	N/A

6- Instantaneous Water Heater

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0
Standard value	1	N/A

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	**General luminaire**	**Display light source**	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
Main Entrance	162	-	-
Daylit Space	160	100	-
Sales Area	160	100	-
DRS	160	-	-
Bakery	108	-	-
Storage Warehouse	160	-	-
Delivery Warehouse	160	-	-
Welfare Corridor	105	-	-
Cloaks	107	-	-
Canteen	105	95	-
IT Room	178	-	-
Utility	178	-	-
Cash Office	140	-	-
Staff WC A	114	-	-
Staff WC B	114	-	-
FOH WC	114	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Daylit Space	YES (+154%)	NO
Sales Area	NO (-96%)	NO
DRS	N/A	N/A
Storage Warehouse	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Delivery Warehouse	N/A	N/A
Canteen	NO (-89%)	NO
IT Room	N/A	N/A
Cash Office	N/A	N/A

Regulation 25A: Consideration of high efficiency 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
Floor area [m^2]	1790	1790
External area [m^2]	6109	6109
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	4	4
Average conductance [W/K]	1322	1526
Average U-value [W/m^2K]	0.22	0.25
Alpha value* [%]	23.4	8.4

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

Building Use

% Area	Building Type
99	**Retail/Financial and Professional Services**
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	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
1	**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	1.25	1.76
Cooling	15.47	19.14
Auxiliary	4.11	3.92
Lighting	8.98	7.66
Hot water	2.78	2.54
Equipment*	156.69	156.69
TOTAL**	**32.6**	**35.02**

* 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	57.9	0.69
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*57.9*	*0.69*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	401.72	336.6
Primary energy [kWh_{PE}/m^2]	-35.43	50.27
Total emissions [kg/m^2]	-2.79	4.55

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	0	546.4	0	23.4	5.4	0	6.5	0	6.5
	Notional	0	443.3	0	28	5	0	4.4	----	----
[ST] No Heating or Cooling										
	Actual	36.1	0	10	0	6.8	1	0	1	0
	Notional	15.2	0	3.2	0	8.9	1.34	0	----	----
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	92.3	52.3	6	2	0	4.3	7.29	4.3	7.29
	Notional	8.8	84.4	0.9	5.3	0	2.64	4.4	----	----
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	51.8	42.8	3.3	1.8	7.8	4.4	6.5	4.4	6.5
	Notional	28	66.4	3	4.2	7.2	2.64	4.4	----	----

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