

David Lloyd Leisure, DLL Reading Extension Energy Strategy

March 2026



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EXECUTIVE SUMMARY

This report provides an Energy Statement for the extension of the existing David Lloyd Leisure club within Thames Valley Business Park, which addresses the Wokingham Borough Core Strategy and Development Plan.

To help in the decision making process the report follows the following format;

Energy Efficient Design

Low Carbon Technologies

Renewable Energy Technologies

Energy Efficient Design

A range of passive and active energy efficient measures have been carefully assessed and incorporated into the design of the new extension. Key strategies include the use of high-performance façades, LED lighting, heat recovery systems, and high efficiency fans, each selected with consideration for the building's intended use and occupancy patterns.

To ensure ongoing performance, these measures will be monitored through a Building Energy Management System (BEMS), enabling continuous evaluation and optimisation of the building's energy efficiency.

Low Carbon Technologies

Combined heat and power (CHP) units generate relatively high levels of CO₂ compared to alternative technologies. As a result, incorporating this technology into the building leads to non-compliance with building regulations. Consequently, a gas-fired CHP system will not be implemented.

Renewable Energy Technologies

Several renewable energy systems have been evaluated for the development and are discussed in detail later in this report. A roof mounted photovoltaic (PV) array has been selected, as it offers a 22% reduction in the development's carbon emissions.

Improvement on 2021 Building Regulations

By incorporating the energy efficiency savings and renewable technologies mentioned within this report the carbon dioxide emissions improvement over 2021 Building Regulations for the new David Lloyd Club is illustrated in Table 1 below.

	National Model Kg/m ²	Actual Model Kg/m ²	Total CO ₂ Savings	Tonnes CO ₂ savings per annum
New Leisure Club Extension	27.2	26.1	12.8%	11

Table 1 - CO₂ emission reduction summary

Based on Table 1, the total carbon saving that can be achieved for the new leisure club extension is 12.8% over 2021 Building Regulations, or 11 tonnes of CO₂ per annum.

1.0 **INTRODUCTION**

1.1 **Background**

Hulley and Kirkwood have been appointed to develop an Energy Strategy for the new extension at DLL Reading within Thames Valley Business Park. This report provides an approach to ensure the new Leisure Club extension meets compliance with the Wokingham Borough Core Strategy and Development Plan.

Jeff Tidy has over 19 years of experience in produce thermal models and energy strategies for a range of non-domestic and domestic buildings.

The energy strategy reviews the new building's energy performance and energy generation via the use of dynamic modelling software (IES VE). The building regulation simulations were run using a level 5 assessment.

1.2 **Planning Policies**

1.2.1 **National Policy**

National Planning Policy Framework 2024

14. Meeting the challenge of climate change, flooding and coastal change

161. The planning system should support the transition to net zero by 2050 and take full account of all climate impacts including overheating, water scarcity, storm and flood risks and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.

Planning for climate change

162. Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating and drought from rising temperatures. Policies should support appropriate measures to ensure the future health and resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

163. The need to mitigate and adapt to climate change should also be considered in preparing and assessing planning applications, taking into account the full range of potential climate change impacts.

164. New development should be planned for in ways that:

a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through incorporating green infrastructure and sustainable drainage systems; and
b) help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings in plans should reflect the Government's policy for national technical standards.

165. To help increase the use and supply of renewable and low carbon energy and heat, plans should:

a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, and their future re-powering and life extension, while ensuring that adverse impacts are addressed appropriately (including cumulative landscape and visual impacts),

b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for colocating potential heat customers and suppliers.

166. In determining planning applications, local planning authorities should expect new development to:

a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and

b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

167. Local planning authorities should also give significant weight to the need to support energy efficiency and low carbon heating improvements to existing buildings, both domestic and non-domestic (including through installation of heat pumps and solar panels where these do not already benefit from permitted development rights). Where the proposals would affect conservation areas, listed buildings or other relevant designated heritage assets, local planning authorities should also apply the policies set out in chapter 16 of this Framework.

168. When determining planning applications for all forms of renewable and low carbon energy developments and their associated infrastructure, local planning authorities should:

a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and give significant weight to the benefits associated with renewable and low carbon energy generation and the proposal's contribution to a net zero future;

b) recognise that small-scale and community-led projects provide a valuable contribution to cutting greenhouse gas emissions;

c) in the case of applications for the repowering and life-extension of existing renewable sites, give significant weight to the benefits of utilising an established site.

169. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

1.2.2 Local Policy

The site is located within Thames Valley Business Park in Reading and will be subject to Wokingham Borough Council Core Strategy and Development Plan. The below sets out the planning requirements in regards to sustainable principles. No policies could be found in regards land use for low carbon and renewable installations. The planning requirements for noise are included within Policy CC06. The below policies will be used as a guide in the development of the energy strategy.

CP1 – Sustainable development

Planning permission will be granted for development proposals that:

- 1) Maintain or enhance the high quality of the environment;
- 2) Minimise the emission of pollutants into the wider environment;
- 3) Limit any adverse effects on water quality (including ground water);
- 4) Ensure the provision of adequate drainage;
- 5) Minimise the consumption and use of resources and provide for recycling;
- 6) Incorporate facilities for recycling of water and waste to help reduce per capita water consumption;
- 7) Avoid areas of best and most versatile agricultural land;
- 8) Avoid areas where pollution (including noise) may impact upon the amenity of future occupiers;
- 9) Avoid increasing (and where possible reduce) risks of or from all forms of flooding (including from groundwater);
- 10) Provide attractive, functional, accessible, safe, secure and adaptable schemes;
- 11) Demonstrate how they support opportunities for reducing the need to travel, particularly by private car in line with CP6; and
- 12) Contribute towards the goal of reaching zero-carbon developments⁴¹ as soon as possible by:
 - a) Including appropriate on-site renewable energy features; and
 - b) Minimising energy and water consumption by measures including the use of appropriate layout and orientation, building form, design and construction, and design to take account of microclimate so as to minimise carbon dioxide emissions through giving careful consideration to how all aspects of development form.

Figure 1 – Wokingham Borough Core Strategy, Policy CP1

Policy CC05: Renewable energy and decentralised energy networks

1. Local opportunities to contribute towards decentralised energy supply from renewable and low-carbon technologies will be encouraged
2. Planning permission will only be granted for proposals that deliver a minimum 10% reduction in carbon emissions through renewable energy or low carbon technology where the development is for:
 - a) Schemes of more than 10 dwellings (gross), or
 - b) Non-residential proposals of more than 1,000 sq m gross floorspace.
3. Proposals for renewable energy and decentralised energy works, including wind turbines, must demonstrate that:
 - a) They are appropriate in scale, location and technology type;
 - b) Are compatible with the surrounding area, including the impact of noise and odour;
 - c) Do not have a damaging impact on the local topography and landscape;
 - d) There is no significant impact upon heritage assets, including views important to their setting;
 - e) In the case of wind turbines, take account of their cumulative effect and properly reflect their increasing impact on the landscape and on local amenity

Figure 2– Wokingham Borough Development Plan, Policy CC05

Policy CC06: Noise

1. Proposals must demonstrate how they have addressed noise impacts to protect noise sensitive receptors (both existing and proposed) from noise impacts in line with Appendix 1 of the MDD.
2. Noise impact of the development must be assessed. Where there is no adverse impact (No Observed Effect Level) then noise will not be a material consideration.
3. Where there is an adverse effect (Lowest Observed Adverse Effect Level to Significant Observed Adverse Effect Level), then
 - a) The development layout must be reviewed. Where this results in there no longer being an adverse impact then design and mitigation measures should be incorporated accordingly.
 - b) Where there is still an adverse impact then internal layout must be reviewed. Where this results in there no longer being an adverse impact then design and measures should be incorporated accordingly.
 - c) Where there is still an adverse impact then physical mitigation measures such as barriers/mechanical ventilation must be reviewed. Where this results in there no longer being an adverse impact then design and mitigation measures should be incorporated accordingly.
 - d) Where there is still an adverse impact and the development falls within the significant observed adverse effect level then planning permission will normally be refused.

Figure 3 – Wokingham Borough Development Plan Policy, CC06

2.0 **ENERGY EFFICIENT DESIGN**

2.1 **Passive Measures**

Consideration of passive measures is a key part of the concept design process of any proposed David Lloyds Club and each aspect of the Passive Design includes methods of conserving energy passively and promoting sustainability. The below passive design measures have been discussed with David Lloyd and the design team as part of a consultation process.

This Passive Design section investigates and details the minimum required efficiency defined by building regulations, known as the 'limiting parameter.' This minimum efficiency or limiting parameter is then compared with the proposed Passive Design parameters to assess the benefits of passive design on energy use of proposed David Lloyds Club.

2.1.1 **Heat Loss**

The improved building fabric for the proposed development will generally reduce the heat loss during the winter months, and is a low risk, cost effective measure which in terms of money invested per kg of CO₂ saved is usually one of the most effective measures which can be taken.

However, in some cases there may be a year round cooling demand and care must be taken to improve the thermal insulation without retaining unwanted low grade heat, which could otherwise result in higher cooling loads.

The proposal is to improve the u-values beyond the notional building values required by Building Regulations in order to reduce the heat loss from the building.

The average U-values for all elements of the new leisure club extension will follow the values below:

Glazing:	U value = 1.4 W/m ² K
External Doors:	U value = 1.5 W/m ² K
External Walls:	U value = 0.2 W/m ² K
Ground Floor:	U value = 0.16 W/m ² K
Roof:	U value = 0.15 W/m ² K

2.1.2 **Reduction of infiltration Losses**

Building air leakage or 'infiltration' can create further heat losses via cold draughts into the building. The Building Regulations outlines the test requirements for air permeability, and calls for a minimum of 8m³ / m² / hour at a pressure differential of 50Pa. The notional model calls for 3m³ / m² / hour @ 50Pa.

The new leisure club extension will achieve an air permeability of 3m³ / m² / hour @ 50Pa.

2.1.3 Solar Shading and Daylighting

Solar shading to windows will reduce the solar gains to the building, which can reduce or potentially eliminate the requirement for comfort cooling.

Passive solar shading typically comprises of awnings or brise soleil. As an alternative the windows solar performance can be improved, this is represented as the g-value.

The windows through the new Leisure Club extension will utilise high performance glazing to reduce the solar gain entering the rooms. The g-values of the glazing are proposed to be set at 0.35.

This has been selected as it provides the best compromise between solar gain and the daylighting level within the room.

2.1.4 Natural Ventilation

Natural ventilation uses either the natural buoyancy of warm air, known as the stack effect or the prevailing wind to create air flow within occupied spaces. The ventilation openings can be in the form of suitably designed windows or low and high level louvred openings.

When designed and constructed adequately the natural ventilation can provide “fresh” air to the room occupants and avoid summer overheating without the need for mechanical ventilation.

However uncontrolled natural ventilation can result in high ventilation rates during the winter months, which will result in higher heating costs.

Natural ventilation will be maximised wherever practically possible, however, in areas such as toilets, showers, kitchens, internal rooms, deep plan rooms and densely occupied rooms where natural ventilation cannot guarantee the required ventilation rates, mechanical ventilation will be employed.

2.2 **Active Measures**

2.2.1 **Lighting Efficiencies**

Light Emitting Diode (LED) technology is the most significant recent development in terms of achieving high lumens per Watt.

It is proposed that for the lighting LED's will be utilised throughout the new leisure club extension. The proposed average lighting efficacy will be as described by the table below, the figures represent a significant increase in efficiency over building regulation standard.

Where appropriate such as storage room, WC's, offices etc., occupancy and daylight sensors will be used to reduce the lighting load, this can provide significant saving in CO₂ emissions.

Proposed Lighting Efficacies		
	General Lighting (lm/W)	Display Lighting (lm/W)
Leisure Club Extension	140	90

Table 2 - Proposed Lighting Efficiencies

2.2.2 **Mechanical Ventilation**

Mechanical ventilation will be required where natural ventilation cannot be achieved. To reduce the amount of energy used, the fan efficiencies will be designed in accordance with the current Energy-related Product (ErP) Directive.

Where required the new building shall be ventilated using air handling units (AHU). It shall be a requirement of the contractor that all fans installed will operate efficiently and all AHU's achieve an SFP of not more than 1.8 W/(l/s), with Class L2 leakage levels.

The ductwork sizing will be consistent with optimising the fan efficiencies so that the installation complies with the requirements of Building Regulations and DW144.

In addition to the above it is proposed to make extensive use of heat recovery in the ventilation systems. Where appropriate this will take the form of either thermal wheel, flat plate heat exchangers or, if space limitations dictate, run-around coils. The heat recovery efficiency will not be less than 78%.

2.2.3 **Variable Speed Drives**

It is proposed to make extensive use of variable speed drive (VSD) technologies for any fans or pumps installed within the building. Variable speed pumps can provide significant savings, but can also provide improved reliability, performance and reduced life cycle cost.

2.2.4 Building Management System

Mechanical services will be designed and installed to match the occupancy and level of operation in the areas being served with service zone designed to match the activity zone. The new leisure club extension will adopt a Building Management System to control and monitor all the installed services.

The following sets out the minimum requirements for the Central Building/Energy Management System (BMS) which will continuously monitor and control the main mechanical plant and electrical system functions within the project to reduce energy consumption and assist effective maintenance while ensuring occupant comfort.

Energy metering systems are to be installed that enable at least 90% of the estimated annual energy consumption of each fuel to be assigned to the various end-use categories of energy consuming systems.

The energy consuming systems in the building will be metered using an appropriate energy monitoring and management system that will provide ongoing feed back to the building operators.

2.2.5 High Efficiency Cooling Units

To reduce the overall energy usage of any cooling system installed, a high SEER will be required. In addition to this low GWP refrigerants will be used where possible.

2.3 **Embodied Carbon**

As part of the wider sustainability strategy for the proposed David Lloyd Leisure Club, careful consideration has been given to the reduction of embodied carbon. The total greenhouse gas emissions associated with the extraction, manufacture, transportation, assembly, maintenance, and eventual disposal of construction materials.

The design team has worked collaboratively to ensure that passive design measures not only reduce operational energy consumption but are also supported by material selections and construction techniques that reduce whole life carbon impact. This has included:

- **Material Selection:** Preference is being given to materials with low embodied carbon values and Environmental Product Declarations (EPDs). Where feasible, responsibly sourced timber and recycled or recyclable content will be used in place of more carbon-intensive materials.
- **Fabric First Approach:** The specification of high-performance insulation and air-tight construction significantly reduces the requirement for operational heating and cooling, thereby justifying the embodied carbon cost of improved materials through long-term carbon savings.
- **Efficient Glazing Systems:** The high-performance glazing not only reduces solar gain (g-value = 0.35) and heat loss (U-value = 1.4 W/m²K), but has been selected with durability and longevity in mind to reduce replacement frequency over the building's lifecycle.
- **Structural Efficiency:** Structural elements are being reviewed to optimise material volumes and minimise waste, with a particular focus on lightweight materials and prefabricated systems where appropriate.
- **Lifecycle Considerations:** Long-term durability and low maintenance requirements are being factored into material selection, helping to reduce embodied carbon associated with refurbishment or replacement cycles.

In summary, while much of the energy strategy focuses on minimising operational emissions, the development is being approached with full recognition of the embodied carbon associated with construction, and measures are being incorporated to deliver a lower impact in regards to embodied carbon.

3.0 **LOW CARBON TECHNOLOGIES**

3.1 **District Heating Scheme**

No other energy centres are operational in the vicinity of the proposed works. Therefore, taking the above into account we cannot connect to a districting heating system but will allow for the facility to do so if one becomes available in the future.

3.2 **Low Carbon Solutions**

Combined Heat and Power

A CHP plant is an installation where there is simultaneous generation of usable heat and power (usually electricity) in a single process. The basic elements of a CHP plant comprise one or more prime movers usually driving electrical generators, where the heat generated in the process is utilised via suitable heat recovery equipment for a variety of purposes including: industrial processes, community heating and space heating.

Due to the utilisation of heat from electricity generation and the avoidance of transmission losses because electricity is generated on site, CHP typically achieves a 35 per cent reduction in primary energy usage compared with power stations and heat only boilers.

The economic viability of CHP is the difference between the cost of electricity and gas, referred to as the "spark gap". The greater the cost of electricity over gas is the more likely a CHP installation is to be viable. Another factor to assess a CHP's economic viability is based on its running hours. It is generally accepted that in order to achieve the economic return of a CHP installation, the operating threshold is 5,000 hours per year.

Despite the economic advantage outlined above, it must be highlighted that a CHP is still a gas fuel-burning appliance. At the same time electricity generation from the National Grid is becoming less reliant on coal or gas-fired power stations reducing the CO₂ output. CHP's are now producing a higher output of CO₂ when compared to the National Grid.

Installing a CHP unit significantly increases the onsite CO₂ production compared to the notional model. This causes the building regulation model to fail. As this technology does not provide a carbon saving and causes the building regulation assessment to fail it will not be utilised on this site.

CHP Calculation Summary	
System Life Cycle Cost	£815,429
Low Carbon Energy Output per year	5,397 kWh/annum
CO ₂ Savings per year	-384 kgCO ₂
Reduction in buildings CO ₂ emissions	-0.4 %
Payback	N/A

Table 3 – CHP Calculation Summary

4.0 RENEWABLES

This section assesses the feasibility of different types of renewable technologies available for on-site installations and their effectiveness for carbon reduction.

4.1 Wind Energy

The annual average wind speed is around 4.6m/s. This is the average wind speed for a wind turbine at 10 metres above ground level according to the NOABL wind data base available on the Department of Trade and Industries website. The power generated by the wind turbine is proportional to the wind speed cubed. This is illustrated in the below figure, which shows the power curve of a 2.5 kW turbine.

In most cases the average wind speed of a site is the defining factor on whether or not a site is suitable for generating electricity from wind energy. An average wind speed of 4.6m/s for a site is too low for any considerable electricity to be generated.

Obstructions to the wind path should also be evaluated. The wind to this site is obstructed by the surrounding buildings and vegetation, creating highly turbulent air flows which would greatly reduce the energy generation.

Wind turbines will also require noise surveys as this could cause potential issues with the residents.

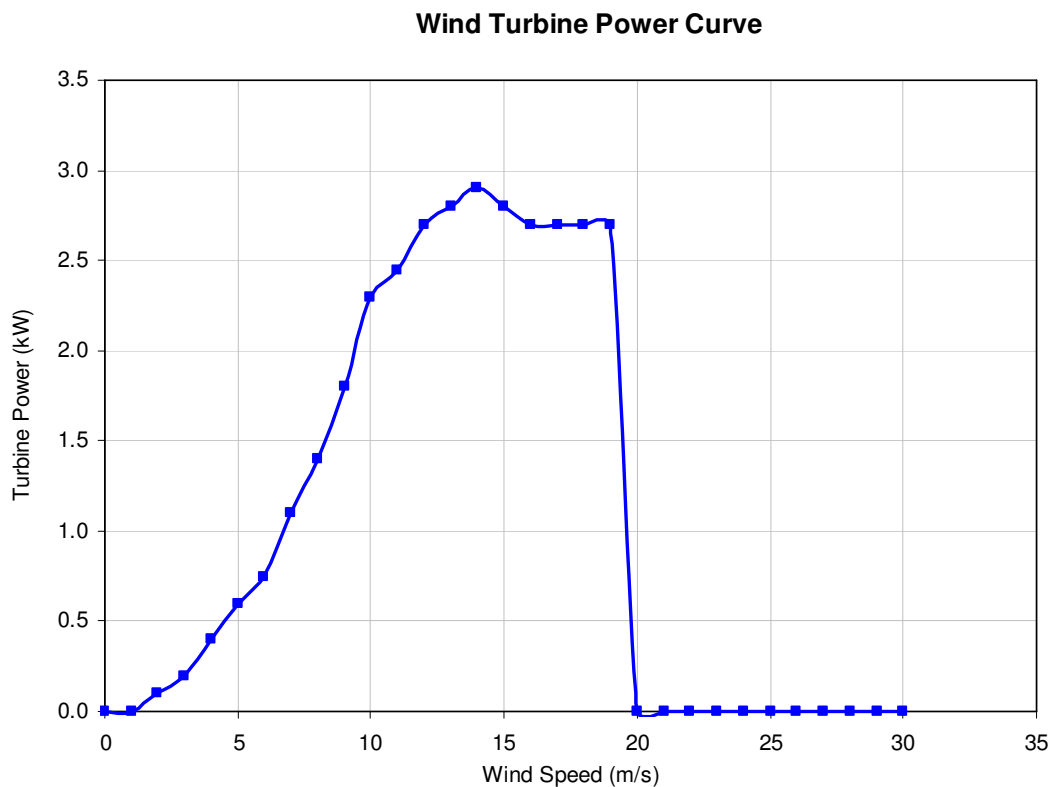


Figure 4 - Wind Turbine Power Curve

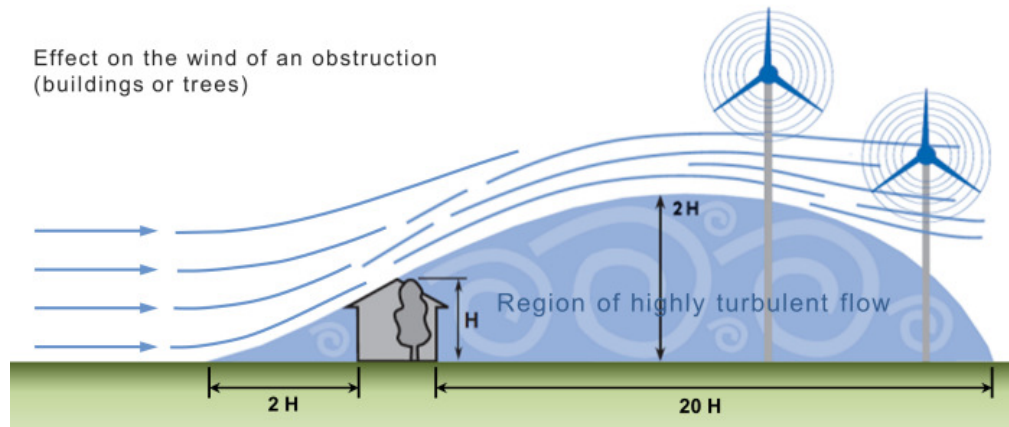


Figure 5 - Effect of Obstructions on Wind Turbines

The site does not have sufficient space for mounting of wind turbines. With the proposed density of buildings, the CO₂ emission reduction could be further lessened if turbulent air flow is experienced. The technology has therefore been discounted.

Wind Turbine Calculation Summary	
Rotor diameter	4.5 m
Capacity	10 kW
Energy Output per year	9,555 kWh
CO ₂ Reduction per year	1,327 kgCO ₂
CO ₂ Savings	1.5%
System Life Cycle Cost	£52,603
Smart Export Guarantee	Variable
Simple Payback	N/A

Table 4 - Wind Turbine Calculation Summary

A 10 kW turbine would have a rotor diameter of 4.5m. It is calculated that this has a limited effect on the buildings CO₂ emissions and payback period of is greater than the life span of the turbine. There is also an issue of locating the turbine in a safe accessible location. Due to low carbon saving and lack of space on site this technology will not be reviewed further.

The smart export guarantee is available for this technology which pays for any electricity exported to the national grid. The price varies depending on which supplier is used, therefore it is important to shop around for the best price. As the electrical load of the building is significantly higher than the wind turbine output, the system is unlikely to generate any income from this grant due to no electrical load being exported to the Nation Grid.

4.2 Solar Water Heating Systems

Solar water heating systems use the energy from the sun to heat water, most commonly in the UK for hot water needs. The systems use a heat collector, generally mounted on the roof or a south facing façade in which a fluid is heated by the sun.

This fluid is used to heat up water that is stored in either a separate hot water cylinder or more commonly a twin coil hot water cylinder with the second coil providing top up to heating from a conventional boiler. Ideally the collectors should be mounted in a south-facing location, although south-east/south-west will also function successfully. The panels can be bolted onto the roof or walls or integrated into the roof.

There are two standard types of collectors used - flat plate collectors and evacuated tube collectors. The flat plate collector is the predominant type used in solar domestic hot water systems, as they tend to have a lower cost for each unit of energy saved. Evacuated tube collectors are generally more expensive due to a more complex manufacturing process (to achieve the vacuum) but manufacturers generally claim better winter performance.

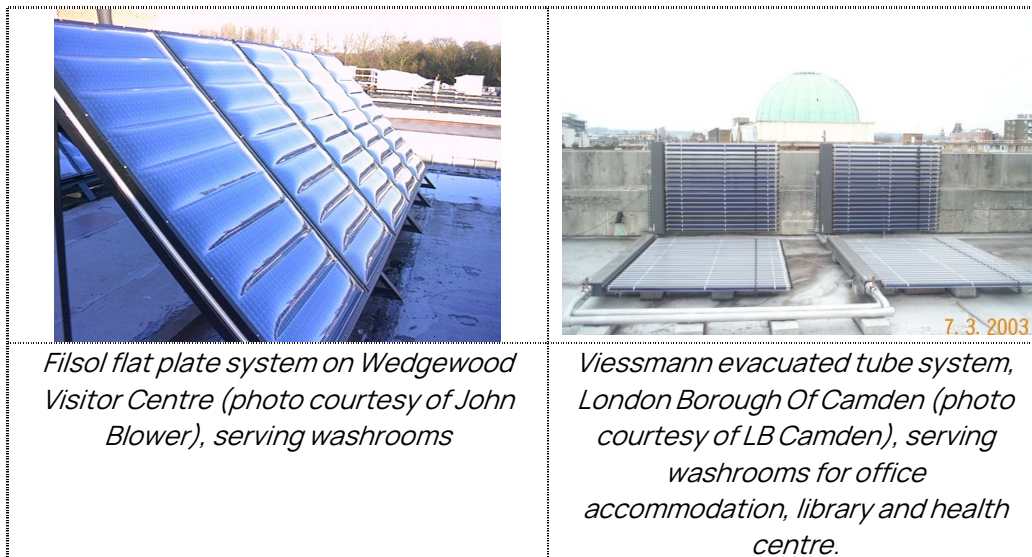


Figure 6 - Typical Solar Thermal Collectors

Solar Thermal Energy Calculation Summary	
Collector type	Flat Plate
System Area	60 m ²
System Life Cycle Cost	£112,183
Energy Output	16,514 kWh/annum
CO ₂ Savings	3,468 kgCO ₂
Reduction in buildings CO ₂ emissions	4 %
Payback	N/A

Table 5 - Solar Thermal Energy Calculation Summary

While this technology does provide some energy savings, they are lower when compared with the savings other technologies can achieve. As this is the case it is proposed that solar thermal collectors are not used on this project.

4.3 Biomass

Biomass is normally considered a carbon neutral fuel, as the carbon dioxide emitted during burning has been (relatively) recently absorbed from the atmosphere by photosynthesis and no fossil fuel is involved. The wood is normally seen as a by-product of other industries and the small quantity of energy for drying, sawing, pelleting and delivery are discounted. Biomass from coppicing is likely to have some external energy inputs, for fertiliser, cutting, drying etc. and these may need to be considered in the future.

Wood from forests, urban tree pruning, farmed coppices or farm and factory waste can be burnt directly to provide heat in buildings, although nowadays most of these wood sources are commercially available in the form of wood chips or pellets, which makes transport and handling on site easier.

Modern systems can be fed automatically by screw drives from fuel hoppers. This typically involves daily addition of bagged fuel to the hopper, although this process can also be automated with use of augers, conveyors or walking floors. Electric firing and automatic de-ashing are also available and systems are designed to burn smokeless to comply with the Clean Air Act.

The most common application of biomass heating is as one or more boilers in a sequenced (multi-boiler) installation where there is a communal i.e. block or district heating system.

Biomass is not thought to be feasible for this development for a number of reasons including:

- On site access problems for large vehicles delivering wood chip.
- Lack of space for a large fuel storage area.
- It's effect on the local air quality.
- Lack of an adequate supply chain in place currently to provide a regular and cheap biomass supply.

Biomass Calculation Summary	
Heat Pump type	ASHP
System Life Cycle Cost	£293,008
Renewable Energy Output per year	48,340 kWh/annum
CO ₂ Savings per year	8,750 kgCO ₂
Reduction in buildings CO ₂ emissions	10.2 %
Payback	N/A

Table 6 – Biomass Calculation Summary

4.4 Heat Pumps

Heat pumps use the refrigeration cycle to take low grade heat from the air, water or the ground (a renewable resource) and deliver it as higher grade heat to a building.

Heat pumps take in heat at a certain temperature and release it at a higher temperature, using the same thermodynamic process as a chiller.

The technology is very efficient. Depending on the source of fuel, heat pumps can generate higher output than the input. Whilst a heat pump is clearly not a wholly renewable energy source as it requires some form of input, the renewable component is considered as the heat extracted from the air, water or ground, measured as the difference between the heat outputs, less the primary energy input and plus the primary energy losses.

Heat Pumps can produce significant savings on the entire site energy requirements by means of a renewable source.

Although a heat pump is clearly not a wholly renewable energy source as it uses electricity, the renewable component is considered as the heat extracted from the air, water or ground, measured as the difference between the heat outputs, less the primary electrical energy input. The heat pump system generates CO₂ and cost savings as its efficiency is often multiple times of its input energy.

A split system will provide the changing rooms with the heating and cooling requirements. They will also be used in the Gym AHU using a multi stage coil to provide heating and cooling.

The renewable contribution made by the heating element of the split system in the building will be 0.4% CO₂ reduction.

Air Source Heat Pump Calculation Summary	
Heat Pump type	ASHP
System Life Cycle Cost	£229,089
Renewable Energy Output per year	1,533 kWh/annum
CO ₂ Savings per year	322 kgCO ₂
Reduction in buildings CO ₂ emissions	0.4 %
Payback	N/A

Table 7 – Air Source Heat Pump Calculation Summary

4.5 Photovoltaics

Photovoltaic (PV) systems convert energy from the sun into electricity through semi-conductor cells. Systems consist of semi-conductor cells connected together and mounted into modules. Modules are connected to an inverter to turn their direct current (DC) into alternating current (AC), which is usable in buildings. PV can supply electricity either to the buildings they are attached to, or when the building demand is insufficient, electricity can be exported to the electricity grid.

For PV to work effectively it should ideally face south and at an incline of 30° to the horizontal, although orientations within 45° of south are acceptable. It is essential that the system is unshaded, as even a small shadow may significantly reduce output. On average UK conditions, a 1 kWp PV system can generate between 700-900kWh annually.

PVs are available in a number of forms including monocrystalline, polycrystalline, amorphous silicon (thin film) panels that are mounted on or integrated into the roof or facades of buildings. The table below shows the efficiency values for all the various forms, which is useful for comparing the various PV technologies currently available.

Type	Thin Film	Polycrystalline	Monocrystalline
Appearance			
Description	A thin-film panel is comprised of a thin layer of silicone laid on a straight surface	Solar panels made of polycrystalline cells. The silicon is not grown as a single cell but as a block of crystals. These blocks are then cut into wafers to produce individual solar cells.	These panels are manufactured from very pure silicon. A crystal of this type of silicon is grown in a complex process to produce a long rod. The rod is then cut into wafers to make the solar cells.
Efficiency	7%-12%	10%-18%	14%-22%
Efficiency in overcast conditions	Excellent	Good	Good

Table 8 - PV Types

PV Panel Calculation Summary	
Collector type	Monocrystalline
PV Panel efficiency	22%
System Area	450 m ²
Total Capacity	98 kWp
System Life Cycle Cost	£-677,915
Energy Output per year	126,099 kWh/annum
CO ₂ Savings per year	18,368 kgCO ₂
Reduction in buildings CO ₂ emissions	22%
Payback	8 Years
Smart Export Guarantee	Variable

Table 9 – PV Panel Calculation Summary

A square metre array could be located on this site at roof level, this will save 18 tonnes of CO₂ per year which is roughly 22% saving of the total carbon produced. The PV array does provide a high enough carbon saving within a realistic payback period.

The smart export guarantee is available for this technology which pays for any electricity exported to the national grid. The price varies depending on which supplier is used, therefore it is important to shop around for the best price. As the electrical load of the building is significantly higher than the PV arrays output, the system is unlikely to generate any income from this grant due to no electrical load being exported to the local DNO.

A number of battery storage options have been considered. When reviewing the various options, it became very clear that the building's electricity usage is significantly higher than what can be produced by the PV array. Therefore, it did not seem practical or economically feasible to provide a store system that would not be utilised and as such this technology is not being included in this project.

4.6 Summary of Renewable Savings

The tables below outlines the CO₂ savings achieved through applying the renewable technologies measures mentioned in the above section.

Commercial Energy Calc											
	Part L2a							Non Part L	Total Regulated site energy Consumption kWh/m²	Total Regulated Site CO ₂ (tonnes per annum)	Regulated Non-Domestic Carbon Dioxide Saving
	Energy Input kWh/m²					Total Regulated Site Demand kWh/m²	Renewables kWh.m²	Unregulated Energy Consumption kWh/m²			
	Space Heating	Cooling	Auxiliary	Lighting	Hot Water						
Baseline	21	2	23	13	93	152		66	152	85	
Be Lean	24	2	36	11	96	168		66	168	92	-8.7%
Be Green	24	2	36	11	96	168	43	66	124	74	12.8%
Total Savings										11	12.8%

Table 10 – Renewable Technology Summary For The New Leisure Club Extension

The Be Lean is showing a negative reduction even with the better than building regulation u-values and system efficiencies. This is due to the type of building and the systems that are utilised. To ensure the correct humidity and temperatures within the pool hall and gym an all air system is utilised. This is causing a higher aux energy in the actual model compared with the baseline.

The table above shows that the new leisure club achieves a total CO₂ reduction of 12.8% against the notional building.

5.0 **WATER EFFICIENCY**

With the onset of climate change and increasing water extraction from rivers and underground supplies the UK's water resources are coming under increasing pressure. This could lead to environmental damage and degradation. Therefore, it is vitally important that the water efficiency of the installed appliances and irrigation systems provide the best efficiency levels possible. To achieve this, the following strategy must be implemented;

- Assess the current market for water efficient fittings and engage the design team, suppliers and contractors to pursue the most appropriate solutions.
- Specify performance and flow rates, rather than percentage reductions. This provides greater clarity to the contractor throughout design and procurement and reduces the ambiguity of targets.
- There is a practical limit to water efficiency; the building must reduce consumption as far as possible without compromising performance or placing onerous maintenance burdens on facility managers.
- Produce a Water Efficiency Plan with clear specifications for water efficient fittings.

The table below has been put together to set water efficiency limits for sanitaryware likely to be used throughout the development.

Water Efficiency Minimum Requirements		
	Flow Rate	Fitting
Urinals	1l/flush	Low flush urinal with individual PIR controls
Toilets	3l/flush	Cistern valve flush with spring mechanism or delay valve siphon flush mechanism
Wash Hand Basin Taps	4l/m	Sensor control with aerated flow
Sink Taps	5l/m	Aerated flow
Showers	7.5l/m	Push controls with aerated flow

Table 11 – Water Efficiency Minimum Requirements

Any irrigation system used internally or externally must be designed to use the least amount of water possible. This system must include the following features;

- Drip feeders
- Water zones based on plant type
- Automatic timers
- Soil moisture sensors linked to automatic controller

6.0 **CONCLUSION**

The client and design team are fully committed to delivering the carbon savings outlined in the energy strategy for the proposed development. This commitment reflects a shared objective to design and deliver a building that exceeds current regulatory standards and aligns with long term sustainability goals.

Following a comprehensive assessment of available energy reduction strategies, it has been determined that the integration of the energy efficiency measures outlined in this report will result in significant reductions in overall energy consumption. These measures include enhancements to the building fabric and the specification of high efficiency mechanical and electrical systems, all of which work collectively to reduce energy demand at source.

A key feature of the proposed energy strategy is the installation of a photovoltaic (PV) array on the roof of the new leisure club extension. This renewable energy system is expected to contribute approximately 22% of the building's regulated carbon emissions savings, further supporting the development's low-carbon agenda.

When combined, these passive and active design measures will deliver an improvement in regulated energy performance compared to the baseline requirements of Part L of the 2021 Building Regulations. This represents a substantial improvement and demonstrates a clear commitment to environmental performance beyond statutory minimums.

As a result, the development is projected to achieve an annual carbon dioxide (CO₂) saving of approximately 11 tonnes, contributing positively to local and national carbon reduction targets.

A detailed summary of the projected energy savings and associated benefits is provided in the table below.

	National Model Kg/m ²	Actual Model Kg/m ²	Total CO ₂ Savings	Tonnes CO ₂ savings per annum
New Leisure Club Extension	27.2	26.1	12.8%	11

Table 12 - Summary of CO₂ Reduction In the New Leisure Club Extension

APPENDICES

Appendix 1 – Be Lean BRUKL

Project name

DLL Reading - Be Lean**As designed**

Date: Wed Mar 11 16:03:00 2026

Administrative information

Building Details

Address:

Certifier details

Name: H&K

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.30

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.30

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

Foundation area [m²]: 868.73The CO₂ emission and primary energy rates of the building must not exceed the targets

The building does not comply with England Building Regulations Part L 2021

Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	27.24
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	31.62
Target primary energy rate (TPER), kWh _{PE} /m ² .annum	164.04
Building primary energy rate (BPER), kWh _{PE} /m ² .annum	206.24
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	0.2	0.2	GF000001:Surf[2]
Floors	0.18	0.16	0.16	GF000001:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.15	0.15	GF000001:Surf[1]
Windows** and roof windows	1.6	1.43	1.43	GF000006:Surf[2]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.52	1.52	GF000005:Surf[2]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

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

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

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

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

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

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	NO
Whole building electric power factor achieved by power factor correction	>0.95

1- Split System

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.64	7.6	0	-	0.78
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					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

2- Gas Boilers - LTHW Swimming Pool

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.97	-	0	1.8	0.78
Standard value	0.91	N/A	N/A	1.9^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

3- Gym All Air

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.64	5.38	0	1.8	0.78
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

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

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I		
Standard value		0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
GF - Changing Room		-	1.5	-	-	-	-	-	-	-	-	N/A
GF - Changing Room		-	1.5	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
GF - Changing Room	-	1.5	-	-	-	-	-	-	-	-	N/A

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
GF - Changing Room		140	-	-
GF - Changing Room		140	-	-
GF - Changing Room		140	-	-
GF - Pool Hall		140	-	-
GF - Plantroom		140	-	-
GF - Spa		140	-	-
GF - Spa		140	-	-
GF - Spa		140	-	-
GF - Spa		140	-	-
GF - Spa		140	-	-
GF - Spa		140	-	-
GF - Spa		140	-	-
FF - Plantroom		140	-	-
FF - Toilet		140	-	-
FF - Spa		140	-	-
FF - Spa		140	-	-
FF - Spa		140	-	-
FF - Spa		140	-	-
FF - Spa		140	-	-
FF - Gym		140	-	-
FF - Gym		140	-	-
FF - Corridor		140	-	-

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?
GF - Changing Room	N/A	N/A
GF - Changing Room	N/A	N/A
GF - Changing Room	N/A	N/A
GF - Pool Hall	NO (-63.8%)	NO
GF - Spa	N/A	N/A
GF - Spa	N/A	N/A
GF - Spa	N/A	N/A
GF - Spa	N/A	N/A
GF - Spa	N/A	N/A
GF - Spa	N/A	N/A
GF - Spa	N/A	N/A
GF - Spa	N/A	N/A
FF - Toilet	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
FF - Spa	N/A	N/A
FF - Spa	N/A	N/A
FF - Spa	N/A	N/A
FF - Spa	N/A	N/A
FF - Spa	N/A	N/A
FF - Gym	NO (-58.1%)	NO
FF - Gym	N/A	N/A
FF - Corridor	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?	NO
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]	1873.5	1873.5
External area [m ²]	2949.3	2949.3
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	3	3
Average conductance [W/K]	677.19	900.38
Average U-value [W/m ² K]	0.23	0.31
Alpha value* [%]	25	10

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

Building Use

% Area Building Type

Retail/Financial and Professional Services
 Restaurants and Cafes/Drinking Establishments/Takeaways
 Offices and Workshop Businesses
 General Industrial and Special Industrial Groups
 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

100 General Assembly and Leisure, Night Clubs, and Theatres

Others: Passenger Terminals
 Others: Emergency Services
 Others: Miscellaneous 24hr Activities
 Others: Car Parks 24 hrs
 Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	24.11	21.29
Cooling	1.73	2.33
Auxiliary	36.02	22.99
Lighting	10.61	13.01
Hot water	95.55	92.79
Equipment*	66	66
TOTAL**	168.03	152.41

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	14.32
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>0</i>	<i>14.32</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	105.6	111.98
Primary energy [kWh _{PE} /m ²]	206.25	164.04
Total emissions [kg/m ²]	31.62	27.24

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Central heating using air distribution, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	171.8	0	50.6	0	22.9	0.94	0	0.97	0
	Notional	145.4	0	44.6	0	22.3	0.91	0	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	44.7	41.2	5.1	2.1	9.5	2.46	5.4	2.64	7.6
	Notional	46.6	89.3	4.7	5.4	2.1	2.78	4.63	----	----
[ST] Constant volume system (variable fresh air rate), [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	0	45.5	0	4.3	66.9	2.46	2.95	2.64	5.38
	Notional	0.6	82	0.1	4.9	34.4	2.78	4.63	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

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

Appendix 2 – Be Green BRUKL

Project name

DLL Reading - Be Green**As designed**

Date: Wed Mar 11 16:26:30 2026

Administrative information

Building Details

Address:

Certifier details

Name: H&K

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.30

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.30

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

Foundation area [m²]: 868.73The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	27.24
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	26.12
Target primary energy rate (TPER), kWh _{PE} /m ² .annum	164.04
Building primary energy rate (BPER), kWh _{PE} /m ² .annum	142.5
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	0.2	0.2	GF000001:Surf[2]
Floors	0.18	0.16	0.16	GF000001:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.15	0.15	GF000001:Surf[1]
Windows** and roof windows	1.6	1.43	1.43	GF000006:Surf[2]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.52	1.52	GF000005:Surf[2]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

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

* 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
m ³ /(h.m ²) at 50 Pa	8	3

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	NO
Whole building electric power factor achieved by power factor correction	>0.95

1- Split System

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.44	7.6	0	-	0.78
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					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

2- Gas Boilers - LTHW Swimming Pool

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.97	-	0	1.8	0.78
Standard value	0.91	N/A	N/A	1.9^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

3- Gym All Air

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.44	5.38	0	1.8	0.78
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

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

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1			
GF - Changing Room	-	1.5	-	-	-	-	-	-	-	-	-	N/A
GF - Changing Room	-	1.5	-	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
GF - Changing Room	-	1.5	-	-	-	-	-	-	-	-	N/A

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	
GF - Changing Room	140	-	-	
GF - Changing Room	140	-	-	
GF - Changing Room	140	-	-	
GF - Pool Hall	140	-	-	
GF - Plantroom	140	-	-	
GF - Spa	140	-	-	
GF - Spa	140	-	-	
GF - Spa	140	-	-	
GF - Spa	140	-	-	
GF - Spa	140	-	-	
GF - Spa	140	-	-	
GF - Spa	140	-	-	
FF - Plantroom	140	-	-	
FF - Toilet	140	-	-	
FF - Spa	140	-	-	
FF - Spa	140	-	-	
FF - Spa	140	-	-	
FF - Spa	140	-	-	
FF - Spa	140	-	-	
FF - Gym	140	-	-	
FF - Gym	140	-	-	
FF - Corridor	140	-	-	

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?
GF - Changing Room	N/A	N/A
GF - Changing Room	N/A	N/A
GF - Changing Room	N/A	N/A
GF - Pool Hall	NO (-63.8%)	NO
GF - Spa	N/A	N/A
GF - Spa	N/A	N/A
GF - Spa	N/A	N/A
GF - Spa	N/A	N/A
GF - Spa	N/A	N/A
GF - Spa	N/A	N/A
GF - Spa	N/A	N/A
GF - Spa	N/A	N/A
FF - Toilet	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
FF - Spa	N/A	N/A
FF - Spa	N/A	N/A
FF - Spa	N/A	N/A
FF - Spa	N/A	N/A
FF - Spa	N/A	N/A
FF - Gym	NO (-58.1%)	NO
FF - Gym	N/A	N/A
FF - Corridor	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?	NO
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]	1873.5	1873.5
External area [m ²]	2949.3	2949.3
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	3	3
Average conductance [W/K]	677.19	900.38
Average U-value [W/m ² K]	0.23	0.31
Alpha value* [%]	25	10

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

Building Use

% Area Building Type

Retail/Financial and Professional Services
 Restaurants and Cafes/Drinking Establishments/Takeaways
 Offices and Workshop Businesses
 General Industrial and Special Industrial Groups
 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

100 General Assembly and Leisure, Night Clubs, and Theatres

Others: Passenger Terminals
 Others: Emergency Services
 Others: Miscellaneous 24hr Activities
 Others: Car Parks 24 hrs
 Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	23.87	21.29
Cooling	1.73	2.33
Auxiliary	36.02	22.99
Lighting	10.61	13.01
Hot water	95.55	92.79
Equipment*	66	66
TOTAL**	167.79	152.41

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	43.36	14.32
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>43.36</i>	<i>14.32</i>

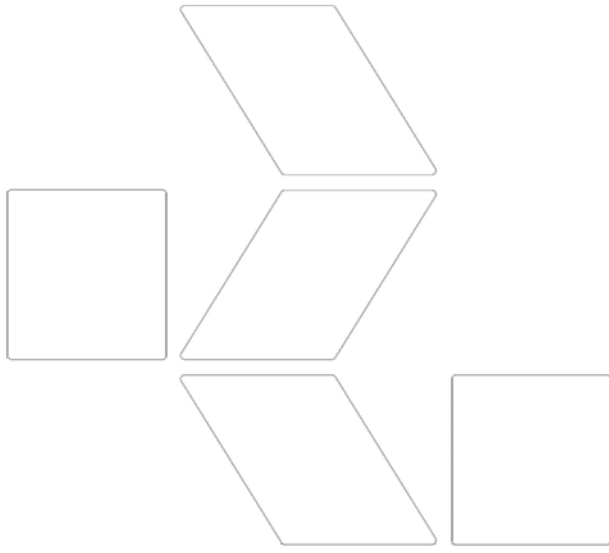
Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	105.6	111.98
Primary energy [kWh _{PE} /m ²]	142.5	164.04
Total emissions [kg/m ²]	26.12	27.24

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Central heating using air distribution, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
Actual	171.8	0	50.6	0	22.9	0.94	0	0.97	0	
Notional	145.4	0	44.6	0	22.3	0.91	0	----	----	
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
Actual	44.7	41.2	3	2.1	9.5	4.14	5.4	4.44	7.6	
Notional	46.6	89.3	4.7	5.4	2.1	2.78	4.63	----	----	
[ST] Constant volume system (variable fresh air rate), [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
Actual	0	45.5	0	4.3	66.9	4.14	2.95	4.44	5.38	
Notional	0.6	82	0.1	4.9	34.4	2.78	4.63	----	----	
[ST] No Heating or Cooling										
Actual	0	0	0	0	0	0	0	0	0	
Notional	0	0	0	0	0	0	0	----	----	

Key to terms

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



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