Energy Assessment

Hampton Wick Royal Cricket Club

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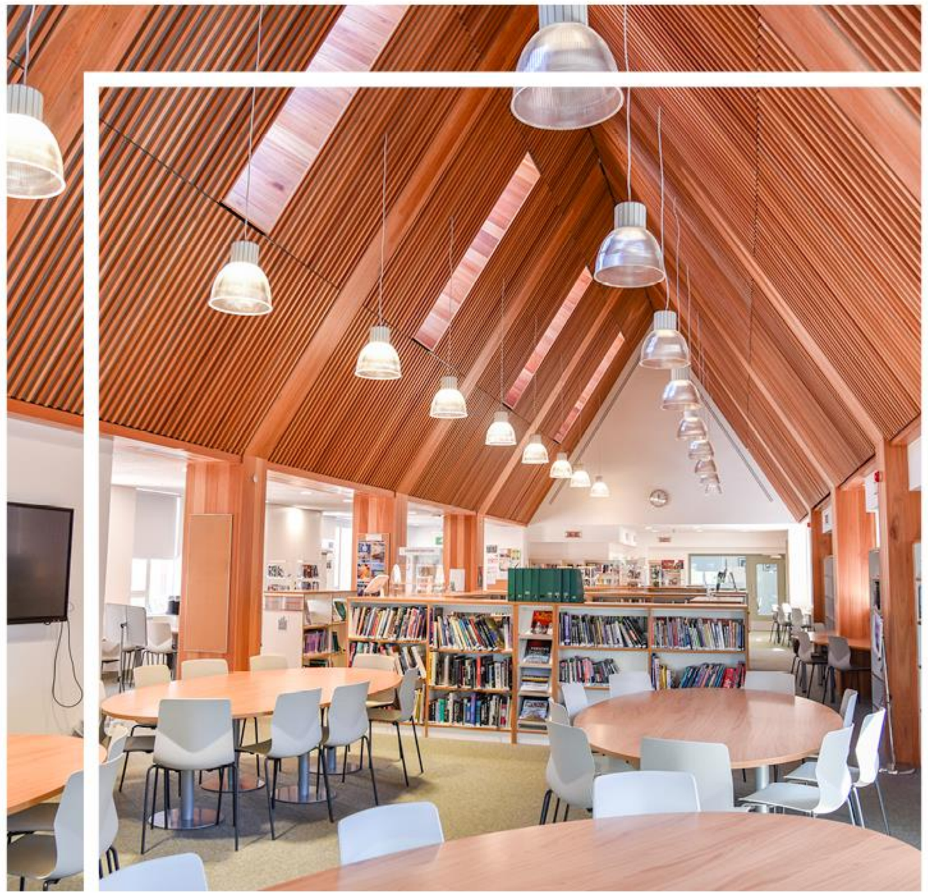
24 May 2024

XX-HML-XX-XX-RP-V-800001

Issue P01







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1. Executive Summary

Hilson Moran was appointed by Hampton Court Royal Cricket Club (the Applicant) to provide an Energy Assessment for the proposed development at Hampton Wick Royal Cricket Ground to support the planning application. The proposed development consists of a 2-storey pavilion in the heart of Bushy Park, designed to blend seamlessly with the natural surroundings and maintain the park's historic charm. The structure aims to meet the operational needs of the club by providing modern facilities, while also incorporating sustainable building practices and materials to minimise environmental impact. This thoughtful integration of functionality, sustainability, and aesthetics will ensure the pavilion enhances both the user experience and the visual appeal of Bushy Park and the members of the Hampton Wick Royal Cricket Club community.

This Energy Assessment has been prepared in accordance with the guidance stipulated in the *'Greater London Authority guidance on preparing energy assessment as part of planning applications (June 2022)'* to fully comply with London Plan Policy SI 2.

Energy and CO_2 emissions performance have been modelled using TAS 9.5.6 DTM software, against current Building regulation methodology and using Part L: 2021 (with 2023 amendments) requirements as guidance due to the size of the pavilion.

Table 1 Carbon Factors

Fuel type	Carbon factors (SAP10)
Electricity	0.136

The methodology of this Energy Assessment robustly follows the London Plan's Energy Hierarchy, as follows:

- **Be Lean:** Incorporating a wide range of passive and energy efficiency measures into the design, including good levels of thermal insulation, high levels of building air tightness, reducing the reliance on artificial lighting by maxing daylight as well as high efficiency building services that exceed Part L: 2021 requirements. It demonstrates that focusing solely on U-values is not sufficient. A comprehensive budget is necessary to integrate these advanced measures, highlighting the economic rationale for investing more to achieve superior energy performance and sustainability.
- **Be Clean**: There is currently no existing Heat Network within 7 miles of the Club and the proposed Heat Network is located on the other side of the river in the Borough of Kingston Upon Thames and does not extend across the river, making a connection to the wider network unlikely. For the pavilion, which is based on a building area of under 500 square meters, the use of an efficient heat pump for heating, cooling (as a precautionary measure in centre spaces), and hot water, along with efficient lighting, is proposed. This approach ensures the development remains sustainable and energy-efficient despite the absence of a broader heat network connection.
- **Be Green**: A detailed assessment of renewable energy opportunities and viability has been undertaken, determining that roof-mounted photovoltaic (PV) arrays, which provide renewable electricity, are a viable technology for integration into the scheme. The proposed array will serve the pavilion's needs as identified in the assessments.
- **Be Seen**: To ensure optimal energy performance, a simple Building Management System (BMS) is being considered. This system will help the building run as efficiently as possible while remaining user-friendly. Energy performance will be monitored, verified, and reported through the mayor's post-construction monitoring platform, providing transparency and accountability.

1.1. Energy Efficiency measures

Key energy efficiency measures have considered and included in the rebuild of Hampton Wick Royal Cricket Club:

- Building Fabric
- Lighting
- Heating and Cooling
- Solar PV System
- Appliances and Equipment
- Ventilation
- Building Management System (BMS)
- Maintenance

By integrating these energy efficiency measures, the cricket pavilion could achieve significant energy savings, reduce its carbon footprint, and provide a comfortable environment for players and visitors. For further detail refer to Appendix 4.

1.2. Results

The following table shows the 'be lean' and 'Be Green' results for the pavilion:

Table 2 Building emissions performance under 'Be Clean' and 'Be Green' measures

	Target CO2 Emissions Rate (TER) (kgCO_2/annum)	Building CO2 Emission Rate (kgCO_2/annum)	Baseline improvement (%) 'Be Clean and Be Green'
Be lean	6.07	6.46	-6.43%
Be green	6.07	3.94	**35.10%**

Note: We have maximised efficiency levels as far as economically feasible, and the results show we need PV for the building to achieve compliance with local plan and part L.

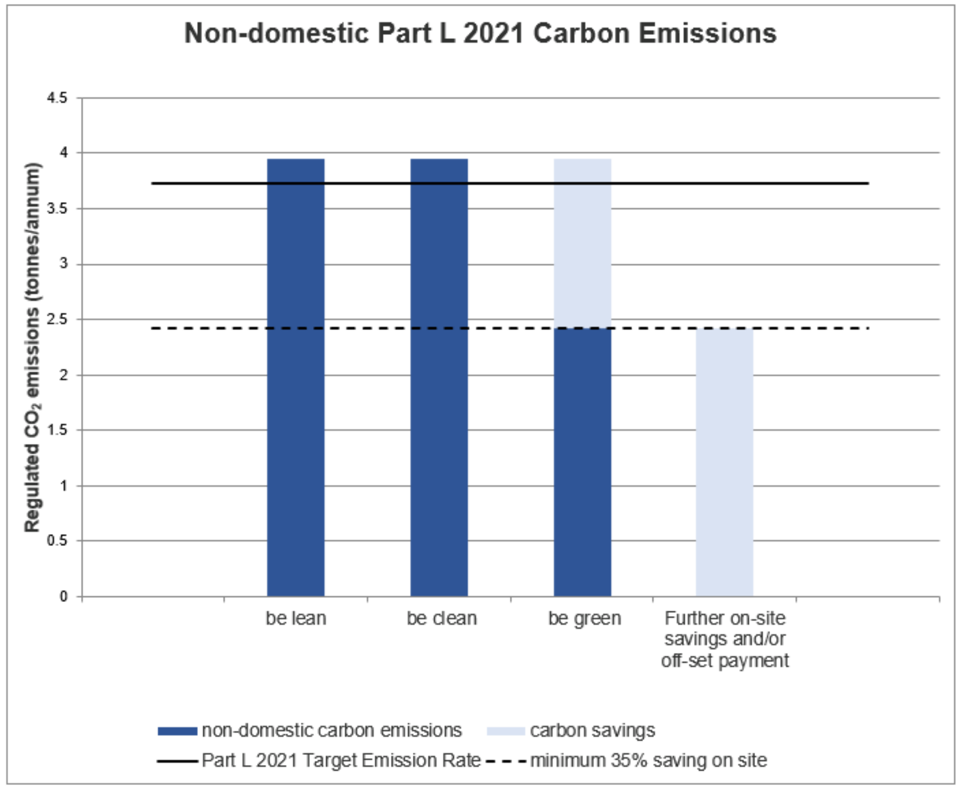

Figure 1 The non domestic energy hierarchy of the proposed development

2. Introduction

Hampton Wick Royal Cricket Club is located in Bushy Park, KT1 4AZ. The proposal is the construction of a new pavilion for Hampton Wick Royal CC following a catastrophic fire which destroyed the previous building. The building consists of a 2-storey pavilion with a gross internal floor area of 479 m^2 and a total floor area of 531m^2.

Figure 2 Site location

2.1. Scope

The proposed development has a gross internal floor area of 479 m^2 and since it is <1000m2, it is not considered a 'major development', nor referable to the GLA however we have included the GLA spreadsheet as a reference in the appendix. The Richmond Local plan encourages minor development to reduce their energy. This report provides a summary of how the development is aligning with these targets.

This Energy Strategy will focus on relevant policies of the London Plan, including Policy SI 2 Minimising Greenhouse gas emissions; Policy SI 3 Energy Infrastructure and Policy SI 4 Managing Heat Risk will provide a robust design route with which to ensure compliance. The report considers other re London Environment Strategy 2018 that sets out the environmental challenge and includes elements on climate change mitigation and energy.

The London Borough of Richmond Upon Thames Policies within the Draft Local Plan and Climate Emergency Strategy (2019-2024) are also addressed as well as Part L 2021.

This document identifies drivers relating to an energy efficient design over and above minimum compliance of the whole development with current Building Regulations and other appropriate national and regional policies.

The project is targeting a BREEAM v6.1 'Good' rating. For this reason, a minimum EPR_{NC} of 0.4 has been targeted for the non-residential component (commercial floors and common areas in the whole building).

The London Plan's and The London Borough of Richmond Upon Thames CO_2 reduction targets for new residential and non-residential building applications zero carbon (with at least 35% on-site with respect to Approved Document Part L 2021 Volume 1 & 2).

2.2. Methodology

A comprehensive energy and carbon dioxide (CO_2) emissions assessment has been carried out for the development in order to achieve a higher level of energy and CO_2 emissions performance than that required by the 2021 Building Regulations. This analysis has included:

- Assessment of the scheme under the Building Regulations Approved Document Part L: 'Conservation of Fuel and Power in Buildings other than Dwellings' 2021 edition incorporating 2023 amendments calculation of the Building CO^2 Emissions Rate (BER) through EDSL TAS v9.5.6 accredited software. The non-domestic Part L 2021 BRUKL reports for each tier of the energy hierarchy have been provided in Appendix 2B.
- A hierarchal design approach to develop an Energy Strategy in line with industry best practice and Policy SI 2 Minimising Greenhouse gases of the London Plan (Figure 4).
- A review of how the cooling hierarchy has been incorporated into the design.
- A summary of energy efficiency measures to reduce residential uses by 10 per cent and 15 per cent for non-residential below those of a development with a compliant Part L 2021 of the Building Regulations

- The report has been aligned with the other supporting documents such as 'be seen'. A summary of how the development is targeting 'Be seen' with the aim to monitor, verify and report on energy performance.

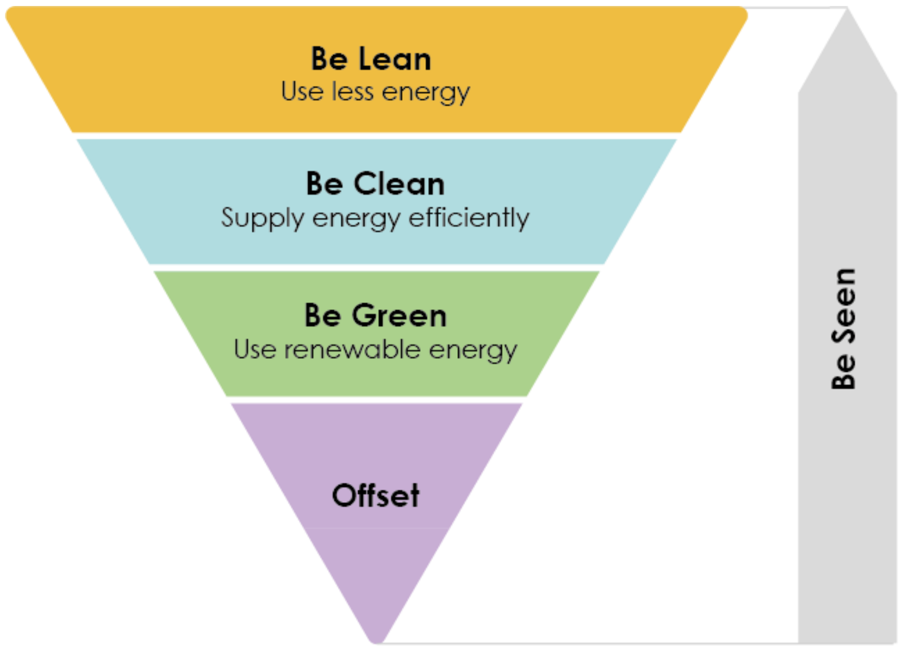

Figure 3 The Energy Hierarchy design approach

2.3. Baseline

The baseline for the pavilion is based on the Part L 2021 Building Regulations Compliant Development. This is based at the be lean stage on as significantly improved u values did not improve the buildings performance a considerable amount when modelling in TAS 9.5.6 DTM software.

2.4. References

The following reports should be reviewed alongside the Energy Strategy, and where appropriate have been referenced in this report. The report is as below:

Table 3 Authors

Report Name	Author	Version
BREEAM pre-assessment report (or equivalent)	Alessandro Cirillo	1

2.5. Report Author

This report has been prepared by Molly Behling who has been assisted by energy specialist Fiona Batha within Hilson Moran who has over 9 years of experience in preparing energy strategies. The author has acquired substantial experience in providing passive design and energy efficiency advice to project teams to find cost effective ways of adding value to new developments and achieving challenging low carbon targets. She is not professionally connected to a single low or zero carbon technology manufacture.

3. Policy context

The following tables summarises applicable national and local environmental sustainability policy and the status of the Proposed Development relative to each.

3.1. National Policy		Addressed
National Planning Policy Framework MHCLG, December 2023	Sets out the Government's Planning Policies for England and how these are expected to be applied, informing Local Councils and communities with regards to local plans and requirements. The document provides a revised and condensed approach to national planning and sustainability that includes economic, social and environmental roles.	Yes
Approved Document L, Conservation of fuel and power, Volume 2: Buildings other than dwellings DCLG, 2021 edition	Sets out elemental minimum energy and CO_2 emissions performance standards for all elements of the built environment along with assessment methodologies necessary to confirm compliance. Sets out amendments to the current Part L documents, with regards to the requirements of the provision of an Energy Strategy document, to include the viability assessment of all Low and Zero Carbon technologies. The 2021 edition of the Building Regulations Approved Document Part L came into effect on **15th June 2022** for use in England.	Yes

3.2. Regional and Local Policy		Addressed
The London Plan Mayor of London, March 2021	The London Plan (March 2021) sets out the London Plan (2016) as the spatial development strategy for London. The London Plan (March 2021) provides a framework to address the key planning issued facing London, allowing boroughs to concentrate on those issues with a distinctly local dimension.	Yes
London Environment Strategy Mayor of London, 2018	This London Environment Strategy (LES) sets out an ambitious vision for improving London's environment for the benefit of all Londoners. The strategy provides a holistic plan for tackling the city's environmental challenges, including air quality, green infrastructure, climate change mitigation and energy, waste, adapting to climate change, ambient noise and low carbon economy.	Yes
Energy Assessment Guidance Mayor of London, 2022	Provides detail on how to prepare energy assessments to accompany planning applications as set out in the London Plan. The purpose of an energy assessment is to demonstrate that climate change mitigation measures comply with London Plan energy policies, including the energy hierarchy.	Yes
Be Seen Energy Monitoring Guidance Mayor of London, September 2021	Guidance on the implementation of the London Plan post construction energy monitoring policy. To truly achieve net zero-carbon buildings we need to have a better understanding of their actual operational energy performance and work towards bridging the 'performance gap' between design theory and measured reality. In order to do so, the London Plan introduces a fourth stage to the energy hierarchy; the 'be seen' stage, which requires monitoring and reporting of the actual operational energy performance of major developments for at least five years.	N/A
Richmond Upon Thames Draft Local Plan	Richmond Upon Thames Local plan is currently in development. Key factors of the plan include climate change and infrastructure: • Policy LP 22 addresses the reduction of carbon emissions (35%) which isn't required as the building GIA is under 500m² but is used as guidance for HWRCC. • Policy LP 23 is related to the BREEAM (Building Research Establishment Environmental Assessment Method) requirements. It mandates that new non-residential buildings achieve a BREEAM rating of 'Excellent' which isn't required for HWRCC as the GIA is under 500m² but is used as guidance.	Yes

London Borough of Richmond Upon Thames – Climate Emergency Strategy (2019-2024)	This document is a summary of the London Borough of Richmond Upon Thames sustainability plan and impacts of climate change on the borough, this includes: • Waste • Air Quality • Green infrastructure and Water The policies outlined within the Climate Emergency Strategy of the London Borough of Richmond Upon Thames (2019-2024) aren't explicitly numbered in the original query.	Yes

Certification		Status
BREEAM New Construction BREEAM v6.1	The Building Research Establishment Environmental Assessment Method (BREEAM) is a widely used environmental assessment methodology for non-domestic buildings, covering a broad range of sustainability categories. This includes Management, Health and Wellbeing, Energy, Transport, Water, Materials, Waste, Land Use & Ecology and Pollution. The methodology is used to quantify and reduce the environmental impacts of the built environment by rewarding designs that take positive steps to minimise their environmental effects. Undertaking a BREEAM assessment and integrating the associated design requirements into the scheme helps to set Best Practice sustainability standards across a broad range of building design, construction and operational targets, summarised by a single rating, from 'Pass' to 'Outstanding'.	'Good' Rating is being targeted.
WELL IWBI, October 2014	The WELL Building Standard v2 is a third-party assessment that provides a flexible framework for improving the health and human experience of buildings by design. It covers air, water, light and sound quality, thermal comfort, mind, movement, materials, and nourishment.	Precertification is pursued. Base Building design to support tenant WELL certification

4. Be Lean (Demand reduction)

Within the first stage of the energy hierarchy, it was proposed to incorporate high levels of passive and energy efficient design measures to improve the building overall fabric.

Design recommendations were provided to the project architect and preliminary tests carried out enabling the development of a strategy from an early stage. It was noted that an improvement in the u-values alone did not help to significantly improve the pavilion's performance and the economic decision to invest in 'Be Clean' and 'Be Green' measures allowed for significant improvements.

The image below shows the energy model produced on EDSL TAS version 9.5.6. This model has been utilised as the method of analysis for all of the results within this energy statement

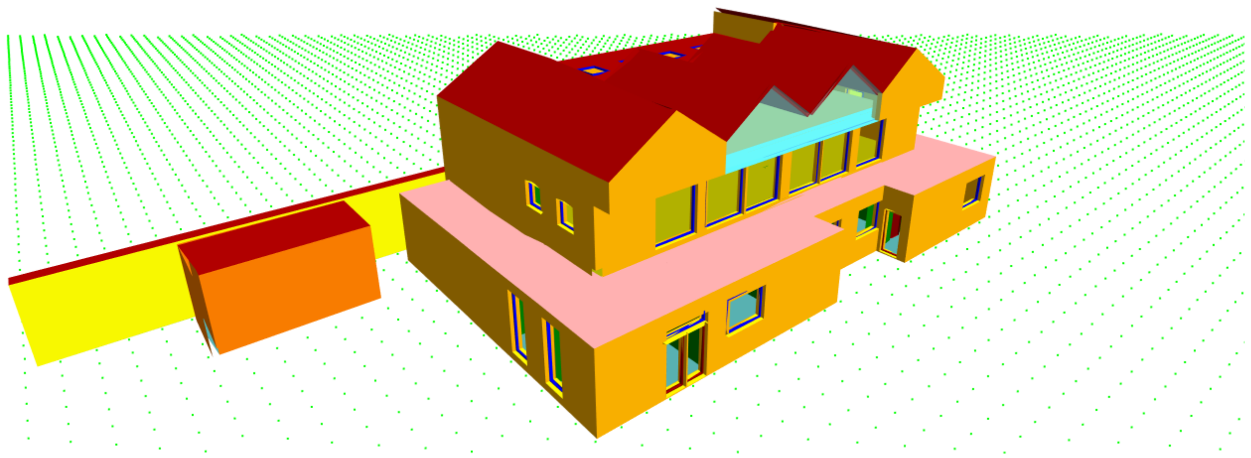

Figure 4 3D Model Image from TAS

The table below summarises some of the viable 'Be lean' measures identified in order to reduce energy demand and as part of the design approach.

Table 4 Be lean' measures summary.

Efficiency measures	Commentary	Scope
		Non-domestic
Site orientation	The site orientation was fixed.	×
Site layout optimization	The buildings layout has been optimised to guarantee enough level of daylight.	✓
Enhanced U-value	Enhanced U-values were considered but didn't propose significant improvements.	×
High performance glass	Slight improvement from the notional can be seen for the glazing.	✓
Glazing percentage of the building*	The glazing percentage of the buildings is 19% and seeks to achieve a balance between overheating/thermal comfort, ingress of daylight and heat losses/gains from the façade.	✓
Air-tightness improvement	Improved levels of air tightness.	✓
Thermal mass	A medium level of internal thermal mass surfaces.	✓
Solar shading	External shading created by balconies.	✓
Natural ventilation	Natural ventilation through openable windows.	✓
Lighting	Energy efficient lighting systems.	✓
Lighting control	Presence detection on lighting controls throughout building.	✓
Mechanical ventilation	Mechanical ventilation only used where it is deemed necessary ie. Changing rooms.	✓
Cooling	Active cooling as a precaution in highly glazed areas ie. Function Area.	✓

**Glazed area to wall area*

4.1. Passive Design

The fabric's thermal and air permeability performance level meets the Part L: 2021 minimum standards and the following tables outline the U-values of the external envelope for the opaque and transparent elements. Additionally, for the glazing, the light transmission has been maximised in order to increase the availability of natural light and reduce the use of artificial lighting. The glazing percentage of the buildings is 19% and seeks to achieve a balance between overheating/thermal comfort, ingress of daylight and heat losses/gains from the façade. The values in the following table highlight the performance against the notional building for Part L.

Table 5 Proposed building envelope thermal properties

Parameter		Part L2:2021 Limiting Value	HWRCC Proposed
U-values	External Wall	0.18 W/m²K	0.18 W/m²K
	Roof	0.11 W/m²K	0.11 W/m²K
	Ground Floor	0.13 W/m²K	0.13 W/m²K

	Doors	1.2 W/m²K	1 W/m²K
Glazing U-Value		1.6 W/m²K	1 W/m²K
Glazing g-value (BS EN 410)		Function Area	0.33
Air Tightness		5 $m^3/h \cdot m^3$@50Pa	3 $m^3/h \cdot m^3$@50Pa

**Solid wall or fully filled cavity with effective sealing at all exposed edges and in line with insulation layers in abutting elements*

External wall refers to any exposed wall or wall to an unheated space

Roof refers to the top roof of the building and any terrace/exposed ceiling

Floor refers to any ground/exposed floor or any floor above an unheated space or space heated in a different pattern.

Table 6 Proposed glazed façade performance properties

Glass Performance	Values for Performance	
	Part L:2021 notional elements W/m²K	Proposed performance
Centre pane U-value, (W/m²K)	1.2 FF 0.7	1.0
Frame U-value, (W/m²K)		1.0
Light transmission	0.8	>0.33
Solar transmittance, (g-value)	0.63	0.28

4.2. Active Design

High efficiency plant and equipment is specified in order to limit the energy consumed to provide the required and best practice indoor environment performance and control. Performance efficiency values were tested and improved in the dynamic thermal model to benchmark the resulting predicted carbon dioxide reduction.

The equipment efficiency measures include high efficiency artificial lighting with the following light power densities and controls:

Table 7 Proposed lighting performance

Use	Power Density (W/m²)	NCM Illuminance (lux)	Auto Presence Detection	Daylight Control	Constance Illuminance Control
Circulation	5	100	*Auto On/Auto Off*	*No Daylight Controls*	*No*
Changing rooms	5	300	*Auto On/Auto Off*	*No Daylight Controls*	*No*
Functional Area	5	200	*Auto On/Auto Off*	*Photocell Control Dimming*	*Yes*
Food and Drink Prep	5	500	*Auto On/Auto Off*	*No Daylight Controls*	*No*
Plant	5	200	*Auto On/Auto Off*	*No Daylight Controls*	*No*
Reception	5	200	*Auto On/Auto Off*	*No Daylight Controls*	*No*
Store	5	100	*Auto On/Auto Off*	*No Daylight Controls*	*No*
WCs	5	200	*Auto On/Auto Off*	*No Daylight Controls*	*No*

The efficiency performance of using predominately natural ventilation has been carefully assessed and selected to exceed Part L: 2021 minimum compliance requirements, as detailed below.

Table 8 Proposed mechanical system efficiencies

Use	Heating	Cooling	DHW	Ventilation
	ASHP	ASHP	ASHP	
Circulation	COP 350(%)	SEER 5	Air-to-water heat pump COP 300(%)	Natural Ventilation
Changing rooms	COP 350(%)	SEER 5	Air-to-water heat pump COP 300(%)	Extract Fans
Functional Area	COP 350(%)	SEER 5	Air-to-water heat pump COP 300(%)	Natural Ventilation
Food and Drink Prep	COP 350(%)	SEER 5	Air-to-water heat pump	Natural Ventilation

			COP 300(%)	
Plant	COP 350(%)	SEER 5	Air-to-water heat pump COP 300(%)	Natural Ventilation
Reception	COP 350(%)	SEER 5	Air-to-water heat pump COP 300(%)	Natural Ventilation
Store	COP 350(%)	SEER 5	Air-to-water heat pump COP 300(%)	Natural Ventilation
WCs	COP 350(%)	SEER 5	Air-to-water heat pump COP 300(%)	Extract Fans

In addition, the following measures will also be adopted:

A **power factor** correction (> 0.95) will be included to improve the electric stability and efficiency of the transmission network.

Smart meters are planned for the development to enable a demand-led response, which makes it possible to save energy by turning off non-essential equipment or running equipment at lower capacities at times of peak demand.

In addition, a **Building User Guide** will be handed over to tenants and will contain recommendations on how to reduce unregulated energy consumption through the procurement of energy efficient equipment.

4.3. Energy Demand

Following the energy efficiency measures, the total energy demand (in MWh/year) for each building use is reported in the table below.

Table 9 Total energy demand Annually

Building use	Energy demand following energy efficiency measures (MWh/year)					
	Space Heating	Hot Water	Lighting	Auxiliary	Cooling	Unregulated electricity	Unregulated gas
Non-residential	13247.1	31635.6	6537.45	6254.55	1162.35	-16.28	0

4.4. Cooling and overheating

The design was developed in line with the GLA's recommended 'Cooling Hierarchy' approach (Policy 5.9) which applies a similar principle to the thorough decision-making process of the 'Energy Hierarchy' applied specifically with the aim of reducing CO_2 emissions from cooling:

Table 10 Cooling hierarchy for the proposed development

Action	Measure
Minimising internal heat generation through energy efficient design	Heat gain from lighting will be minimised through energy efficient lighting design and controls. Daylight dimming along the perimeter of workspace will help reduce the use of artificial lighting. Light transmittance of glazing will be optimised to maximise natural daylight
Reduction of the amount of heat entering the building in summer	Window bays will be shaded by the façade's overhangs. Furthermore, the windows are easier to operate and can be opened more easily, making natural ventilation feasible. Due to the high percentage of windows on the West façade of the design it was determined that a g-value of 0.33 is appropriate for the new windows of the new West façade.
Management of the heat within the building through exposed thermal mass and high ceilings	Although side this in the function area design considerations have been made relating to window placement and shading to help with cooling and cross ventilation in the space.
Passive ventilation	The primarily strategy for the building is passive ventilation and the use of cross ventilation seen on level one.
Mechanical ventilation	An ASHP is proposed to demand control strategy the overall ventilation strategy proposed, with openable windows throughout the perimeter and mechanical ventilation being primarily used in the changing rooms, WC and food prep areas. Mechanical ventilation will be centralised and specified with energy efficient Specific Fan Power.
Active cooling	Cooling is delivered to the building by the efficient air source heat pump with a SEER 5.

Overheating	Overheating strategy is mainly focused on the large upper level function space due to both the glazing percentage and the potential for high occupancy density.

4.4.1. Active cooling

The table below shows how the cooling demand for this non-domestic building. The proposed design reduces the actual cooling demand below the notional building for the overall pavilion where an active cooling is proposed as a precaution.

Table 11 Cooling demand for the proposed development

Building	Cooling demand ($kWh/m^2/yr$)		% Reduction
	Part L2:2021 Notional	Actual	
Pavilion	11.47	1.37	88.08%

4.5. 'Be lean' Results

The following table summarises the results from the application of the 'Be Lean' measures only, without the application of any viable 'Be Clean' and 'Be Green' measures at this stage:

Table 12 Building emissions performance under 'Be Lean' measures only

Use	Target Emission Rate (Tonnes CO_2/annum)	Dwelling/ Building Emission Rate (Tonnes CO_2/annum)	Part L:2021 improvement (%) 'Be Lean' only
Pavilion	6.07	6.46	**-6.43%**

5. Be Clean (Heating Infrastructure)

Opportunities to supply energy efficiently and reduce CO_2 emissions have been investigated. The potential for the proposed development to connect to a district heating system has been reviewed for the scheme.

5.1. Existing and Planned District Heating Networks

The potential for the proposed development to connect to a district heating system has been reviewed for the scheme. The development is located within the centre of Bushy Park and there is no heat load within the vicinity.

5.1.1. London Heat Map

The site is approximately 1150 m from the planned Kingston proposed District Heating Network (as shown below) and at the time of writing, the timescales and capacities for the Kingston Proposed District Heating Network are uncertain and plans for extending closer to the development site are not provided.

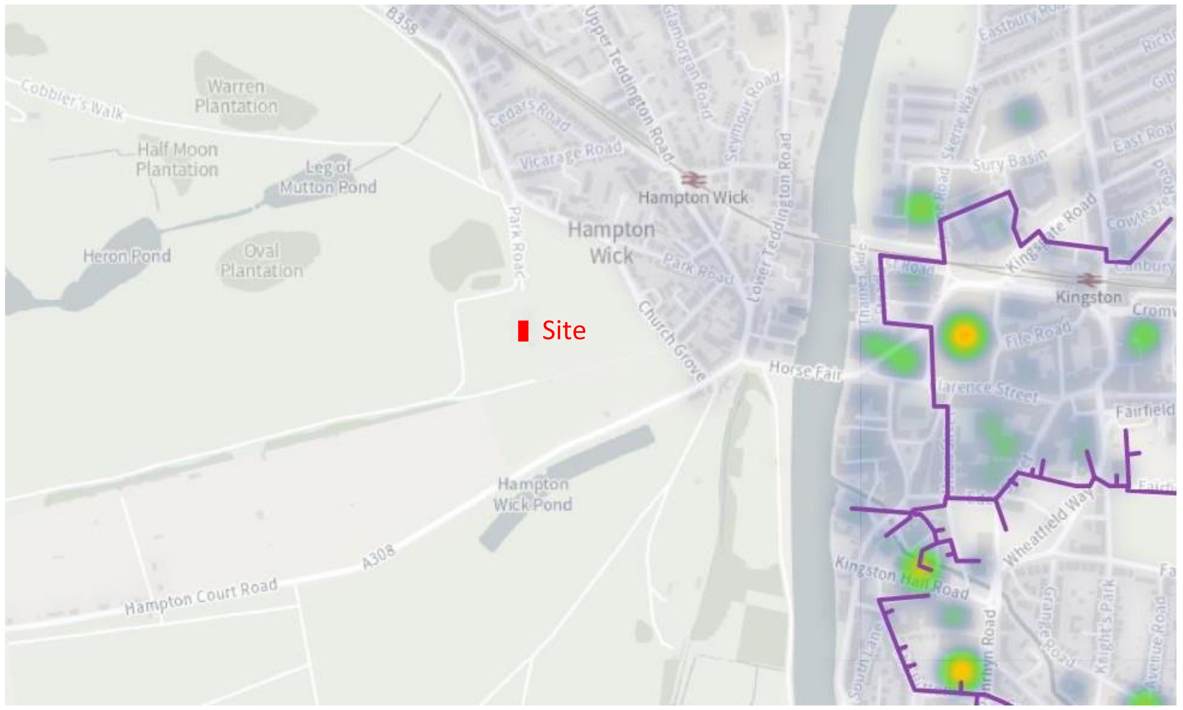

Figure 5 London Heat Map review of the site (Map data has been updated (08/03/2024))

5.1.2. Heating Hierarchy

The Proposed Development is not located within a Heat Network Priority Area (HNPA) and there are no nearby district heating networks. The building's energy demands are predominantly dictated by the need for cooling, significantly surpassing the requirement for heating throughout the year. Given the pronounced emphasis on cooling requirements, the feasibility, and potential advantages of integrating the building into a district heat network appear limited. The relatively lower demand for heating, particularly when contrasted with the substantial need for cooling, does not justify the investments and complexities associated with connecting to a district heat network. This means there is no improvement from ‘Be Clean’.

6. Renewable Energy (Be Green)

All commercially available Low and Zero Carbon options have been reviewed with respect to the development. These technologies have been considered within the constraints of the prevailing environmental conditions, building operation, loads, integration within the concept building services, viability, architectural design, capital and maintenance costs with associated payback and overall effective carbon dioxide reduction.

The development will include feasible renewable energy technology to reduce the development's CO_2 emissions once passive design and active energy efficiency measures have been considered.

The table below sets out the complete list of potential low and zero and renewable technologies along with their concluding viability for this development.

Table 13 Summary of Renewables Sources Appraisal

Technology	Feasible	Notes
Photovoltaics	Yes	Photovoltaic (PV) panels convert the suns energy into electricity. As the Proposed Development is solely electricity serviced, offsetting imported energy from the grid will benefit the scheme and therefore this technology will be used.
Battery Storage	Yes	To be consider alongside the photovoltaic (PV) panels to secure the electricity when the Pavilion is not in use to be used at the building's peaks.
Combined Heat and Power	No	A Combined Heat and Power (CHP) plant integrates the production of heat and power into a single, highly efficient process. CHP is considered feasible where the heating requirement of a scheme brings together many small intermittent loads to form a substantial base load demand for heat. For this reason, CHP is generally suitable for scheme which link residential to large commercial buildings ranging from hotels, offices, hospitals and leisure centres. As the development consists of Pavilion, and therefore has low base load demand and intermittent heat demand, CHP was not considered a technically feasible and cost-effective option.
Solar Thermal	No	Solar thermal panels convert the suns energy into hot water and are typically used to pre heat domestic hot water systems. Solar thermal systems are renowned to be major contributors in the summer however, it is questionable whether they can sustain the demands through the months where the solar resource is at its weakest, and when the DHW demand is at its highest. For this reason, the building makes it more favourable to utilise roof space to install photovoltaic panels (PV) in lieu of solar thermal.
Bio-fuel Heating	No	There are currently a number of environmental concerns regarding the use of biofuel in buildings. These include, fuel transportation / storage issues, potential air quality impact and resulting flue structure, plant space / storage requirements & maintenance requirements It is not considered that the biofuel market has developed sufficiently to resolve the above concerns and is not considered viable for this development due to environmental issues surrounding this fuel type.
Ground/Water Source Heat Pump	No	Ground source heat pumps make use of the relatively stable ground temperatures to improve the efficiencies of the heat pumps compared to an air source option but funding wise this isn't current a viable option.
Air Source Heat Pump	Yes	Air source heat pumps (ASHP) are like ground source heat pumps but extract heat from the ambient air rather the ground. The efficiency of air source heat pumps are generally slightly lower than ground source heat pumps. Alternative technology such as CO_2 air source heat pumps may also be considered for domestic hot water systems to maximise energy efficiency. This is economically the cheaper option.
Wind power	No	There is considerable evidence of urban wind turbines failing to perform to manufacturer's output estimates. Significant planning and integration issues also exist and consequently wind turbines are not viable.

6.1. Photovoltaics (PV)

Photovoltaic cells directly convert sunlight into electrical current using semi-conductors. The output of a cell is directly proportional to the intensity of the light received by the active surface of the cell. Exposure to sunlight causes electricity to flow through the cells. Direct sunlight produces the greatest output, but power is produced even when overcast.

Table 14 Feasibility of PV

Discussion	Commentary
Local planning Criteria	Roof mounted PV panels, particularly angled arrays, must not exceed the maximum design envelope imposed on the development. Safe access around the panels and to other roof plant should be maintained.
Feasibility of exporting energy from the system	It is likely that all electricity generated from the PV Array will be used by the proposed building.
Available grants and subsidies	Could be eligible for Smart Export Guarantee (SEG) that replaced fee in tariffs. Alternative tariff options and incentives will be sought during the procurement stage. However, SEG includes only an export tariff options and proposed development will probably use all of the produced electricity onsite.
Microgeneration certification Scheme (MCS)	Will require certification to apply for the SEG
Reasons for excluding this technology	N/A

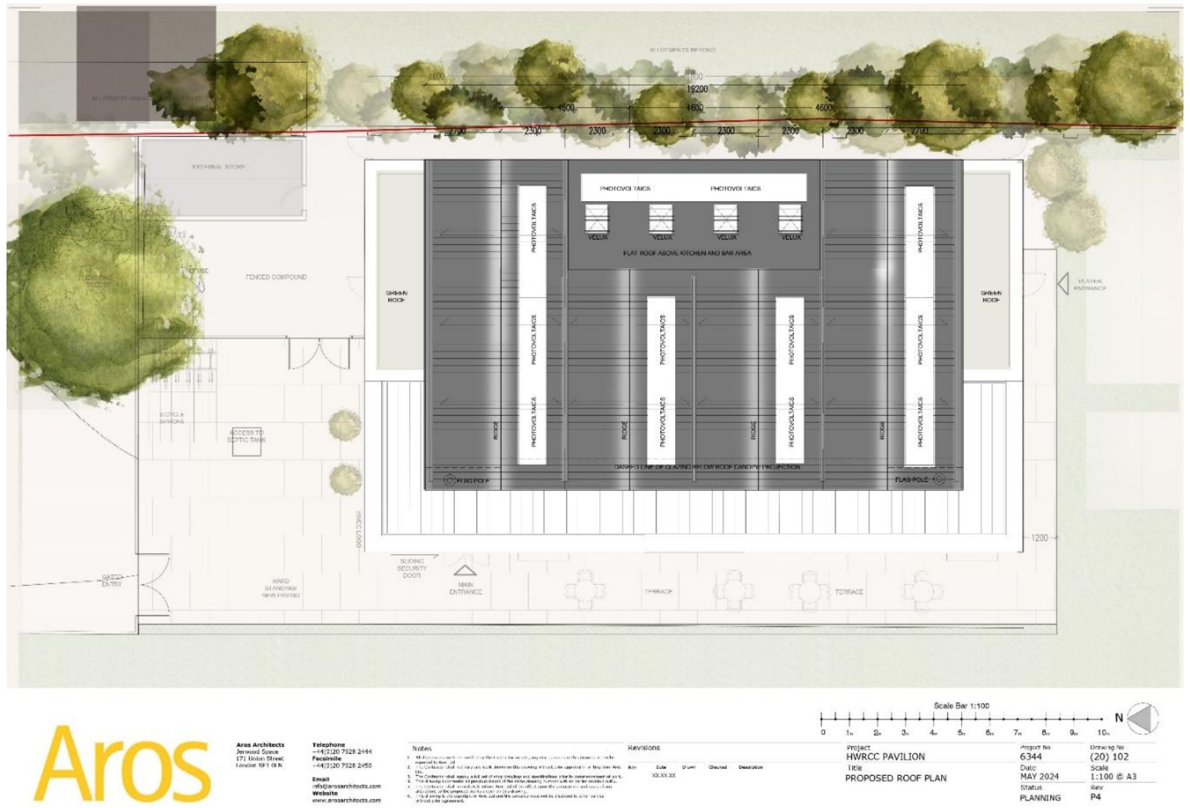

Table 15 PV performance summary

Performance Summary	Value	Unit
Approximate total net area of active PV	35	m^2
System size	7.125	kWp
Performance per unit	0.375	kWh/kWp
Estimated electricity generation	10,012.2	kWh/annum
Total CO_2 emissions reduction	1.381	Tonnes CO_2/annum
Total CO_2 emissions reduction	37%	% CO_2 of regulated scheme emissions
CAPEX (approximate)	To be determined at stage 3	£
Feed in Tariff rate (Smart Export Guarantee)	N/A	p/kWh
Export tariff	N/A	p/kWh
Electricity cost saved	To be determined at stage 3	£/annum
Simple payback	To be determined at stage 3	Years
Expected lifetime	To be determined at stage 3	Years
Maintenance cost	To be determined at stage 3	£/years
Life Cycle Cost	To be determined at stage 3	£

6.1.1. Aerothermal Energy for Heating (Heat Pumps)

Using ambient air as a thermal resource for a heat pump can provide lower emission heating, although typically the highest heating loads occur when the outside ambient air temperature, and subsequent heat pump efficiency, is at their lowest. Rejected heat from typical non-domestic buildings are traditionally used for pre-heating of incoming air within a simpler heat recovery system.

Additionally, recovered heat cannot be truly classed as ‘renewable’ by relevant guidance including BSRIA Guidance BG 1/2008 and EU Directive 2009/28/EC. However, the GLA’s Energy Planning guidance classifies heat pumps are under the third and final element of the energy strategy, hence ASHP are included in the ‘Be Green’ section.

It is envisaged that ASHPs will be incorporated into the Proposed Development.

A central ASHP system will be provided. The ASHP unit(s) will be located externally to the plant area. The ASHP will be sized for 100% of the peak design load. Further resilience will be built within the ASHP to be considered in the next design stage.

6.2. 'Be Green' Results

The 'Be Green' stage includes all passive design and energy efficiency measures and includes heat pumps, low carbon, and renewable energy.

The following table summarises the results from the application of the 'Be Green' measures at this stage:

Table 16 Building emissions performance under 'Be Green' measures.

	Target CO2 Emissions Rate (TER) ($kgCO_2$/annum)	Building CO2 Emission Rate ($kgCO_2$/annum)	Baseline improvement (%) 'Be Clean and Be Green'
Pavilion	6.07	3.94	**35.10%**

6.3. Further Energy Improvements

The proposed development meets the relevant Richmond Upon Thames sustainability policies, with potential to improve the energy performance even further. In the next stages the following items will have to be considered:

Table 17 Improvements being considered

Ref	Opportunity	Currently	Improvements
1	Reduce Cooling Demand	Current cooling set point is 24°C	Set point could be increased to 25°C or 26°C
2	Improve ventilation efficiency and control	No air temperature control	Linked to reference 5. Monitoring of air temperature to be included in key spaces such as the function area, changing rooms etc.
3	Improve air tightness in fabric	Openable windows included	Improved G-value and improved air tightness.
4	Domestic hot water	Water temperature is 70°C	Reduce distribution temperature to 55°C
5	Building Management System	Metering only	A simple BMS to control and coordinate the services in the building.

7. Be Seen

As the development has a gross internal floor area of 479 m², a full "Be Seen" assessment is not being undertaken. However, the following measures are in place to reduce energy consumption during occupancy:

- Meters: Installation of advanced metering systems to monitor energy usage in real-time, enabling occupants to track and manage their consumption effectively.
- Lighting Controls: Implementation of automated lighting controls, such as occupancy sensors and daylight harvesting systems, to minimise unnecessary energy use.
- Energy-Efficient Appliances: Selection of energy-efficient appliances and equipment that meet or exceed regulatory standards, helping to lower overall energy demand.
- Building Management System (BMS): The integration of a simple BMS to optimise the operation of building services, ensuring efficient performance and allowing for adjustments based on real-time data.
- User Education: Providing occupants with information and training on energy-saving practices to encourage behaviour that supports energy efficiency.

These measures collectively contribute to the 'Be Seen' measure by minimising energy consumption and promoting efficient use of resources during occupancy.

8. Summary

Hilson Moran has been appointed by Hampton Court Royal Cricket Club to provide an Energy Assessment for a proposed 2-storey pavilion at Hampton Wick Royal Cricket Ground in Bushy Park. The pavilion is designed to blend with the natural surroundings and historic charm of the park, offering modern facilities while incorporating sustainable building practices and materials to minimize environmental impact.

The Energy Assessment follows the Greater London Authority guidance and complies with London Plan Policy SI 2. It outlines measures and CO2 reductions for each stage of the energy hierarchy:

Be Lean: Improving the Part L notional u-values did not improve the buildings performance significantly which meant the economic decision to improve other aspects were shown.

Be Clean: An efficient heat pump for heating, cooling, and hot water was proposed after this stage, due to the unavailability of a broader heat network connection.

Be Green: Recommends roof-mounted photovoltaic (PV) arrays to provide renewable electricity for the pavilion also side an efficient heat pump for heating, cooling and hot water.

Be Seen: Implements a simple Building Management System (BMS) for optimal energy performance, with energy performance monitored and reported through the Mayor's post-construction monitoring platform has been address as an option but not a requirement.

Key energy efficiency measures include:

- **Building Fabric:** Air permeability is key in this building.
- **Lighting:** Use of LED lighting, motion sensors, and daylighting strategies to maximise natural light.
- **Heating and Cooling:** Optimised heat pump use, programmable thermostats, and zoning systems.
- **Solar PV System:** Regular maintenance and monitoring of solar panels and consideration of energy storage solutions.
- **Appliances and Equipment: Selection** of ENERGY STAR-rated appliances.
- **Water Heating:** Use of heat pump water heaters and low-flow fixtures.
- **Ventilation:** Utilisation of natural ventilation strategies.
- **Building Management System (BMS):** Consideration of smart controls and energy monitoring systems.
- **Maintenance:** Regular and preventive maintenance to ensure peak efficiency.

These measures aim to achieve significant energy savings, reduce the pavilion's carbon footprint, and provide a comfortable environment for users.

APPENDIX 1: 'BE LEAN' BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

35569 - HWRCC — As designed

Date: Fri May 24 10:46:20 2024

Administrative information

Building Details

Address: Hampton Wick Royal Cricket Club, Bushy Park, Kingston Upon Thames, London, KT1 4AZ

Certifier details

Name:

Telephone number:

Address: , ,

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]: 307.39

The CO_2 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), $kgCO_2/m^2annum$	6.07	
Building CO_2 emission rate (BER), $kgCO_2/m^2annum$	6.46	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	66.1	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	69.52	
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	0.18	0.18	External Wall
Floors	0.18	0.13	0.13	Ground Floor
Pitched roofs	0.16	0.11	0.11	Roof
Flat roofs	0.18	-	-	No flat roofs in project
Windows** and roof windows	1.6	1.27	2.03	Above ex door
Rooflights***	2.2	1.78	1.78	Velux
Personnel doors^	1.6	1.32	1.32	Door single in
Vehicle access & similar large doors	1.3	-	-	No vehicle access or similar large doors in project
High usage entrance doors	3	-	-	No high usage entrance doors in project

$U_{a-Limit}$ = 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
m³/(h.m²) 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	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- Extract Only (10 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.64	-	-	0.3	-
Standard value	2.5*	N/A	N/A	1.9^	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.

2- Nat Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.64	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

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

3- Mix Mode (3 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.64	5	-	1.6	0.7
Standard value	2.5*	3	N/A	1.9^	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- New HWS Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	2.86	0
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

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	Zone	Standard
HWRCC_CH_00_Changing room 01	0.3	-	-	-	-	-	-	-	-	-	N/A
HWRCC_CH_00_Changing room 02	0.3	-	-	-	-	-	-	-	-	-	N/A
HWRCC_CH_00_Changing room 03	0.3	-	-	-	-	-	-	-	-	-	N/A
HWRCC_CH_00_Changing room 04	0.3	-	-	-	-	-	-	-	-	-	N/A
HWRCC_CH_00_Official 01	0.3	-	-	-	-	-	-	-	-	-	N/A
HWRCC_CH_00_Official 02	0.3	-	-	-	-	-	-	-	-	-	N/A
HWRCC_ED_01_Functional Area	-	-	-	-	0.2	-	-	-	-	-	N/A
HWRCC_FP_01_Bar	-	-	-	-	0.2	-	-	-	-	-	N/A
HWRCC_FP_01_Kitchen	-	-	-	-	0.2	-	-	-	-	-	N/A
HWRCC_P_00_Plant 1	0.3	-	-	-	-	-	-	-	-	-	N/A
HWRCC_WC_00_Female	0.3	-	-	-	-	-	-	-	-	-	N/A
HWRCC_WC_00_Male	0.3	-	-	-	-	-	-	-	-	-	N/A
HWRCC_WC_00_DDA	0.3	-	-	-	-	-	-	-	-	-	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
HWRCC_CI_00_Feature Stair	-	-	-
HWRCC_CH_00_Changing room 01	-	-	-
HWRCC_CH_00_Changing room 02	-	-	-
HWRCC_CH_00_Changing room 03	-	-	-
HWRCC_CH_00_Changing room 04	-	-	-
HWRCC_CH_00_Official 01	-	-	-
HWRCC_CH_00_Official 02	-	-	-
HWRCC_CI_00_Lift	-	-	-
HWRCC_CI_00_Escape Stair	-	-	-
HWRCC_CI_01_Feature Stair	-	-	-
HWRCC_CI_01_Lift	-	-	-
HWRCC_CI_01_Escape Stair	-	-	-
HWRCC_ED_01_Functional Area	-	95	-
HWRCC_FP_01_Bar	-	-	-
HWRCC_FP_01_Kitchen	-	-	-
HWRCC_P_00_Plant 1	-	-	-
HWRCC_R_00_Lobby	-	-	-
HWRCC_R_00_Foyer	-	-	-
HWRCC_ST_00_Cellar	-	-	-
HWRCC_ST_00_Store 1	-	-	-
HWRCC_ST_00_Cleaner Cupboard	-	-	-
HWRCC_ST_00_Store 2	-	-	-
HWRCC_ST_00_Store 3	-	-	-
HWRCC_ST_01_Store 4	-	-	-
HWRCC_ST_01_Store 5	-	-	-
HWRCC_WC_00_Female	-	-	-

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
HWRCC_WC_00_Male	-	-	-
HWRCC_WC_00_DDA	-	-	-
HWRCC_CI_00_Changing Room Lobby 1	-	-	-
HWRCC_CI_00_Changing Room Lobby 2	-	-	-

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?
HWRCC_ED_01_Functional Area	NO (-51%)	NO
HWRCC_FP_01_Bar	NO (-85%)	NO
HWRCC_FP_01_Kitchen	NO (-86%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	615	615
External area [m²]	1168	1168
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	401	361
Average U-value [W/m²K]	0.34	0.31
Alpha value* [%]	35.91	20.91

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

Building Use

% Area	Building Type
100	**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
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	8.16	4.16
Cooling	0.4	3.2
Auxiliary	10.17	9.94
Lighting	10.1	7.48
Hot water	17.99	20
Equipment*	40.26	40.26
TOTAL**	**46.81**	**44.77**

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	84.35	74.34
Primary energy [kWh_{PE}/m^2]	69.52	66.1
Total emissions [kg/m²]	6.46	6.07

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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] Central heating using air distribution, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	129.2	0	14.3	0	10.7	2.51	0	2.64	0
	Notional	70.4	0	7.4	0	14.2	2.64	0	----	----
[ST] Central heating using air distribution, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	104.9	0	11.6	0	0	2.51	0	2.64	0
	Notional	62.2	0	6.5	0	0	2.64	0	----	----
[ST] Fan coil systems, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	30.3	15	3.4	0.9	17.4	2.51	4.5	2.64	5
	Notional	11.9	72.2	1.3	7.4	11.1	2.64	2.7	----	----

Key to terms

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

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APPENDIX 2 – 'BE GREEN' BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

35569 - HWRCC As designed

Date: Wed May 15 19:35:20 2024

Administrative information

Building Details

Address: Hampton Wick Royal Cricket Club, Bushy Park, Kingston Upon Thames, London, KT1 4AZ

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

Certifier details

Name:

Telephone number:

Address: , ,

Foundation area [m²]: 307.39

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	6.07	
Building CO_2 emission rate (BER), $kgCO_2/m^2$annum	3.94	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	66.1	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	41.2	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	First surface with maximum value
Walls*	0.26	0.18	0.18	External Wall
Floors	0.18	0.13	0.13	Ground Floor
Pitched roofs	0.16	0.11	0.11	Roof
Flat roofs	0.18	-	-	No flat roofs in project
Windows** and roof windows	1.6	1.27	2.03	Above ex door
Rooflights***	2.2	1.78	1.78	Velux
Personnel doors^	1.6	1.32	1.32	Door single in
Vehicle access & similar large doors	1.3	-	-	No vehicle access or similar large doors in project
High usage entrance doors	3	-	-	No high usage entrance doors in project

$U_{a-Limit}$ = 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
m³/(h.m²) at 50 Pa	8	3

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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	>0.95

1- Extract Only (10 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	-	-	0.3	-
Standard value	2.5*	N/A	N/A	1.9^	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.

2- Nat Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

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

3- Mix Mode (3 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	5	-	1.6	0.7
Standard value	2.5*	3	N/A	1.9^	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- New HWS Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3	0
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

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.

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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
HWRCC_CH_00_Changing room 01	0.3	-	-	-	-	-	-	-	-	-	N/A
HWRCC_CH_00_Changing room 02	0.3	-	-	-	-	-	-	-	-	-	N/A
HWRCC_CH_00_Changing room 03	0.3	-	-	-	-	-	-	-	-	-	N/A
HWRCC_CH_00_Changing room 04	0.3	-	-	-	-	-	-	-	-	-	N/A
HWRCC_CH_00_Official 01	0.3	-	-	-	-	-	-	-	-	-	N/A
HWRCC_CH_00_Official 02	0.3	-	-	-	-	-	-	-	-	-	N/A
HWRCC_ED_01_Functional Area	-	-	-	-	0.2	-	-	-	-	-	N/A
HWRCC_FP_01_Bar	-	-	-	-	0.2	-	-	-	-	-	N/A
HWRCC_FP_01_Kitchen	-	-	-	-	0.2	-	-	-	-	-	N/A
HWRCC_P_00_Plant 1	0.3	-	-	-	-	-	-	-	-	-	N/A
HWRCC_WC_00_Female	0.3	-	-	-	-	-	-	-	-	-	N/A
HWRCC_WC_00_Male	0.3	-	-	-	-	-	-	-	-	-	N/A
HWRCC_WC_00_DDA	0.3	-	-	-	-	-	-	-	-	-	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
HWRCC_CI_00_Feature Stair	-	-	-
HWRCC_CH_00_Changing room 01	-	-	-
HWRCC_CH_00_Changing room 02	-	-	-
HWRCC_CH_00_Changing room 03	-	-	-
HWRCC_CH_00_Changing room 04	-	-	-
HWRCC_CH_00_Official 01	-	-	-
HWRCC_CH_00_Official 02	-	-	-
HWRCC_CI_00_Lift	-	-	-
HWRCC_CI_00_Escape Stair	-	-	-
HWRCC_CI_01_Feature Stair	-	-	-
HWRCC_CI_01_Lift	-	-	-
HWRCC_CI_01_Escape Stair	-	-	-
HWRCC_ED_01_Functional Area	-	95	-
HWRCC_FP_01_Bar	-	-	-
HWRCC_FP_01_Kitchen	-	-	-
HWRCC_P_00_Plant 1	-	-	-
HWRCC_R_00_Lobby	-	-	-
HWRCC_R_00_Foyer	-	-	-
HWRCC_ST_00_Cellar	-	-	-
HWRCC_ST_00_Store 1	-	-	-
HWRCC_ST_00_Cleaner Cupboard	-	-	-
HWRCC_ST_00_Store 2	-	-	-
HWRCC_ST_00_Store 3	-	-	-
HWRCC_ST_01_Store 4	-	-	-
HWRCC_ST_01_Store 5	-	-	-
HWRCC_WC_00_Female	-	-	-

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
HWRCC_WC_00_Male	-	-	-
HWRCC_WC_00_DDA	-	-	-
HWRCC_CI_00_Changing Room Lobby 1	-	-	-
HWRCC_CI_00_Changing Room Lobby 2	-	-	-

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?
HWRCC_ED_01_Functional Area	NO (-51%)	NO
HWRCC_FP_01_Bar	NO (-85%)	NO
HWRCC_FP_01_Kitchen	NO (-86%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	615	615
External area [m²]	1168	1168
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	401	361
Average U-value [W/m²K]	0.34	0.31
Alpha value* [%]	35.91	20.91

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

Building Use

% Area	Building Type
100	**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
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	6.16	4.16
Cooling	0.4	3.2
Auxiliary	10.17	9.94
Lighting	10.1	7.48
Hot water	17.15	20
Equipment*	40.26	40.26
TOTAL**	**43.97**	**44.77**

* 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	16.28	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*16.28*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	84.35	74.34
Primary energy [kWh_{PE}/m^2]	41.2	66.1
Total emissions [kg/m²]	3.94	6.07

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] Central heating using air distribution, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	129.2	0	10.8	0	10.7	3.32	0	3.5	0
	Notional	70.4	0	7.4	0	14.2	2.64	0	----	----
[ST] Central heating using air distribution, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	104.9	0	8.8	0	0	3.32	0	3.5	0
	Notional	62.2	0	6.5	0	0	2.64	0	----	----
[ST] Fan coil systems, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	30.3	15	2.5	0.9	17.4	3.32	4.5	3.5	5
	Notional	11.9	72.2	1.3	7.4	11.1	2.64	2.7	----	----

Key to terms

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

APPENDIX 3 – GLA SPREADSHEET

3.1 Part L Outputs

NON-RESIDENTIAL CO_2 ANALYSIS (PART L2)

				Baseline		'Be Lean'	'Be Clean'	'Be Green'			Baseline		'Be Lean'			'Be Clean'			'Be Green'	
Building Use	Model Area (m²)	Number of units	Total area represented by model (m²)	BRUKL TER ($kgCO_2 / m^2$)	BRUKL Displaced electricity (-) (kWh / m^2)	BRUKL BER ($kgCO_2 / m^2$)	BRUKL BER ($kgCO_2 / m^2$)	BRUKL BER ($kgCO_2 / m^2$)			Part L 2021 CO_2 emissions ($kgCO_2$ p.a.)	Energy saving/generation technologies ($kgCO_2$ p.a.)	Part L 2021 CO_2 emissions ($kgCO_2$ p.a.)	Part L 2021 CO_2 emissions with Notional PV savings included ($kgCO_2$ p.a.)	'Be Lean' savings ($kgCO_2$ p.a.)	Part L 2021 CO_2 emissions ($kgCO_2$ p.a.)	Part L 2021 CO_2 emissions with Notional PV savings included ($kgCO_2$ p.a.)	'Be Clean' savings ($kgCO_2$ p.a.)	Part L 2021 CO_2 emissions ($kgCO_2$ p.a.)	'Be Green' savings ($kgCO_2$ p.a.)
Cricket Pavilion *a's include shading from wall and small unconditioned shed*	*615*	*1*	*615*	6.07		6.46	6.46	3.94			3,733	0.00	3,972.90	3,973	-240	3,973	3,973	0	2,423	1,550
Sum		1	615	6.1	0.0	6.5	6.5	3.9			*3,733*	*0*	*3,973*	*3,973*	*-240*	*3,973*	*3,973*	*0*	*2,423*	*1,550*
SITE-WIDE ENERGY CONSUMPTION AND CO_2 ANALYSIS																				
Total Sum			615	-	-	-	-	-			*3,733*	*0*	*3,973*	*3,973*	*-240*	*3,973*	*3,973*	*0*	*2,423*	*1,550*

3.2 EUI & Space heating Demand

Non-residential predicted energy use

Building type	GIA (m^2)	EUI & space heating demand (kWh/year)									Has the following energy use been included?		Results		Table 4 of the guidance comparison		Methodology used		
		Space heating demand	Annual Electricity Use	Annual Gas Use	Annual Oil Use	Annual Biomass Use	Annual District Htg Use	Annual District Clg Use	Elec Generation, Gross	Solar Thermal Generation	Regulated	Unregulated	EUI (kWh/m^2/year) (excluding renewable energy)	Space heating demand (kWh/m^2/year) (excluding renewable energy)	EUI value from Table 4 of the guidance (kWh/m^2/year) (excluding renewable energy)	Space heating demand from Table 4 of the guidance (kWh/m^2/year) (excluding renewable energy)	Software	Operational energy use assessment	notes (if expected performance differs from the Table 4 values in the guidance or other software used)
					if applicable	if applicable	if applicable	if applicable	if applicable	if applicable									
All other non-residential	615	13247.1	37038.96	0	0	0	0	0	10012.2	0	Yes	Yes	76.50595122	21.54	55	15			
Total	615	13247.1	37038.96	0	0	0	0	0	10012.2	0									

3.3 GLA Summary Tables

Part L 2021 Performance (Non-residential)

Table 18 Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-residential buildings

	Carbon Dioxide Emissions for non-residential buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	3.7	
After energy demand reduction (be lean)	4.0	
After heat network connection (be clean)	4.0	
After renewable energy (be green)	2.4	

Table 19 Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-residential buildings

	Regulated non-residential carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be lean: savings from energy demand reduction	-0.2	-6%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	1.5	42%
Total Cumulative Savings	**1.3**	**35%**
Annual savings from off-set payment	2.4	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**73**	-
Cash in-lieu contribution (£)	**6,906**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

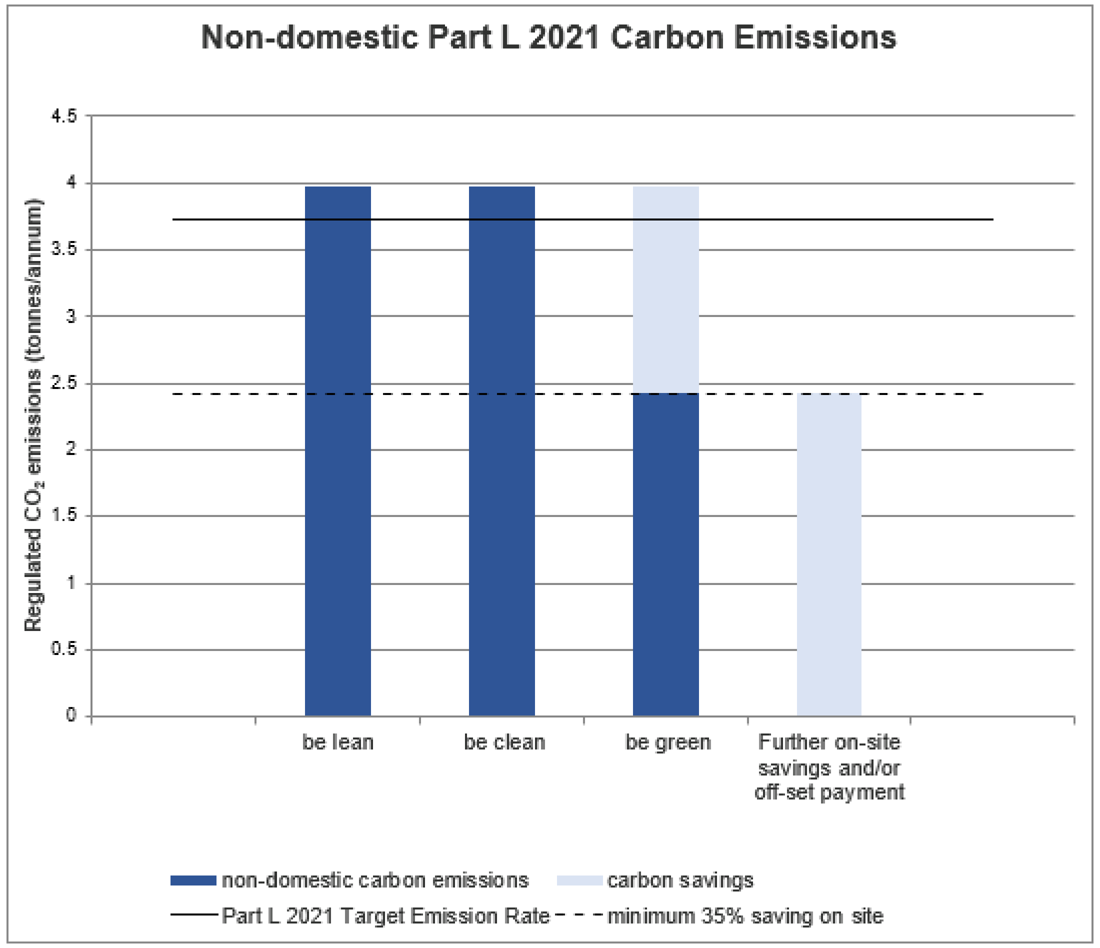

Figure 6 Chart of Part L 2021 Carbon emissions

Site Wide

Table 20 Site wide CO^2 percentage savings

	Total regulated emissions (Tonnes CO_2 / year)	**CO_2 savings (Tonnes CO_2 / year)**	**Percentage savings (%)**
Part L 2021 baseline	3.7		
Be lean	4.0	-0.2	-6%
Be clean	4.0	0.0	0%
Be green	2.4	1.5	42%
Total Savings	-	1.3	35%
	-	CO_2 savings off-set (Tonnes CO_2)	-
Off-set	-	72.7	-

EUI and Space heating Demand (predicted energy use)

Table 21 EUI and Space heating Demand (predicted energy use)

Building type	EUI ($kWh/m^2/year$) (excluding renewable energy)	Space heating demand ($kWh/m^2/year$) (excluding renewable energy)	EUI value from Table 4 of the guidance ($kWh/m^2/year$) (excluding renewable energy)	Space heating demand from Table 4 of the guidance($kWh/m^2/year$) (excluding renewable energy)
All other non-residential	76.50595122	21.54	55	15

APPENDIX 4 – Expanded measure notes on Energy Efficiency

4.1 Energy Efficiency measures

Key energy efficiency measures have considered and included in the rebuild of Hampton Wick Royal Cricket Club:

Building Fabric

- Insulation: Ensuring External walls and the roof is well-insulated to minimise heat loss in winter and heat gain in summer.
- Windows and Doors: Use of well-sealed windows and door to prevent drafts and heat leakage.

Lighting

- LED Lighting: The use of LED is more energy-efficient and these bulbs usually have a longer lifespan.
- Motion Sensors: The installation motion sensors in all spaces especially less frequently used areas like storage rooms and restrooms to ensure lights are only on when needed.
- Daylighting: Maximising the use of natural light through windows and skylights. Using light shelves or reflective surfaces to distribute daylight deeper into the building.

Heating and Cooling

- Heat Pump Optimisation: Ensuring the heat pump is correctly sized and maintained for optimal performance. Use programmable thermostats to manage heating and cooling schedules efficiently.
- Zoning Systems: Implementing zoning in the pavilion to control temperatures in different areas independently, reducing unnecessary heating or cooling.

Solar PV System

- Maximise Solar Output: Ensuring all solar panels are clean and unobstructed to maximize energy production. Monitoring of the system's performance will be done regularly to ensure it operates efficiently.
- Energy Storage: Considering battery storage to store excess solar energy generated during the day for use at night or during peak usage times.

Appliances and Equipment

- Energy-Efficient Appliances: Consciousness decision to choose ENERGY STAR-rated appliances for the kitchen, bar, and other facilities within the pavilion.
- Water Heating
- Efficient Heat Pump: Heat pump water heaters creates greater efficiency.
- Low-Flow Fixtures: Installation of low-flow faucets, showerheads, and toilets to reduce water usage and the energy required to heat water.

Ventilation

- Natural Ventilation: Utilising natural ventilation strategies, such as operable windows and vents, to reduce the need for mechanical ventilation and active cooling.

Building Management System (BMS)

- Smart Controls: Implementing a simple BMS to monitor and control lighting, heating, cooling, and ventilation systems more efficiently.
- Energy Monitoring: Using energy monitoring systems to track and analyse energy usage, identifying areas where further efficiency improvements can be made.

Maintenance

- Regular Maintenance: Conducting regular maintenance of all systems, including the heat pump, solar PV system, and lighting systems, to ensure they are operating at peak efficiency.
- Preventive Maintenance: Developing a preventive maintenance schedule to address potential issues before they lead to energy waste.
- By integrating these energy efficiency measures, the cricket pavilion could achieve significant energy savings, reduce its carbon footprint, and provide a comfortable environment for players and visitors.

APPENDIX 5 – TAS Zoned Areas

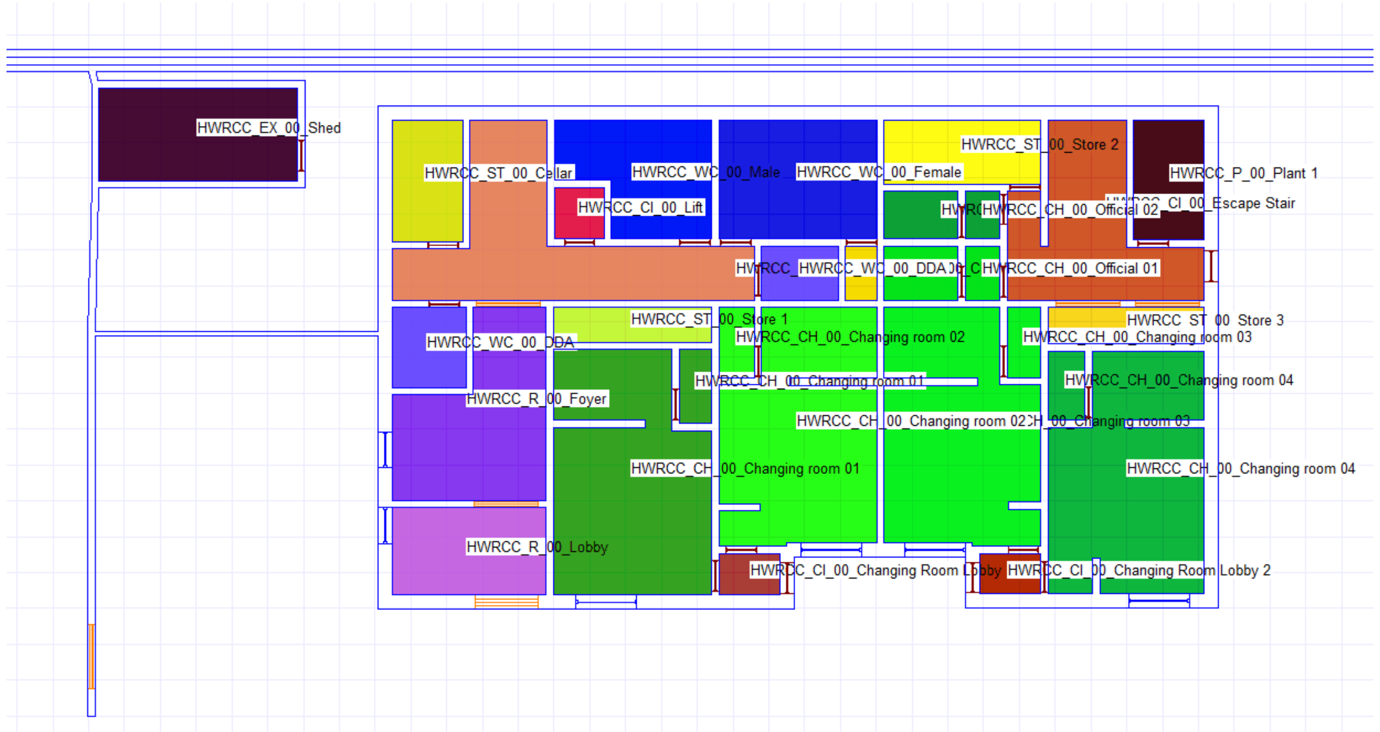

Figure 7 TAS Model Zoning Ground Floorplan

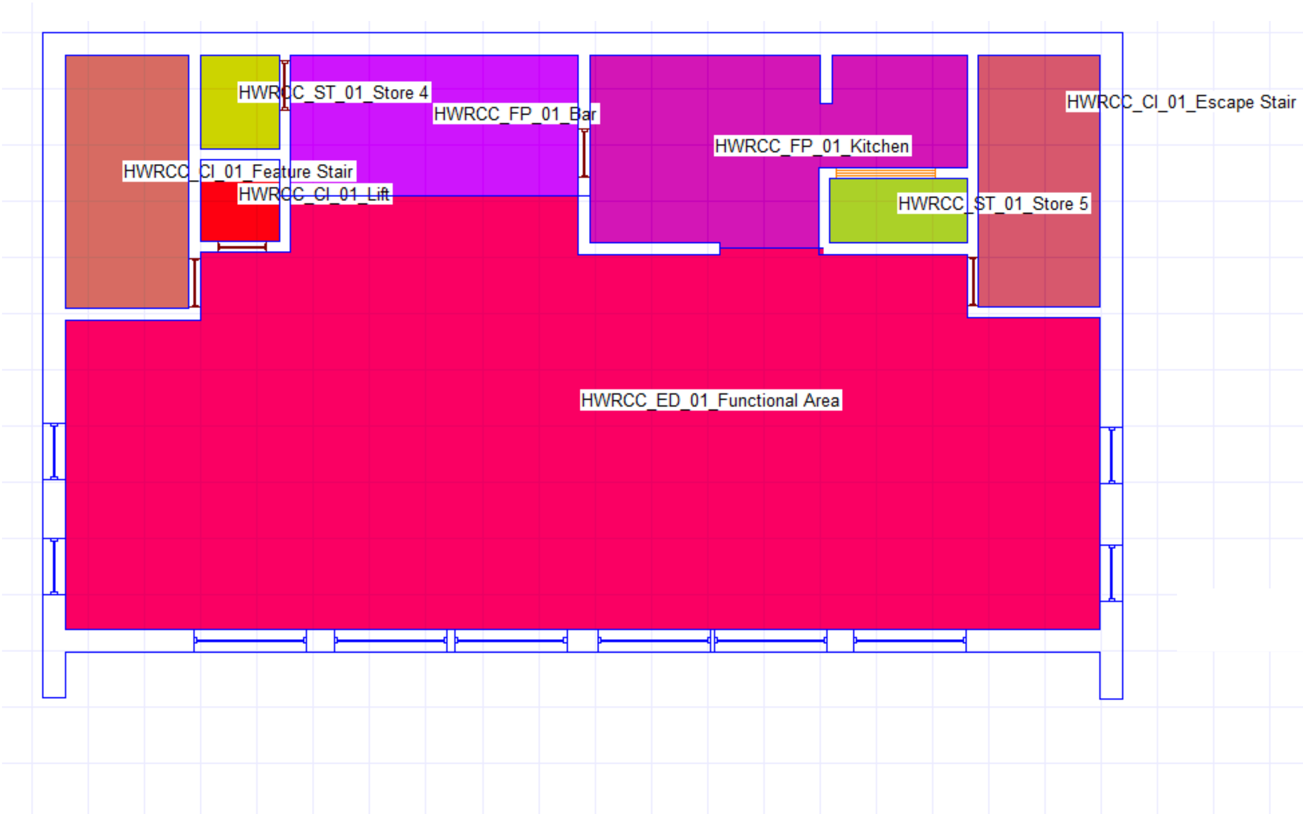

Figure 8 TAS Model Zoning First Floorplan

Hilson Moran

People. Places. Planet.