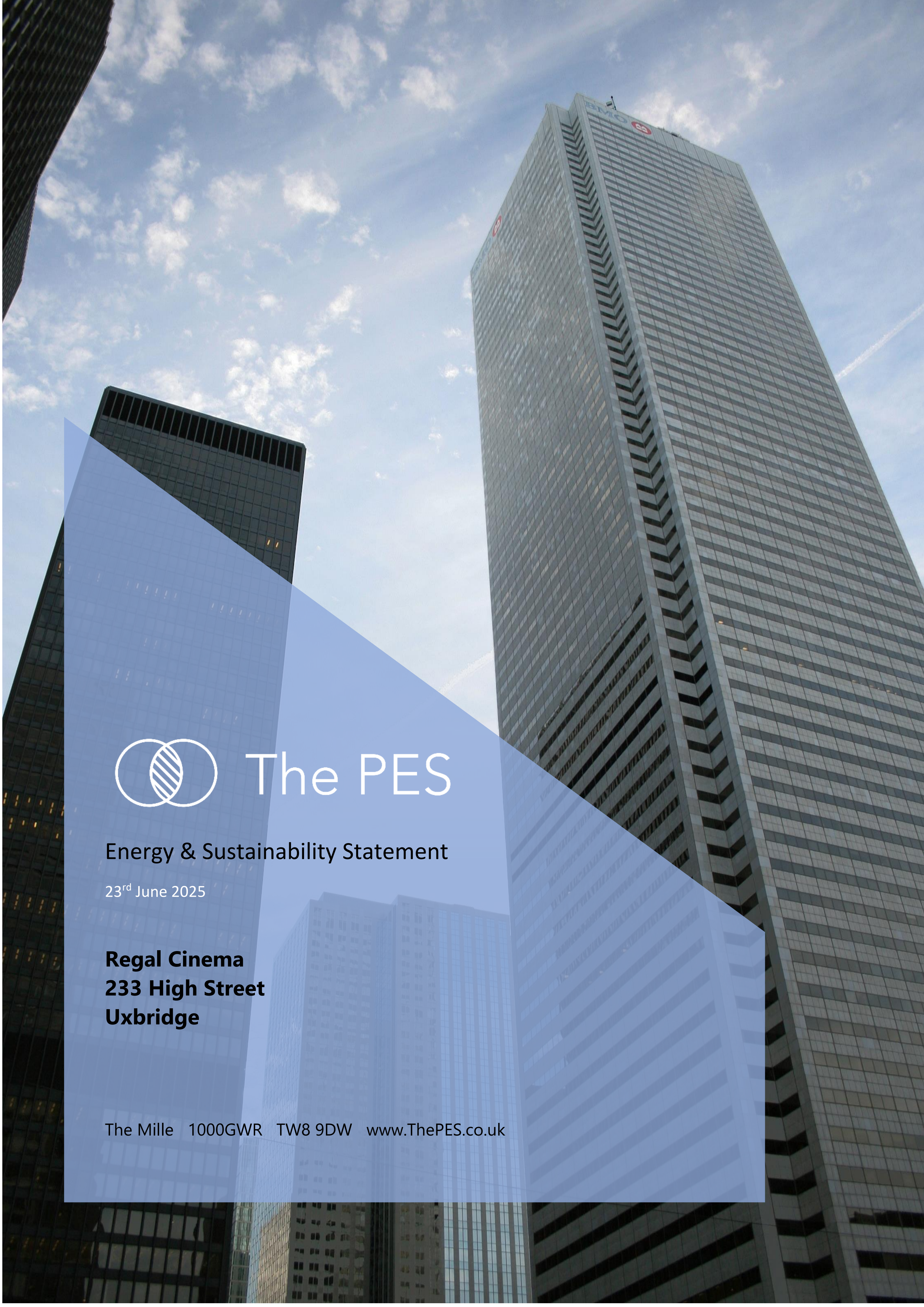


The PES

Energy & Sustainability Statement

23rd June 2025

Regal Cinema
233 High Street
Uxbridge

The Mille 1000GWR TW8 9DW www.ThePES.co.uk

The PES

Contents

Appendices

1.0 Executive Summary

The proposed development project at the Regal Cinema part reconfiguration of the existing structures, with a new build extension to provide a new hotel offering across basement and 4 upper floors.

It has been designed to achieve the highest of environmental performance standards following the Energy Hierarchy as set down by the London Plan and the London Borough of Hillingdon's Local Plan policies.

A 'Lean, Clean, Green, Be Seen' approach to assessing energy and thermal comfort needs and appropriate solutions has been adopted following the guidance under Chapter 9 of the London Plan and the latest GLA guidance on the preparation of energy statements (June 2022) the development achieves an overall improvement (BER/TER) in regulated emissions of **47.84%**.% over the Part L 2021 standard and a reduction in overall emissions at **37.29%** when taking into account unregulated energy use, through the adoption of high standards of insulation, super-efficient variable refrigerant flow heating/cooling, domestic hot water generated by twin compressor heat pump technology and natural ventilation.

The above strategy if further supplemented by a 14.92kWp PV installation to the existing roof areas; generating some 11,300kWh per annum.

2.0 The Site & Proposal

The existing building is located to the rear of the High Street in central Uxbridge.

The proposals under consideration within this report is for the part reconfiguration of the existing structures, with a new build extension to provide a new hotel offering

2.1 Local Planning Context

The site sits within the London Borough of Hillingdon

The Local Plan: Part 1 - Strategic Policies was adopted November 2012)

Section 8 Core Policies - Environmental Improvement

Policy EM1: Climate Change Adaptation and Mitigation

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

1. Prioritising higher density development in urban and town centres that are well served by sustainable forms of transport.

2. Promoting a modal shift away from private car use and requiring new development to include innovative initiatives to reduce car dependency.

3. Ensuring development meets the highest possible design standards whilst still retaining competitiveness within the market.

4. Working with developers of major schemes to identify the opportunities to help provide efficiency initiatives that can benefit the existing building stock.

5. Promoting the use of decentralised energy within large scale development whilst improving local air quality levels.

6. Targeting areas with high carbon emissions for additional reductions through low carbon strategies. These strategies will also have an objective to minimise other pollutants that impact on local air quality. Targeting areas of poor air quality for additional emissions reductions.

7. Encouraging sustainable techniques to land remediation to reduce the need to transport waste to landfill. In particular developers should consider bioremediation as part of their proposals.

8. Encouraging the installation of renewable energy for all new development in meeting the carbon reduction targets savings set out in the London Plan. Identify

opportunities for new sources of electricity generation including anaerobic digestion, hydroelectricty and a greater use of waste as a resource.

9. Promoting new development to contribute to the upgrading of existing housing stock where appropriate.

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

10. Locating and designing development to minimise the probability and impacts of flooding.

11. Requiring major development proposals to consider the whole water cycle impact which includes flood risk management, foul and surface water drainage and water consumption.

12. Giving preference to development of previously developed land to avoid the Loss Of Further Green Areas.

13. Promoting the use of living walls and roofs, alongside sustainable forms of drainage to manage surface water run-off and increase the amount of carbon sinks.

14. Promoting the inclusion of passive design measures to reduce the impacts of urban heat effects.

Local Plan - Part 2 - Development Management Policies (Adopted 16 January 2020)

Policy DMEI 2: Reducing Carbon Emissions

A) All developments are required to make the fullest contribution to minimising carbon dioxide emissions in accordance with London Plan targets.

B) All major development7 proposals must be accompanied by an energy assessment showing how these reductions will be achieved.

C) Proposals that fail to take reasonable steps to achieve the required savings will be resisted. However, where it is clearly demonstrated that the targets for carbon emissions cannot be met onsite, the Council may approve the application and seek an off-site contribution to make up for the shortfall.

POLICY DMEI 3: Decentralised Energy

A) All major developments are required to be designed to be able to connect to a Decentralised Energy Network (DEN).

B) Major developments located within 500 metres of an existing DEN, and minor new-build developments located within 100 metres, will be required to connect to that network, including provision of the means to connect to that network and a reasonable financial contribution to the connection charge, unless a feasibility assessment demonstrates that connection is not reasonably possible.

C) Major developments located within 500 metres of a planned future DEN, which is considered by the Council likely to be operational within 3 years of a grant of planning permission, will be required to provide a means to connect to that network and developers shall provide a reasonable financial contribution for the future cost of connection and a commitment to connect via a legal agreement or contract, unless a feasibility assessment demonstrates that connection is not reasonably possible.

D) The Council will support the development of DENs and energy centres in principle, subject to meeting the wider policy requirements of this plan and in particular on design and air quality.

2.2 The London Plan

Chapter 9 deals with Sustainable Infrastructure:-

Policy SI2 Minimising greenhouse gas emissions

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

1) Be lean: use less energy and manage demand during construction and operation.
2) Be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly. Development in Heat Network Priority Areas should follow the heating hierarchy in Policy SI3 Energy infrastructure.
3) Be green: generate, store and use renewable energy on-site.

B Major development should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy and will be expected to monitor and report on energy performance.

C In meeting the zero-carbon target a minimum on-site reduction of at least 35 per cent beyond Building Regulations is expected. Residential development should aim to achieve 10 per cent, and non-residential development should aim to achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided:

1) through a cash in lieu contribution to the relevant borough's carbon offset fund, and/or
2) off-site provided that an alternative proposal is identified and delivery is certain.

Policy SI3 Energy infrastructure

D Major development proposals within Heat Network Priority Areas should have a communal heating system

1) the heat source for the communal heating system should be selected in accordance with the following heating hierarchy:

a) connect to local existing or planned heat networks

b) use available local secondary heat sources (in conjunction with heat pump, if required, and a lower temperature heating system)
c) generate clean heat and/or power from zero-emission sources
d) use fuel cells (if using natural gas in areas where legal air quality limits are exceeded all development proposals must provide evidence to show that any emissions related to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler)
e) use low emission combined heat and power (CHP) (in areas where legal air quality limits are exceeded all development proposals must provide evidence to show that any emissions related to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler)
f) use ultra-low NOx gas boilers.

2) CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that there is no significant impact on local air quality.
3) Where a heat network is planned but not yet in existence the development should be designed for connection at a later date.

Policy SI4 Managing heat risk

A Development proposal should minimise internal heat gain and the impacts of the urban heat island through design, layout, orientation and materials.

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

1) minimise internal heat generation through energy efficient design
2) reduce the amount of heat entering a building through orientation, shading, albedo, fenestration, insulation and the provision of green roofs and walls
3) manage the heat within the building through exposed internal thermal mass and high ceilings
4) provide passive ventilation
5) provide mechanical ventilation
6) Provide active cooling systems.

Policy SI5 Water infrastructure

C Development proposals should:

1) minimise the use of mains water in line with the Optional Requirement of the Building Regulations (residential development), achieving mains water consumption of 105 litres or less per head per day (excluding allowance of up to five litres for external water consumption)
2) achieve at least the BREEAM excellent standard (commercial development)
3) be encouraged to incorporate measures such as smart metering, water saving and recycling measures, including retrofitting, to help to achieve lower water consumption rates and to maximise future proofing.

Policy SI12 Flood risk management

C Development proposals which require specific flood risk assessments should ensure that flood risk is minimised and mitigated, and that residual risk is addressed. This should include, where possible, making space for water and aiming for development to be set back from the banks of watercourses.

E Development proposals for utility services should be designed to remain operational under flood conditions and buildings should be designed for quick recovery following a flood.

F Development proposals adjacent to flood defences will be required to protect the integrity of flood defences and allow access for future maintenance and upgrading. Where possible, development proposals should set permanent built development back from flood defences to allow for any foreseeable future upgrades.

Policy SI13 Sustainable Drainage

A Lead Local Flood Authorities should identify – through their Local Flood Risk Management Strategies and Surface Water Management Plans – areas where there are particular surface water management issues and aim to reduce these risks.

B Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

1) rainwater harvesting (including a combination of green and blue roofs)
2) infiltration techniques and green roofs
3) rainwater attenuation in open water features for gradual release
4) rainwater discharge direct to a watercourse (unless not appropriate)
5) rainwater attenuation above ground (including blue roofs)
6) rainwater attenuation below ground
7) rainwater discharge to a surface water sewer or drain
8) rainwater discharge to a combined sewer.

C Development proposals for impermeable paving should be refused where appropriate, including on small surfaces such as front gardens and driveways.

D Drainage should be designed and implemented in ways that address issues of water use efficiency, river water quality, biodiversity, amenity and recreation.

It is noted that the proposed non-domestic development is less than 1,000m^2 and would be considered n0n-major development.

In line with the latest GLA guidance, the design team have progressed this assessment based upon the recently introduced Part L 2021 calculation methodology on this basis following the latest GLA guidance.

The GLA Part L 2021 reporting tool is attached at **Appendix D**.

3.0 Baseline energy results

The first stage of the Mayor's Energy Hierarchy is to consider the baseline energy model.

The following section details the baseline energy requirements for the development – the starting point when considering the energy hierarchy.

3.2 Commercial Space - Change of Use/Conversion/Extension

The energy requirements for space heating, water heating and ventilation within the proposed hotel have been calculated using the National Calculation Method (NCM) in line with AD L2 of the Building Regulations 2021.

The Government approved assessment methodology is the Simplified Building Energy Model (SBEM), The PES Ltd use an advanced modelling software - Design Builder - which enables accurate SBEM models to be created, as well as heat loss and cooling load calculations and full M&E design to be undertaken.

The new build extensions will be assessed separately in line with the GLA guidance, utilising notional heat pump efficiencies as required.

To consider the refurbished element of the building performance against The Building Regulations (Approved Document L2) SBEM first creates the notional reference building, the characteristics of which are defined within the latest GLA Guidance (June 2022) Appendix 3 and reproduced below.

In order to establish the baseline, the HVAC solution has been assumed as an air to air heat pump system and mechanical cooling. Domestic Hot Water (DHW) will be supplied from the same heat pump systems via appropriately sized calorifiers and a secondary circulation loop.

This creates the notional Building Emission Rate (BER) and should be considered as stage 'zero' of the energy hierarchy as described earlier and sets the benchmark for the worst performing, but legally permissible, development against which, SBEM assesses the "actual" design, fabric values, heating lighting and ventilation systems and creates the "actual" Building Emissions Rate (BER).

Element	Unit	Specification[1]
External Wall (cavity insulation)	W/m²K	0.55
External Wall (external or internal insulation)	W/m²K	0.30
Roof (flat roof)	W/m²K	0.18
Roof (pitched roof)	W/m²K	0.16
Floor	W/m²K	0.25
Glazing	W/m²K	1.40
Vision element	g-value	0.40
Air permeability	(m^3/h m^2 @ 50 Pa)	1. Less than 10 – only with an accredited air pressure test result 2. 10 – buildings > 500 m² built to 2002 Building Regulations (or later) 3. 15 – buildings <= 500 m² built to 2002 Building Regulations (or later) 4. 15 – Buildings built to 1995 Building Regulations 5. 25 – buildings built to Building Regulations pre 1995
Thermal Bridging	W/m²K	Default
HVAC System	Type	As per final building specification
Heating and Hot Water	Per cent	Efficiencies to match the applicable notional values for existing buildings (see tables 6.2, 6.4, 6.5 & 6.8 in Approved Document L2)
Cooling (air-condition)[2]	SEER	6. As per final building specification. Seasonal energy efficiency ratio (SEER) to match the applicable notional values for existing buildings (see table 6.9 in Approved Document L2)
Central ventilation SFP	W/l/s	Specific fan power to match the applicable notional values for existing buildings (see table 6.9 in Approved Document L2)
Terminal Unit SFP	W/l/s	Specific fan power to match the applicable notional values for existing buildings (see table 6.9 in Approved Document L2)
Heat Recovery	Per cent	70 per cent
Lighting	Lm/Watt	60

GLA Guidance 2022 - Appendix 3

3.2 Unregulated Energy Use

The unregulated energy use for the refurbished spaces can be derived from the BRUKL outputs under section "Energy Consumption by End Use" - Equipment.

Table 1 – Unregulated Energy Use

Unit	Unregulated Energy Use Kg/sqm
Regal Cinema- New	2,044
Regal Cinema- Refurb	6,179

The un-regulated emission rates are added to the baseline regulated emission rates (as calculated under 3.1 above) in order to set the total baseline emission rates before then applying the energy hierarchy in line with The London Plan and Hillingdon policies.

3.3 Baseline Results

The baseline building results have been calculated and are presented in Table 2 below. The Baseline BRUKL TER & BER outputs, which summarise the key data are attached at **Appendix A**.

Table 2 – Baseline energy consumption and CO_2 emissions

Unit	Total Regulated Emissions Kg/Annum	Total Unregulated Emissions Kg/Annum	Total Baseline Emissions Kg/Annum
Regal Cinema- New	19,247	2,044	21,291
Regal Cinema- Refurb	9,841	6,179	16,020
Development Total	**29,088**	**8,223**	**37,311**

The GLA Part L 2021 reporting spreadsheet is attached at **Appendix D.**

4.0 Design for energy efficiency

The first step in the Mayor's 'Energy Hierarchy' as laid out in Chapter 9 of The London Plan, requires that buildings be designed to use improved energy efficiency measures – Be Lean. This will reduce demand for heating, cooling, and lighting, and therefore reduce operational costs while also minimizing associated carbon dioxide emissions.

This section sets out the measures included within the design of the development, to reduce the demand for energy, both gas and electricity (not including energy from renewable sources). The table at the end of this section details the amount of energy used and CO_2 produced by the building after the energy efficiency measures have been included. From these figures the overall reduction in CO_2 emissions, as a result of passive design measures, can be calculated. To achieve reductions in energy demand the following measures have been included within the design and specification of the building:

4.1 Passive Design

Local and London Plan policy requires designers to introduce measures to control heat gain and deliver passive cooling.

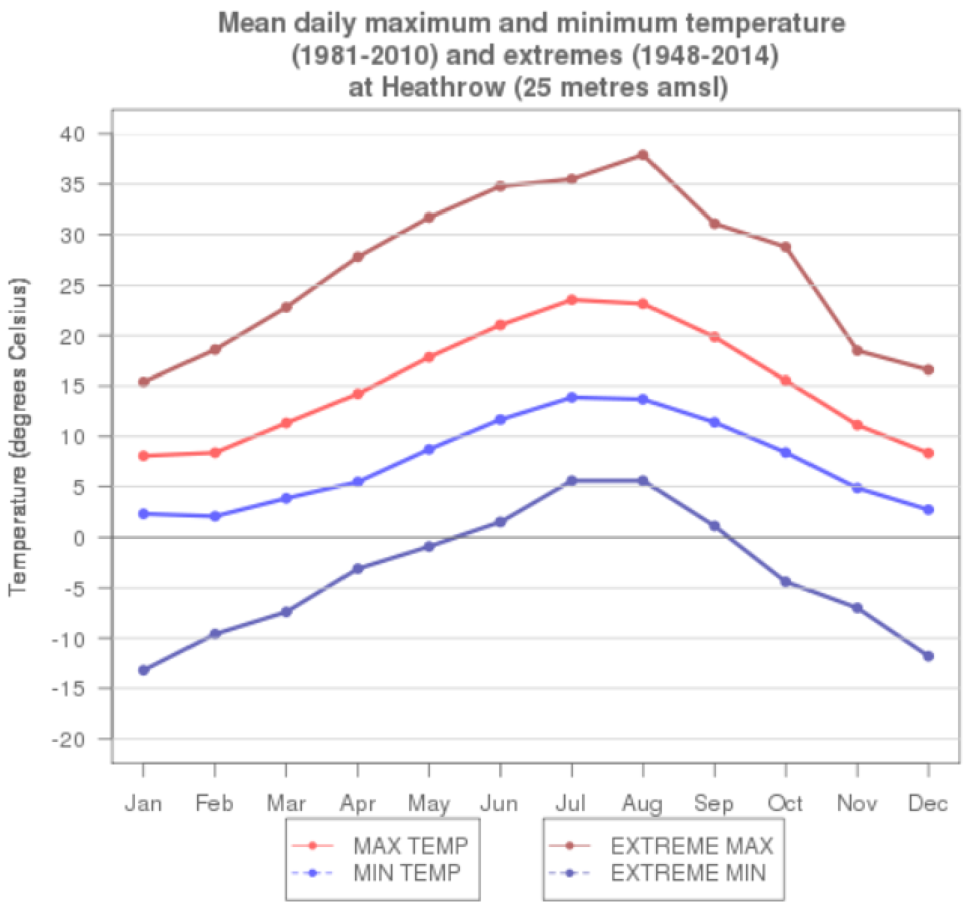
It is further explained that; "the NPPF emphasises the need to take account of climate change over the longer term and plan new developments to avoid increased vulnerability to the range of impacts arising from climate change. The UK Climate Impacts Programme 2009 projections suggest that by the 2080's the UK is likely to experience summer temperatures that are up to 4.2°C higher than they are today."

Accordingly, designers are to ensure buildings are designed and constructed to be comfortable in higher temperatures, without resorting to energy intensive air conditioning.

Accordingly, careful consideration of this issue has been undertaken as part of the application for renewal. The applicants will seek to follow the guidance within CIBSE Guide A and KS03 – Sustainable Low Energy Cooling; An Overview in order, where practical and feasible, to deliver a passive cooling strategy.

4.1.1 Local Environment

The project is located in London. Mean daily maximum temperatures range from just over 6 °C to 8 °C during the winter months and from 20 °C to 23 °C in the summer. These are comparable with typical values found in the summer in the London area which tends to be the warmest part of the UK. Thus, the area is not vulnerable to temperature extremes.



Across the region, sunshine annual averages 1600 hours in the London area, just above the UK average, while much of southern England receives less than 700 mm per year and includes some of the driest areas in the country.

The location in a high rise area of Uxbridge suggest that the project may well be affected by heat island effect and wind tunnels effects.

4.1.2 Passive Design

Clearly, the are limited passive design measures available to a conversation/extension project, with fixed orientations, but the design team have identified key opportunities;

- Minimising south facing hotel rooms
- New double glazing is to have a low g value to minimise internal heat gains.
- Rooms will have semi-reflective blinds installed to assist in reducing unwanted solar gains.
- Taking advantage of the existing concrete frame and heavyweight structure – exposing soffits and thermal mass to assist in the regulation of heat within the internal spaces.
- The use of low energy LED lighting will be significant in reducing internal heat gains.
- Hotel room equipment will also be selected in order to limit internal gains.

4.1.3 Services

The new hotel accommodation will utilise a low energy natural ventilation strategy, via trickle ventilation and opening windows.

The building will be tested for air tightness, seeking to achieve a 10 or better enables better control of the air balance into the space.

The design team has confirmed that the use of variable refrigerant flow heat pumps is proposed to provide heating and cooling in a superefficient manner as part of "be green" HVAC solution, the justification for which will be confirmed as this report progresses through the Energy Hierarchy.

Finally, a low energy lighting system – utilising linear surface mounted or suspended direct/indirect, LED luminaires in all newly created rooms and other occupied areas - controlled via reactive lighting switches and absence detectors - will ensure a/ minimal internal gains, b/ low energy consumption and c/ much reduced running costs.

4.2 Heating System

The "notional" heating system considered under the "be lean – use less energy" section of the Energy Hierarchy for the refurbished element will consist of heat pump driven heating with the assumption of mechanical cooling as set out in the GLA Guidance (June 2022).

Domestic hot water will also be provided by the same systems via appropriately size calorifiers and a secondary return loop.

To increase the efficiency in the use of the heating system, the following controls will be used to eliminate needless cycling of the heat pumps.

- BMS systems enabling load compensation and delayed start thermostats.

4.3 Fabric heat loss

Insulation measures will be utilised to ensure the calculated U-values exceed the Building Regulations minima, with specific guidance taken from the design team:-

- New wall constructions will be of a highly insulated light frame, meeting a u-value at 0.20W/m^{2}k or better.
- Existing Wall constructions will be internally lined and will target a U-Value of 0.28W/m2k or better.
- The new warm roof will be insulated to meet a U-Value of 0.15W/m^{2}k or better.
- The heat loss floors will be retro-insulated and will target a U-Value of 0.15W/m2k or better, with a similar performance for intermediate floors.

Air Tightness

- The newly refurbished spaces will be air tested to rating at circa $10m^3/hr/m^2$, while the new build element will be assumed to meet $3m^3/hr/m^2$.

Glazing

- New and replacement double glazing is to achieve a u value at $1.4W/m^2k$, with a g value at 0.40.

4.4 Ventilation

As noted above, the proposed natural ventilation strategy will offer low energy ventilation via trickle ventilation, opening windows and en-suite extraction on trickle and boost.

4.5 Waste Water Heat Recovery

The project is to install waste water heat recovery to the shower units to recover a minimum of 50% of heat from drained shower water.

4.6 Lighting and appliances

The development will incorporate high efficiency light fittings utilising LED lamps.

Common/circulation areas will also have an absence detection system to ensure lights cannot be left on when not in occupation.

The new hotel rooms will have key-card control for electrical systems

4.7 Energy efficiency results

The above data has been used to update the SBEM models the Building Emission Rate outputs of which are attached at **Appendix B**, with the reporting spreadsheet at **Appendix D**.

The following Table 3 shows the emissions levels, as well as the overall emissions from the building.

Table 3 – Energy Efficient emission levels

Unit	Total Regulated Emissions Kg/Annum	Total Unregulated Emissions Kg/Annum	Total Emissions Kg/Annum
Regal Cinema- New	13,016	2,044	15,060
Regal Cinema- Refurb	8,159	6,179	14,338
Development Total	**21,175**	**8,223**	**29,398**

The results show that the energy efficiency measures introduced have resulted in the reduction in CO_2 emissions from the development by **21.21%**

Further, the GLA reporting spreadsheet confirms that the passive design/"Be Lean" measures have resulted in a reduction in regulated emissions at **27.20%**

5.0 Supplying Energy Efficiently

The second stage in the Mayor's 'Energy Hierarchy' is to ensure efficient and low carbon energy supply – Be Clean. In particular, this concerns provision of decentralised energy where practical and appropriate.

5.1 Community Heating/Combined Heat and Power (CHP)

The London Plan, Chapter 9, requires that major developments exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly. Development in Heat Network Priority Areas should follow the heating hierarchy in Policy SI3 Energy infrastructure.

Therefore, this report must consider the availability of heat networks in the local area

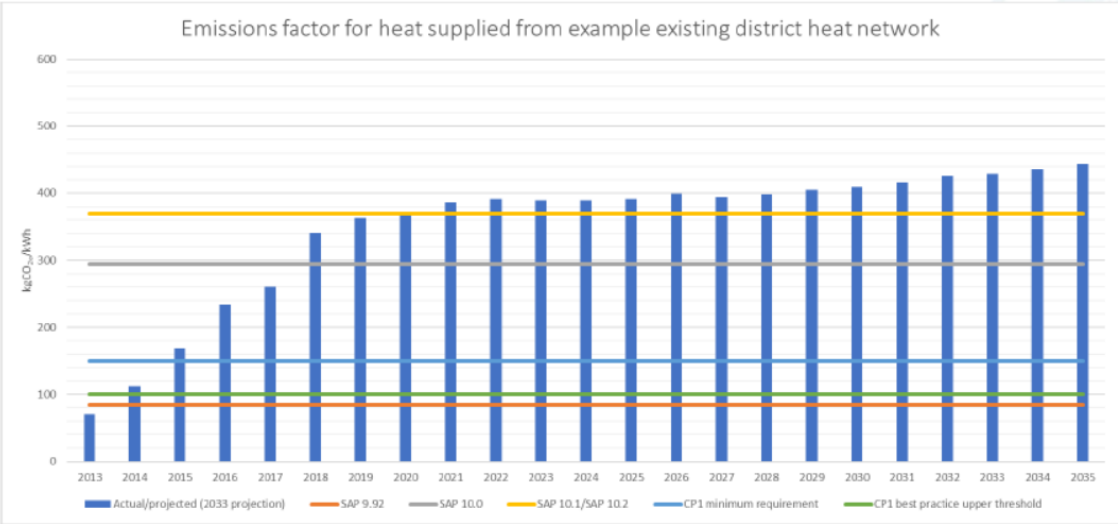
The extract from the London Heat Map (reproduced below) indicates that the Regal Cinema site is within the Heat Network Priority Area, and on the proposed Hillingdon - Uxbridge and Brunel Uni DEN, and also in an area of high network potential

Extract from London Heat Map

As a non-major scheme, there is no obligation to be DEN connection ready; however, in any hotel/hostel development, the DHW demand is by far the largest of the energy loads and the calorifiers and circulation equipment will all be located in at ground floor level.

Should the proposed DEN become available to the project/hotel - then the plant space is available and it would be perfectly feasible to connect the hotel to the DEN to deliver the DHW requirements.

However, the decarbonisation of the UK electricity grid (see further commentary below) is having a detrimental impact on the carbon efficiency of heat networks, with the current grid based CO2 emissions rending the emission factors for networks some 3 times that of electrical only heat pump systems.



DEN Emission Factors Over Time

So should there be any opportunity to connect to any future network, this would have to be subject to a further feasibility exercise accounting for DEN heat losses and emission factors to ensure the quality of any such connection.

5.3 On-site CHP/District Heating

The heat production facility for a district heating scheme is generally considered to include heat only boilers (HOB) and/or the production of both electricity and heat i.e. CHP.

In order to optimise a CHP system, “sizing” is critical to the success of the project. The aim of the process is to maximise the potential financial savings and ensure compliance with current legislation.

The most important factor is to establish the energy profiles – the site’s electrical and thermal characteristics; these can be ascertained by referring to either the site’s utility bills or by following dynamic design data for new build projects.

Typically, to get the full environmental and financial benefits, CHP is sized to the heat load of a site. That will recover all of the heat and give the best overall efficiency. Excess electricity generated can be exported or a shortfall in power can be met through a supplier.

To gain a good level of benefit from operating a CHP system, it is advisable that running hours are at least 4,500 hours a year, whilst having a high and constant demand for heat. However, it could still be worth exploring CHP viability for some sites with a low demand for heat if there is a high demand for electrical output, and thereby off-set peak daytime tariffs.

However, the most suitable sites for CHP generally have year-round demand for heat – domestic hot water demand - where the unit will be run as “lead boiler”.

For units sized just above base load, thermal modulation is possible, where the unit is run at reduced output for short periods. In some cases, a limited amount of heat may be rejected in order to maintain the CHP unit running at full electrical output.

The key benefit from running a CHP engine is that it produces electricity, which can displace grid supplied electricity, which has significant carbon savings. It is for this reason that CHP is designed to run for as many hours of the year as possible.

A hotel scheme is usually a perfect candidate for a CHP installation - the high hot water load – present almost 24 hours a day, in combination with a low heating load (though the passive design measures already incorporated).

However, we must also consider the net carbon benefits from such a system as the de-carbonisation of national grid dilutes the benefits obtained from the higher efficiency of larger-scale CHP led system.

Reference is made to the key CIBSE Symposium on the topic; “An operational lifetime assessment of the carbon performance of gas fired CHP led district heating” (2016). This paper sets out a calculation methodology to determine the greenhouse gas emissions associated with district heat networks which use gas fired CHP as a heat source.

At the time, Part L 2013 calculations and CHP emissions savings are based on the grid based emission rate taken from the SAP 2012 3-year average - 519g/KwhCO2; SAP 2012 introduced a 15-year average at 381g/KwhCO2 to assist designers considering the longer term impacts.

Such a difference will markedly affect the relative calculated performance of a gas CHP engine versus a gas boiler.

The CIBSE paper further advises that “Using a typical good practice assumption of 40% thermal efficiency of the CHP, the threshold for net benefit is a grid carbon factor of around 338 gCO2/kWh. Below that threshold, CHP is found to be worse than a gas boiler and grid electricity.”

DECC provides data for treating energy and emissions in their guidance; this provides projections of grid emissions factors over the next 85 years. With the rapid and recent introduction of renewable technologies to the grid – wind power and PV - DECC’s “Green Book” guidance confirms assumptions that grid carbon intensity is currently at circa 230 gCO2/kWh.

SAP10.2 data, to be introduced in 2022 as part of the launch of the new building regulations and being utilised within this report uses a figure of 136 gCO_2/kWh.

So it can be surmised, that by the time an CHP led communal network at the Regal Cinema has reached maturity in 2 or 3 years, the carbon benefits will already have been lost.

The use of CHP can be dismissed.

6.0 Renewable Energy Options

The final element of the Mayor's 'Energy Hierarchy' requires development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible – Be Green.

Renewable energy can be defined as energy taken from naturally occurring or renewable sources, such as sunlight, wind, wave's tides, geothermal etc. Harnessing these energy sources can involve a direct use of natural energy, such as solar water heating panels, or it can be a more indirect process, such as the use of Biofuels produced from plants, which have harnessed and embodied the suns energy through photosynthesis.

The energy efficiency measures and the sourcing the energy efficiently outlined above have the most significant impact on the heating and hot water energy requirements for the development, and the associated reduction in gas consumption.

It should be noted, that when using SAP10.2 emission factors, each kWh of gas energy saved reduces emissions by 0.21kgCO_2/kWh, whereas, grid based electrical energy has a emissions factor of 0.136kgCO_2/kWh but a much higher cost – some 3.5 that of gas - and accordingly, emphasis will be placed upon "off-setting" grid based electricity in order to achieve the optimum use of renewable technologies, albeit, it should be noted that the emissions reduction impact of renewable technologies actually generating electricity will be considerably reduced.

This section then sets out the feasibility of implementing different energy technologies in consideration of: -

- Potential for Carbon savings
- Capital costs
- Running costs
- Payback period as a result of energy saved/Government incentives
- Maturity/availability of technology
- Reliability of the technology and need for back up or alternative systems.

6.1 Government incentives

6.1.1 Smart Export Guarantee (SEG)

Introduced in 2020, the SEG will enable solar photovoltaic (PV), wind, hydro and anaerobic digestion (AD) installations up to 5MW and micro-combined heat and power (micro-CHP) up to 50kW will be able to receive an export tariff under the policy.

The SEG is a market-led initiative, requiring electricity supply licensees to offer export tariffs to eligible generators. Suppliers are free to set their own SEG compliant tariff price (provided it is above zero pence at all times) and decide how their tariffs work.

Installation owners are able to shop around and select the Licensee of their choice based upon an offer of the most appropriate tariff.

Payment are made against metered exports only.

6.1.2 Renewable Heat Incentive

The Renewable Heat Incentive (RHI) was formally withdrawn for non-domestic application in March 2021.

6.2 Wind turbines

Wind turbines come in two main types'- horizontal axis and vertical axis. The more traditional horizontal axis systems rotate around the central pivot to face into the wind, whilst vertical axis systems work with wind from all directions.

The potential application of wind energy technologies at a particular site is dependent upon a variety of factors. But mainly these are: -

- Wind speed
- Wind turbulence
- Visual impact
- Noise impact
- Impact upon ecology

The availability and consistency of wind in urban environments is largely dependent upon the proximity, scale and orientation of surrounding obstructions. The Regal Cinema is bordered by the adjacent commercial developments of similar height in all directions. To overcome these potential obstructions and to receive practical amounts of non-turbulent wind, the blades of a wind turbine would need to be placed significantly above the roof level of the surrounding buildings and the proposed project at Regal Cinema itself.

It is inconceivable that any wind turbines of this size would be considered acceptable in this location.

6.3 Solar Energy

The hotel has areas of flat roofed areas - not taken up by terraces and existing plant - that could accommodate solar panels orientated to the south.

general, the roofs will have an unrestricted aspect, so there is scope therefore to site solar photovoltaic (PV) or water heating equipment at roof level.

6.3.1 Solar water heating

Solar water heating panels come in two main types; flat plate collectors and evacuated tubes. Flat plate collectors feed water, or other types of fluid used specifically to carry heat, through a roof mounted collector and into a hot water storage tank.

Evacuated tube collectors are slightly more advanced as they employ sealed vacuum tubes, which capture and harness the heat more effectively.

Both collector types can capture heat whether the sky is overcast or clear. Depending on location, approximately 900–1100 kWh of solar energy falls on each m^2 of unshaded UK roof surface annually. The usable energy output per m^2 of solar panel as a result of this amount of insolation ranges from between 380 – 550 kWh/yr.

Solar hot water systems are of course, displacing gas or high efficiency heat pumps for DHW provision; accordingly solar thermal systems tend to have a very poor pay back model.

Accordingly, given the limited roof space available and the strategy to off-set the electrical use, solar PV may be a stronger candidate (see below) and offer a greater return in terms of a return on investment.

Accordingly, solar thermal would not be the optimum solution for the proposed development.

6.3.2 Photovoltaics (PV)

A 1kWp (1 kilowatt peak) system in the UK could be expected to produce between 790-800kWh of electricity per year based upon a south east orientation according to SAP2005 methodology used by the Microgeneration Certification Scheme (MCS). The figure given in the London Renewables Toolkit is 783 kWh per year for a development in London.

Despite the withdrawal of the Feed in Tariff, PV panels also offer an attractive return due to the ever increasing cost of grid based electricity.

Accordingly, a 33 panel/14.52kWp PV array is to be accommodated at the new flat roof level - generating some 11,300kWh per annum.

6.4 Biomass heating

Biomass is a term given to fuel derived directly from biological sources for example rapeseed oil, wood chip/pellets or gas from anaerobic digestion. It can only be considered as a renewable energy source if the carbon dioxide emitted from burning the fuel is later recaptured in reproducing the fuel source (i.e. trees that are grown to become wood fuel, capture carbon as they grow).

Biomass heating systems require space to site a boiler and fuel hopper along with a supply of fuel – which can be very bulky items. There also needs to be a local source of biomass fuel that can be delivered on a regular basis. There are also issues with fuel storage and delivery which mitigate against this technology.

Additionally, a boiler of this type would replace the need for a conventional gas boiler and therefore offset all the gas energy typically used for space and water heating. However, biomass releases high levels of NO_x emissions and particulate matters, as well as other pollutants and would therefore have to be considered carefully against the high standard of air quality requirements the London boroughs; indeed, the whole of Hillingdon is a designated Air Quality Management Area. Accordingly, the use of biomass is not considered appropriate for this project.

6.6 Ground source heat pump

All heat pump technologies utilise electricity as the primary fuel source – in this case displacing gas, as such, the overall reduction in emissions when using this technology can be less effective when opposed to a technology that is actually displacing electricity.

Ground source heating or cooling requires a source of consistent ground temperature, which could be a vertical borehole or a spread of pipework loops and a 'heat pump'. The system uses a loop of fluid to collect the more constant temperature in the ground and transport it to a heat pump. In a cooling system this principle works in reverse and the heat is distributed into the ground.

The heat pump then generates increased temperatures by 'condensing' the heat taken from the ground, producing hot water temperatures in the region of 45°C. This water can then be used as pre-heated water for a conventional boiler or to provide space heating with an under floor heating system.

The use of a ground source heating/cooling system will therefore require:

- Vertical borehole or ground loop
- Use of under floor heating
- Space for heat pump unit

Clearly, there is no opportunity to install the required ground collectors, as such, ground source heating cannot be considered.

6.7 Air source heat pump

Air source heating or cooling also employs the principle of a heat pump. This time either, upgrading the ambient external air temperature to provide higher temperatures for water and space heating, or taking warmth from within the building and dissipating it to the outdoor air.

Given the requirement to future proof the development against future overheating potential, the design team are considering the use of variable refrigerant (VRF) flow air-to-air heating and cooling system which incorporates inter-zone heat recovery.

VRF systems can have numerous indoor units, served by a single outdoor unit, in both heating and cooling modes simultaneously. This mixed mode operation leads to energy savings as both ends of the thermodynamic cycle are delivering useful heat exchange. If a system has a cooling COP (Coefficient of Performance) of 3, and a heating COP of 4, then heat recovery operation could yield a COP as high as 7.

VRF typical layout

It should be noted that this perfect balance of heating and cooling demand is unlikely to occur for many hours each year, but whenever mixed mode is used energy is saved. In mixed mode the energy consumption is dictated by the larger demand, heating or cooling, and the lesser demand, cooling or heating is delivered free.

Accordingly, the design team are proposing the use of VRF heating and cooling to service the new hotel spaces.

This approach will obviate the need to utilise the fossil fuels, and in keeping with this strategy, DHW will also be provided via twin scrolling heat pump technology - generating the hotel rooms' DHW requirements at an efficiency of 430%.

As part of the electrical only strategy - back of house areas will utilise electric panel radiators.

6.8 Demand Side Response

6.8.1 Peak Load Reduction

The development features new and existing building elements. The performance of the existing and new fabric has been optimised to reduce the peak heating and cooling loads; this includes the enhancement of the existing building fabric/air permeability.

Having worked to reduce the peak loads, highly efficient heat pumps are proposed to meet the heat/coolth loads, such that the electrical demand is reduced.

6.8.2 Active Demand Response

The HVAC strategy is based on the use of an localised floor based HVAC systems, this can avoid wasting heat associated with longer duct and pipe runs, enabling a reduced peak load

Electrically, the design have reviewed the potential for use of battery storage onsite and have assessed the viability of using batteries to peak lop and also to maximise the use of onsite generated electricity.

By analysing both the PV output and the peak electrical demands, it is apparent that:

- The electricity generated by the PVs will be used at the point of generation and as such batteries will not impact the efficacy
- The payback period for a battery array to peak lop would be greater than the predicted lifespan of the battery array and as such is not deemed as economically viable.

6.9 Final Emissions Calculation

Given the outcome of the feasibility study above, the developer is proposing the use of VRF heat pump technology, to provide the required heating and cooling to the new hotel and hostel space, with heat pump technology providing the DHW.

A roof mounted 14.52kWp PV array will finalise the renewables mix.

The final table – Table 4 – summarises the final outputs from the SBEM models; the BRUKL output attached at **Appendix C.**

Table 4 – "Be Green" emission levels

Unit	Total Regulated Emissions Kg/Annum	Total Unregulated Emissions Kg/Annum	Total Emissions Kg/Annum
Regal Cinema- New	9,082	2,044	11,126
Regal Cinema- Refurb	6,091	6,179	12,270
Development Total	**15,173**	**8,223**	**23,396**

The data at Table 4 confirms that overall emissions – including unregulated energy use - have been reduced by **37.29%** over and above the baseline model, with a **16.09%** reduction in emissions directly from the use of energy generating and renewable technologies, i.e. over and above the energy efficient model.

Excluding the un-regulated use, i.e. considering regulated emissions controlled under AD L2, then the final reduction in BER/TER equates to **47.84%.**

Energy use intensities are reported below:-

Table 5 – Energy and Heat Demands

Building Type	Energy Use Intensity (kWh/m^2/year)	Space Heating (kWh/m^2/year)
Regal Cinema- New	60.67	44.17
Regal Cinema- Refurb	77.38	143.48

7.0 "Be Seen"

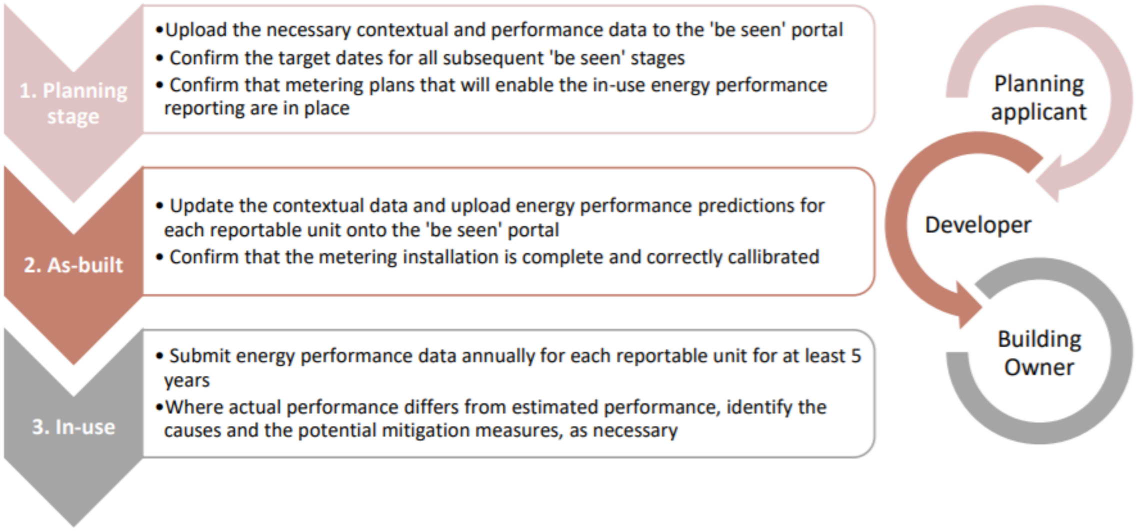
The "Be Seen" Energy Monitoring Guidance Consultation Draft was published in October 2020 and adopted in September 2021.

Although Part L calculations and Energy Performance Certificates (EPCs) give an indication of the theoretical performance of buildings, it is well established that there is a 'performance gap' between design theory and measured reality.

To address this gap the London Plan Policy SI 2 'Minimising greenhouse gas emissions' 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 via the Mayor's 'be seen' monitoring portal.

The 'be seen' policy establishes post-construction monitoring as good practice, enabling developers and building owners to better understand their buildings and identify methods for improving energy performance from the project inception stage and throughout the building's lifetime.

The extract below graphically 'be seen' process through the reporting stages of a development including the parties likely to be responsible for the provision of the necessary data at each reporting stage.



The applicants make the commitment that the development will be designed to enable post construction monitoring and that the information set out in the 'be seen' guidance is submitted to the GLA's portal at the appropriate reporting stages.

It is further acknowledged that this may be secured via legal agreement.

8.0 Sustainable Design & Construction

The sustainable assessment criteria as developed by BRE are utilised within this report to confirm that the development meets with the requirements of the Hillingdon's sustainability policies

8.1 Energy efficiency; vacant & underused land and buildings

For matters of Passive Design, Solar gain control & daylighting, Ventilation, Thermal Performance, Services Strategy, Low or zero carbon technologies and overall Energy Performance, all these matters have been dealt within the London Plan compliant Energy Statement within Sections 2 to 6 above.

8.2 Materials

The design team have put a strong focus on sustainability and durability when considering construction profiles and building materials for the development. High Green Guide ratings will be achieved wherever possible and materials will be assessed for suitability with regards to Whole Life Costs, which given the use of a retained building, is expected to perform extremely well.

Clearly, the rescue of the existing building - to be extended and improved to enhance useability and thereby, longevity – is clearly and highly sustainable by default.

The principal issue when considering the environmental impact of new construction materials is the embodied carbon – i.e. the carbon cost extraction of raw material, transport to factory, manufacturing, transport to site and erection on site.

Additional carbon costs are occurred through maintenance and repairs as well as end of life (deconstruction/demolition)

The design team will seek out construction techniques with a lower embodied carbon contents; steel work and lightweight concrete floor slabs.

It is recognised that concrete utilised to form the upper floors has a significant embodied CO_2e content, the majority of which comes from the cement, which makes up about 10% of concrete by volume, but accounts for around 75-90% of its embodied impact.

The team will aspire to utilise concrete with a significant recyclable content; concrete with a minim 30% GGBS content; higher if such product can be sourced at the time.

Emissions of CO_2 associated with calcium carbonate decomposition during concrete production are partly reversible through carbonation.

The mix design of structural concrete purposefully limits carbonation of the surface layer, preventing corrosion of any embedded steel reinforcement, which might otherwise be affected during the building's life. There is, however, a greater degree of carbonation during the end-of-life stage, when concrete is crushed for reuse as an aggregate. The crushing process substantially increases the material's surface area, allowing CO_2 to be more readily absorbed.

It is generally acknowledged that the concrete carbonisation process will remove up to 30% of the up-front embodied CO2e during the buildings lifespan, including end of life.

Other significant measure considered to reduce the project CO2e content include:-

- Structural Steels with a 30% recycled content
- Plasterboard with a significant recycled content – subject to market availability

In addition to the above low carbon strategy, the development will source all materials form supplier that can demonstrate that materials are sourced responsibly in line with recognised Environmental Management Systems (FCS, BES6001 etc.)

Insulating materials will be specified to maximise thermal performance whilst still paying attention to the environmental impact of the materials used. The use of recycled products will be pursued wherever feasible and the use of other low embodied energy products will be further investigated.

Non-toxic materials will be used wherever possible, including the specification of products with low VOC content in line with European testing standards.

A Site Waste Management Plan (SWMP) will be produced for the site, which will determine how to maximise the recovery of materials from the enabling works for subsequent high-grade/value applications.

8.3 Air pollution

Construction site impacts

The construction site will be managed in such a way that the environmental impact is minimised. This includes following best practice policies for dust pollution by using dust sheets, covering skips and damping down where appropriate.

The contractor will be enrolled on the Considerate Constructors Scheme and achieve a best practice score of at least 35.

Plant and machinery

All plant and equipment installed in the building will be appropriately sized and selected for efficiency in order to reduce greenhouse gas emissions. All equipment will be frequently maintained to ensure it continues to run efficiently and cleanly.

Operational impacts

The use of heat pump technology for all heating systems and domestic hot water systems, confirms that the project will have a neutral impact on local air quality.

8.4 Noise pollution

Construction site impacts

The construction site will be managed in such a way that the environmental impact is minimised. This includes following best practice policies to minimise noise pollution, including the use of quieter machinery where possible. Site working hours will be managed to mitigate the possibility that they will cause a nuisance to the surrounding properties.

Noise impact of the building

The development will comply with Building Regulations Part E, providing a good level of sound insulation between the proposed development and surrounding buildings.

All external plant and potential noise impacts of the new ventilation and AC plant in operation will be assessed, attenuated and reported upon accordingly.

8.5 Contaminated land

It is not thought that the site is contaminated, however, given the previous commercial use, a site investigation will be undertaken to investigate this issue, with any contaminants formally remediated.

The proposed building use will not involve the storage, processing or transfer of hazardous substances.

8.6 Water quality, saving and drainage

Flood risk and surface water drainage

The design team have commissioned a formal report to consider the projects risk of flooding from all sources, the projects impact on surface water run-off and appropriate attenuation measures.

Water consumption

Internal potable water use will be limited through the specification of low flow fittings and dual flush toilets. All white goods provided will have maximum water efficiency ratings.

The following specifications will be considered in order to meet the water consumption target:

- Basin Taps - 5l/min
- WCs – 5/2.6 litre flush
- Showers – 7.5l/min

Construction site impacts

The construction site will be managed in such a way that the environmental impact is controlled and minimised. Best practice guidelines for preventing water pollution will be followed on site.

8.7 Light pollution

Any external lighting will be designed in accordance with the ILE guidance so as not contribute to increasing the effects of light pollution.

8.8 Waste and recycling

Site waste management

A construction site resource management plan will be developed and implemented to ensure that construction site waste is effectively reduced and recycled, including designing waste out from the initial stages. Material ordering control and modern construction methods will be employed to minimise the potential for waste on site.

Waste will either be segregated on site into at least 5 different streams for recycling or collected, sorted and recycled by an external recycling contractor. Re-use of construction waste will also be encouraged. The site waste management plan will also ensure that hazardous waste is properly managed.

Operational waste management

The recycling of operational waste once the building is occupied will also be encouraged through the provision of recycling facilities and dedicated internal and external storage for recyclable materials, separate to those for domestic refuse.

The PES

9.0 Conclusions

This report has detailed the baseline energy requirements for the proposed development, the reduction in energy demand as a result of energy efficiency measures and the potential to achieve further CO_2 reductions using renewable energy technologies.

Throughout the assessment against the energy hierarchy – as set out in The London Plan – SAP10.2 emissions data has been used in line with the very latest GLA guidance on the preparation of energy statements.

The baseline results have shown that if the development was built to a standard to meet only the minimum requirements of current building regulations, the total amount of CO_2 emissions would be **37,311Kg/year**

Following the introduction of passive energy efficiency measures into the development, as detailed in section 4, the total amount of CO_2 emissions would be reduced to **29,398Kg/year**

There is also a requirement to reduce CO_2 emissions across the development using renewable or low-carbon energy sources. Therefore the report has considered the feasibility of the following technologies:

- Wind turbines
- Solar hot water
- Photovoltaic systems
- Biomass heating
- CHP (Combined heat and power)
- Ground & Air source heating

The results of the assessment of suitable technologies relative to the nature, locations and type of development suggest that the most suitable solution to meeting reduction in CO_2 emissions would be via the use of VRF heat pump technology to service the heat and cooling loads, as well as the DHW demand.

There will also be an 14.52kWp PV array at roof level on the new extension.

This has been used in the BRUKL models (reproduced at **Appendix C**) for the development which have also been detailed above in Table 4, which show a final gross emission level of **23,396Kg/year**, representing a total reduction in emissions over the baseline model, taking into account unregulated energy, of **37.29%.**

In addition, the final BRUKL outputs at **Appendix C** demonstrate that the building achieves an overall improvement in emissions over the Building Regulations Part L standards for regulated emissions of minimum of **47.84%**.

Tables 6 & 7 Demonstrate how the Regal Cinema project complies with the London Plan requirements and the GLA guidance relating to zero carbon development.

Table 6 – Carbon Emission Reductions – Non-domestic Buildings

Key	Tonnes/annum
Baseline CO_2 emissions (Part L 2013 of the Building Regulations Compliant Development)	29.1
CO2 emissions after energy demand reduction (be lean)	21.2
CO2 emissions after energy demand reduction (be lean) AND heat network (be clean)	21.2
CO2 emissions after energy demand reduction (be lean) AND heat network (be clean) AND renewable energy (be green)	15.2

Table 7 – Regulated Emissions Savings – Non-domestic Buildings

	Regulated Carbon Dioxide Savings	
	(Tonnes CO2 per annum)	%
Savings from energy demand reduction	7.9	27%
Savings from renewable energy	6.0	21%
Total Cumulative Savings	**13.9**	**48%**
	(Tonnes CO_2)	
Carbon Shortfall	15.2	
Cumulative savings for off-set payment	**455**	
Cash-in-lieu Contribution	**£43,242**	

Appendix A

Baseline/Un-regulated Energy Use:-

BRUKL Outputs & Target/Building Emission Rates

Appendix B

Energy Efficient Design:-

BRUKL Outputs & Building Emission Rate

Appendix C

Generating energy on-site:-

Final BRUKL Outputs & Building Emission Rate

Appendix D

GLA SAP201 Reporting Tool