Expansion of Kingsgate Primary School and Redevelopment of Liddell Road

Sustainability and Energy Statement

Submitted in support of
Application 01 for Phase 01
Application 02 for Phase 02
December 2014

Camden

London Borough of Camden
Kingsgate Primary School

ATELIER TEN
19 Perseverance Works
38 Kingsland Road
London E2 8DD
T +44 (0) 20 7749 5950
F +44 (0) 20 7729 5388

Cert No. 0497

036

PROJECT INFORMATION

JOB TITLE: LIDDELL ROAD AND KINGSGATE PRIMARY SCHOOL
JOB NUMBER: 3708
DOCUMENT TITLE: SUSTAINABILITY & ENERGY STATEMENT
VERSION: REV. 01
DIGITAL FILE NAME: 3708 Sustainability & Energy Statement 141201 Rev01.indd

PREPARED

PREPARED BY: JAMES LACY-SMITH & ED CREMIN

SIGNED: JLS & EC

DATED: 21.11.2014

CHECKED

CHECKED BY: MICHELA MANGIAROTTI

SIGNED: MM

DATED: 28.11.14

APPROVED

APPROVED BY: RUDOLPH DUNCAN-BOSU

SIGNED: RDB

DATED: 28.11.14

REVISIONS

NO.:	DATE:	APPROVED:
01	01.12.2014	RDB
02		
03		

Contents

- Blank Page -

0.0 Executive Summary

The Sustainability and Energy Statement sets out the environmental sustainability and energy strategy for the proposed Kingsgate school expansion and redevelopment of Liddell Road in response to the London Borough of Camden (LBC's) and Greater London Authority's (GLA's) current planning requirements.

The development consists of four buildings: the primary school, the workspace the residential mansion building and tall residential building. The development will be built in two phases. Phase 1 will include the school. Phase 2 will include the workspace and residential buildings. Each phase will meet planning requirements independently of each other. As such, this statement will illustrate how the school will meet the planning requirements as part of Phase 1, and the entire site including the school and siet wide enabling works, workspace and residential elements as part of Phase 2.

Sustainability lies at the core of the proposed development of Liddell Road and Kingsgate Primary School as a whole. By adopting a sustainable approach in design, construction and operation, the proposed development aims to meet the requirements of the current local planning policy and exceed Building Regulations standards wherever it is technically, functionally and economically viable.

Both the primary school and workspace will be built to achieve a BREEAM Excellent target rating. Both the mansion and taller residential blocks will be designed and built to achieve Code for Sustainable Homes (CSH) Level 4.

The proposed development tackles the following key environmental areas: energy and CO_2 emissions, water, surface water run-off, materials, waste, pollution, health and wellbeing, management, ecology and land use, and transport.

The Mayor's energy hierarchy has been applied to the design strategy of the Liddell Road development and Kingsgate Primary School to minimise CO_2 emissions from the operation of, and within, the buildings.

Passive design measures have been adopted, such as efficient built form, high levels of insulation and airtightness and solar overheating control optimization. In particular the proposed U-values and air permeability will be better than Building Regulations Part L 2013 standards.

Active energy efficient systems have been integrated as part of the low carbon strategy. Some of the strategies which are currently proposed include mixed mode ventilation, mechanical ventilation with heat recovery, underfloor heating in the residential buildings, highly efficient heating, cooling and domestic hot water (DHW) systems, energy efficient internal and external lighting, lifts, appliances and workspace equipment, energy display devices in the residential units, a building energy management system (BEMS) and sub-meters in the school, workspace and residential common areas.

An initial feasibility study was carried out to establish the low and zero carbon (LZC) technologies most appropriate for the proposed development. As part of Phase 1 photovoltaic (PV) panels on the roof of the school building are proposed to offset a portion of the school's electricity demand.

As part of Phase 2 a site-wide community energy system, including a gas fired combined heat and power (CHP) system and back up gas fired condensing boilers is proposed to serve the whole site. PV panels on the roofs of the residential and workspace blocks are proposed. An air source heat pump (ASHP) is also proposed for the workspace block.

From initial sizing, it has been estimated that the CHP plant will be able to provide the majority of the DHW to the whole site, as well as a portion of the space heating for the whole development. The PV panels will be able to supply some electricity for fans, pumps, lighting and small power. The ASHP will provide the majority of the space heating and cooling to the workspace block.

From an initial energy assessment, it has been estimated that the whole of the proposed development will achieve a 20% carbon saving as part of Phase 1 and Phase 2 separately through on-site renewable energy technologies, thus meeting the 20% CO_2 emissions reduction target set by LBC.

In Phase 1 the school will achieve a minimum 35% improvement over Part L 2013, thus meeting the 35% CO_2 emissions reduction target over Part L 2013 set by the GLA. In Phase 2, the workspace building will achieve a 35.2% improvement over Part L 2013, thus meeting the 35% CO_2 emissions reduction target set by the GLA. The residential buildings will achieve a 53% improvement over Part L 2013, thus meeting the 35% CO_2 emissions reduction target set by the GLA.

Once Phase 1 and Phase 2 are completed and the proposed community scheme is connected to provide heating to both phases, the entire masterplan will achieve a 43% improvement over Part L 2013, thus meeting the 35% CO_2 emissions reduction target.

The consumption of potable water in sanitary applications and landscape irrigation will be minimised through the adoption of low water use fixtures and fittings, a low-water irrigation strategy, including planting of low maintenance species, and water sub-meters. The feasibility rainwater recycling will be assessed as a measure to further reduce potable water use on the proposed development. The risk of leaks on the mains water supply and in toilet facilities will also be reduced through appropriate systems in the school and workspace blocks.

The proposed development will be situated in a

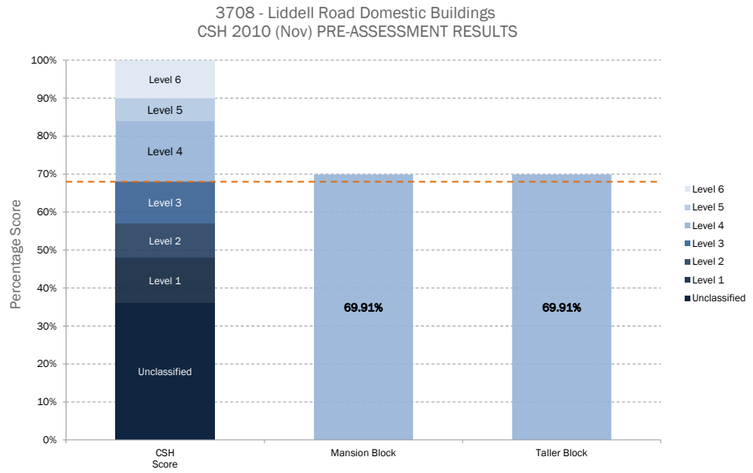


FIGURE 0.1. SUMMARY OF THE CSH LEVELS AND SCORES TARGETED BY THE RESIDENTIAL BUILDINGS

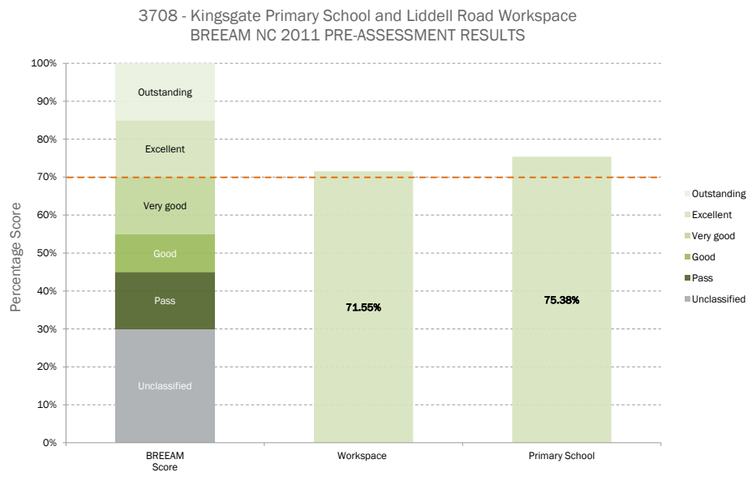


FIGURE 0.2. SUMMARY OF THE BREEAM LEVELS AND SCORES TARGETED BY THE WORKSPACE AND SCHOOL BUILDINGS

low flood risk area, as confirmed by the Flood Risk Assessment (FRA) undertaken by Price & Myers. Surface water run-off storage and attenuation measures and Sustainable Drainage Systems (SuDS), including rainwater harvesting and permeable paving, will be evaluated and adopted where appropriate to reduce and delay the discharge of rainfall run-off to public sewers and watercourses.

The use of construction materials with a low environmental impact over the full life cycle of the buildings will be ensured by specifying materials with a minimum 'Green Guide to Specification' rating of A, wherever feasible. These materials aspire to be responsibly sourced (i.e. EMS certified). Any timber will be legally sourced (e.g. FSC certified). The frequency of material replacement will be minimised by protecting vulnerable parts of the building and landscape.

Waste sent to landfill will be minimised during the buildings' construction and operation through the development and implementation of a Site Waste Management Plan (SWMP), the use of recycled and/or secondary aggregates (if these can be reasonably procured) and the provision of adequate dedicated storage space for recyclable waste.

Insulating materials with low Global Warming Potential (GWP) will be specified. Night time light pollution will also be minimised. Potential noise from the new buildings affecting nearby noise-sensitive buildings will be reduced by adopting noise attenuation measures, if required. Extensive acoustic attenuation will be provided to the school and residential blocks to reduce the impact of noise caused by the proximity of railway lines to the site.

The health and well-being of the occupants will be promoted by ensuring a good access to daylight and views out, adequate glare and solar overheating control, internal and external lighting compliant with best practice for visual performance and comfort, adequate indoor ambient noise levels and sound insulation levels, internal finishes and fittings with low emissions of volatile organic compounds (VOCs), good indoor air quality, appropriate thermal comfort levels, water systems that reduce the risk of legionellosis and good quality communal outdoor spaces.

Through a consultation process, the relevant stakeholders have been involved in the design process in order to deliver functional, accessible and inclusive buildings. The implementation of effective measures will reduce the opportunity for crime. The final design will embody the recommendations of the local police Architectural Liaison Officer (ALO) or Crime Prevention Design Advisor (CPDA) on designing out opportunity for crime, in accordance with the principles and guidance of "Secured by Design" (SbD).

The building contractor will be contractually required to comply with best practice principles under the Considerate Constructors Scheme (CCS). An appropriate level of building services commissioning will be carried out during construction and operation to ensure optimum performance under occupancy conditions. Home/ Building User Guides will be provided to the occupants to enable them to operate their homes/ school/office efficiently and make the best use of local facilities.

The proposed buildings will be developed on a previously developed site of low ecological value and their impact will enhance the ecological value of the site. The site will also undertake an evaluation of whether major remedial works are required during construction. The recommendations included in the ecological assessment undertaken by The Ecology Consultancy for enhancement of the site ecology will be implemented. A landscape and habitat management plan will be produced to protect and enhance local biodiversity. As a key strategy to promote biodiversity to the site, brown and/or green roofs will be adopted where feasible.

The use of private vehicles to move building users to and from the site will be minimised through the location in proximity to an excellent public transport network and local amenities, the provision of adequate dedicated cycle storage for the users of all the buildings, and scooter spaces for children at the school as well as the development of a green travel plan. A well-planned site layout will provide safe and secure pedestrian and cycle access routes and delivery and manoeuvring operations.

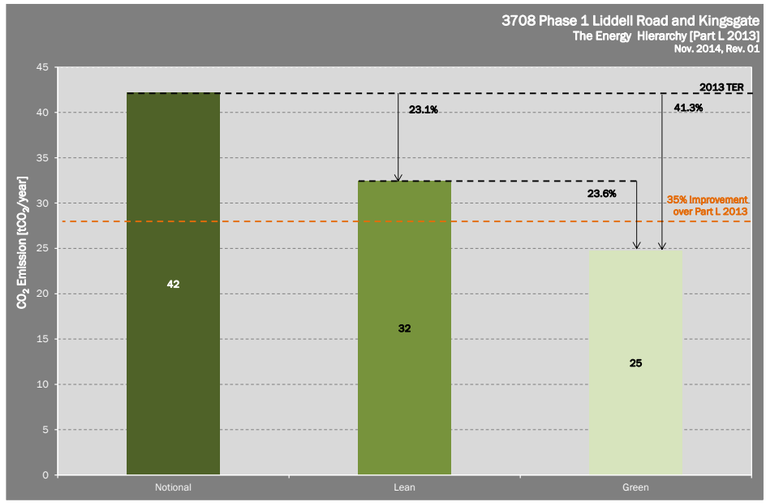


FIGURE 0.3. CHART ILLUSTRATING THE AREA-WEIGHTED AVERAGE CARBON SAVINGS (IN TCO_2/YEAR) IN THE SCHOOL BUILDINGS IN PHASE 1, EXCLUDING UNREGULATED LOADS, ACCORDING TO PART L 2013.

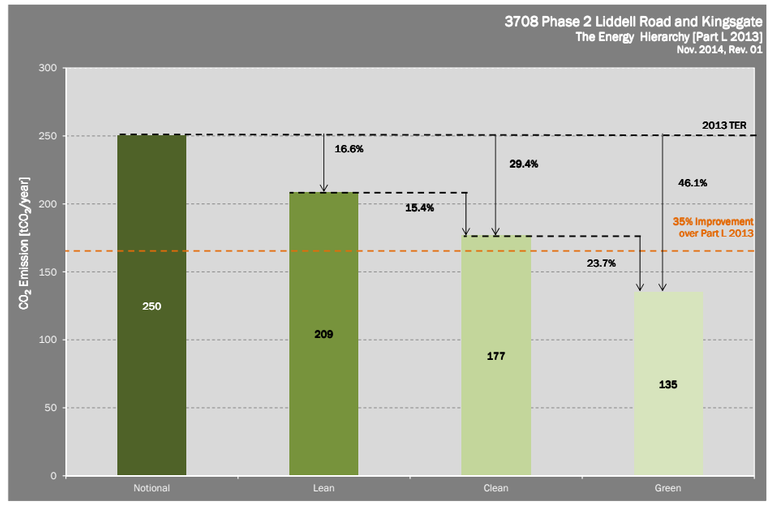


FIGURE 0.4. CHART ILLUSTRATING THE ESTIMATED CARBON SAVINGS (IN TCO_2/YEAR) ACROSS ALL BUILDINGS IN PHASE 2, EXCLUDING UNREGULATED LOADS, ACCORDING TO PART L 2013.

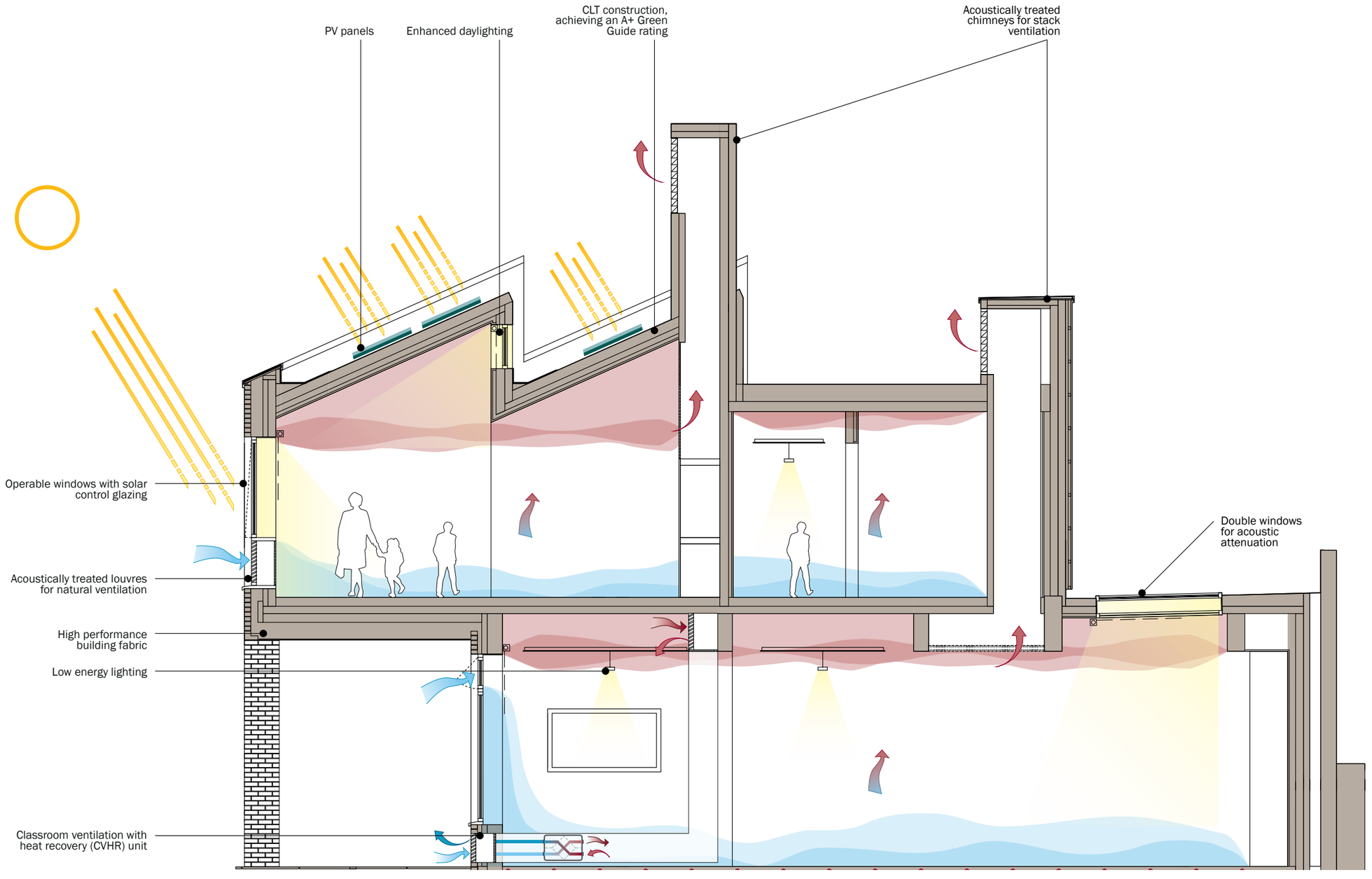


FIGURE 0.5 PROPOSED ENVIRONMENTAL STRATEGY FOR KINGSGATE SCHOOL

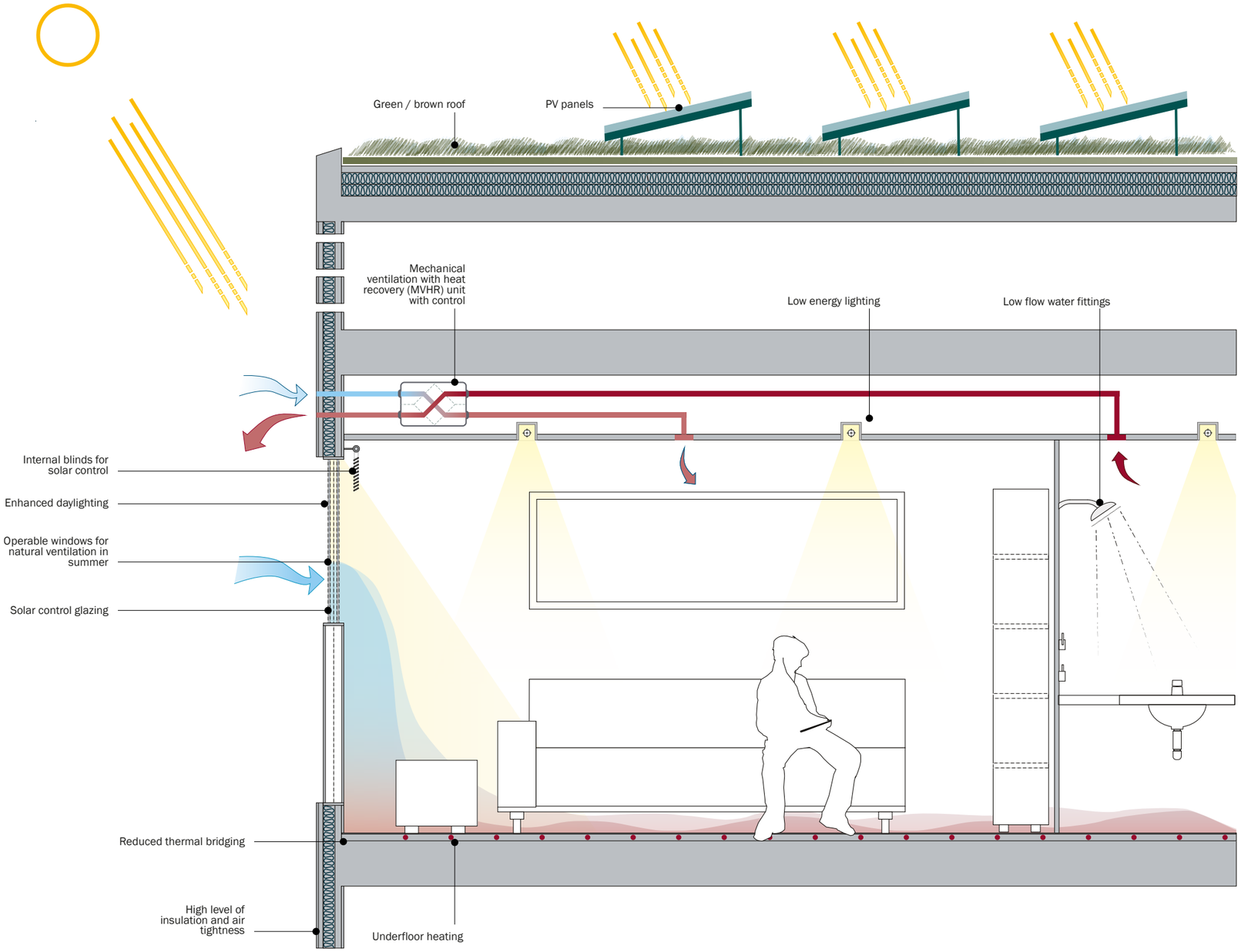


FIGURE 0.6 PROPOSED ENVIRONMENTAL STRATEGY FOR A TYPICAL RESIDENTIAL UNIT WITHIN LIDDELL ROAD DEVELOPMENT

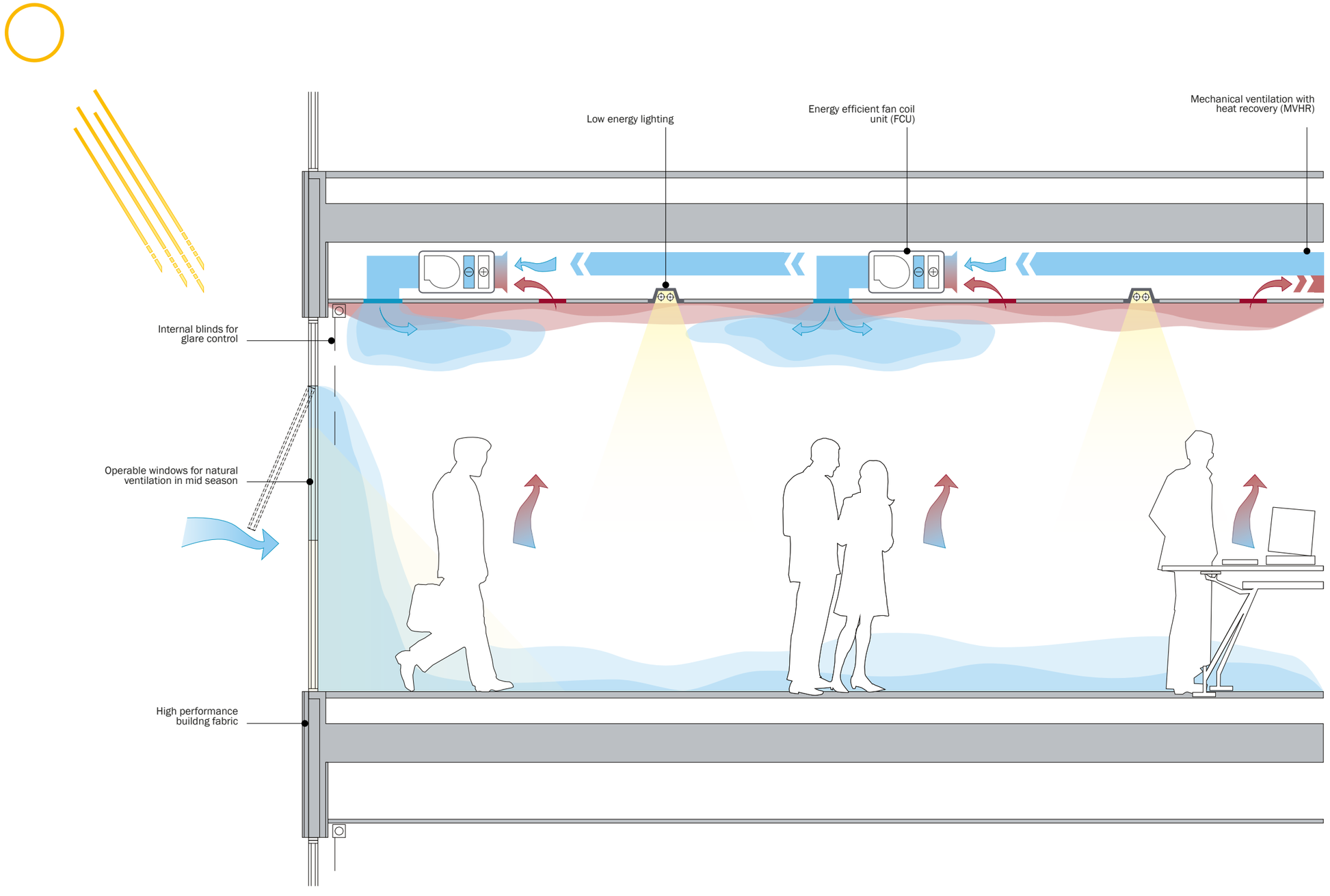


FIGURE 0.7 PROPOSED ENVIRONMENTAL STRATEGY FOR A TYPICAL WORKSPACE FLOOR WITHIN THE LIDDELL ROAD DEVELOPMENT

- Blank Page -

1.0 Introduction

Atelier Ten have compiled this Sustainability and Energy Statement on behalf of the London Borough of Camden (LBC) (the Applicant) for the proposed Kingsgate school expansion and Liddell Road redevelopment.

The development consists of four buildings: the primary school, the workspace block the mansion residential building and taller residential building. The development will be built in two phases. Phase 1 will include the school. Phase 2 will include the workspace and residential buildings. Each phase will meet planning requirements independently of each other. As such, this statement will illustrate how the school will meet the planning requirements as part of Phase 1, and the entire site including the school, workspace and residential elements as part of Phase 2.

This Statement sets out the environmental sustainability and energy strategy for the proposed development in response to the LBC's and Greater London Authority's (GLA's) current planning requirements.

Sustainability lies at the core of the proposed Kingsgate school expansion and Liddell Road redevelopment as a whole. By adopting a sustainable approach in design, construction and operation, the proposed development aims to satisfy the requirements of the current local planning policy and exceed Building Regulations standards, wherever it is technically, functionally and economically viable. These requirements are summarised under section 2.0 Key Drivers.

This Statement outlines both the sustainable design and construction measures and energy and CO_2 emissions saving measures proposed for the proposed Kingsgate school expansion and Liddell Road redevelopment with reference to renewable energy technologies. These are illustrated in sections 4.0 Sustainability Strategy and 5.0 Energy Strategy.

The proposed development tackles the following key environmental areas: energy and CO_2 emissions, water, surface water run-off, materials, waste, pollution, health and wellbeing, management, ecology and land use, and transport. These are illustrated in section 4.0 Sustainability Strategy.

To demonstrate the environmental awareness of the proposed development, Atelier Ten has undertaken a BREEAM preliminary assessment of the workspace and school buildings and a Code for Sustainable Homes (CSH) preliminary assessment of the residential blocks. This is illustrated in section 3.0 Benchmarking, 6.0 Appendix A BREEAM Pre-Assessment and 6.0 Appendix B. CSH Pre-assessments.

FIGURES 1.1, 1.2, 1.3. AND 1.4. VIEWS OF THE PROPOSED DEVELOPMENT. (IMAGES COURTESY OF MACCREANOR LAVINGTON AND JCLA)

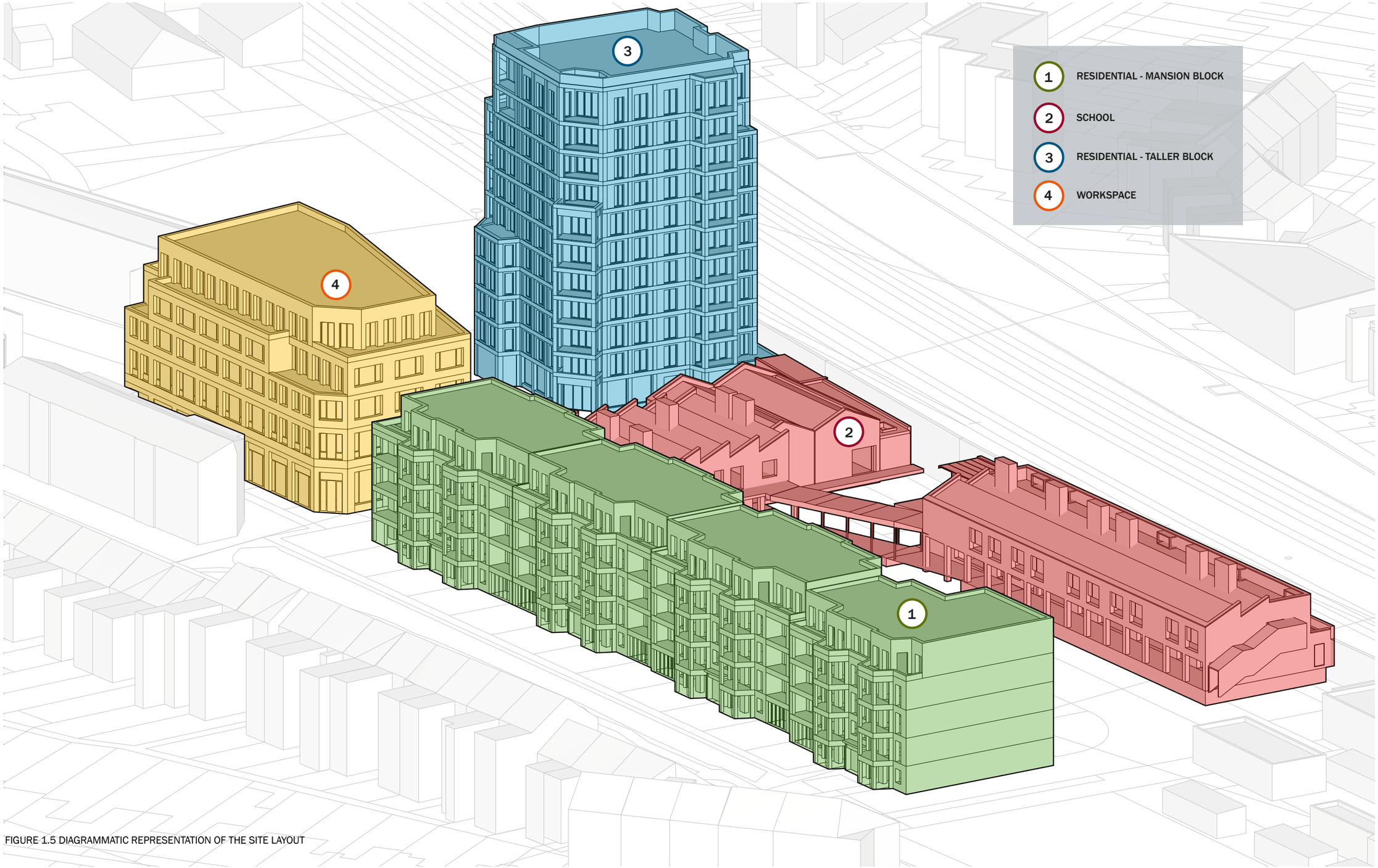


FIGURE 1.5 DIAGRAMMATIC REPRESENTATION OF THE SITE LAYOUT

2.0 Key Drivers

2.1 Planning Policy Context

CURRENT PLANNING POLICY:

- National Planning Policy Framework (NPPF), published in March 2012
- The London Plan (LP), published in July 2011
- The London Plan (LP) - Revised Early Minor Alterations (REMA), published in October 2013
- Energy Planning Guidance, published in April 2014
- The London Housing Strategy (LHS), published in February 2010
- Sustainable Design and Construction Supplementary Planning Guidance (SPG), published in April 2014
- London Housing Design Guide (LHDG) – Interim Edition, published in August 2010
- Housing Supplementary Planning Guidance (SPG), published in November 2012
- Camden Council Local Development Framework (LDF), adopted in November 2010
- Camden Core Strategy (CS), adopted in November 2010
- Camden Development Policies (DP), adopted November 2010
- Camden Planning Guidance 3 Sustainability (CPG3), published in September 2013

2.1.1 NATIONAL PLANNING POLICY FRAMEWORK

The National Planning Policy Framework (NPPF) is a key part of the Government's reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth. It sets out the Government's planning policies for England and how these are expected to be applied. The NPPF replaces the current suite of national Planning Policy Statements, Planning Policy Guidance Notes and some Circulars.

This document does not contain any specific environmental sustainability and energy targets.

2.1.2 THE LONDON PLAN, INCLUDING REVISED EARLY MINOR ALTERATIONS

The London Plan (LP), published in July 2011, sets out the spatial development strategy for London. It is the overall strategic plan for London, setting out an integrated economic, environmental, transport and social framework for the development of the capital to 2031. It forms part of the development plan for Greater London. London boroughs' local plans need to be in general conformity with the LP, and its policies guide decisions on planning applications by Councils and the Mayor.

In October 2013, the Mayor published Revised Early Minor Alterations to the London Plan (REMA). From this date, the REMA are operative as formal alterations to the LP and form part of the development plan for Greater London.

Policy 5.2 Minimising Carbon Dioxide Emissions requires all new residential buildings to achieve a 40% improvement on Part L of the Building Regulations 2010 by 2013 and be carbon zero by 2016. It also requires all new non-domestic buildings to achieve a 40% improvement on Part L of the Building Regulations 2010 by 2013 and be carbon zero by 2019.

The minimum target for residential buildings to be achieved by 2016 is equivalent to the CO_2 emissions requirement for CSH Levels 5 and 6. The minimum target for non-domestic buildings to be achieved by 2013 is approximately equivalent to the CO_2 emissions requirement for BREEAM New Construction (NC) Outstanding rating.

The CO_2 reduction targets should be met on-site. Where it is clearly demonstrated that the specific targets cannot be fully achieved on-site, any shortfall may be provided off-site or through a cash-in-lieu contribution to the relevant borough to be ring fenced to secure delivery of CO_2 savings elsewhere.

Policy 5.3 Sustainable Design and Construction requires development proposals to demonstrate that sustainable design standards are integral to the proposal, including its construction and operation, and ensure that they are considered at the beginning of the design process.

Major development proposals should meet the minimum standards outlined in the Mayor's supplementary planning guidance (SPG). These standards include measures to achieve other policies in the LP and the following sustainable design principles:

- Minimising CO_2 emissions across the site, including the building services (such as heating and cooling systems)
- Avoiding internal overheating and contributing to the urban heat island effect
- Efficient use of natural resources (including water), including making the most of natural systems both within and around buildings
- Minimising pollution (including noise, air and urban run-off)
- Minimising the generation of waste and maximising reuse or recycling
- Avoiding impacts from natural hazards (including flooding)
- Ensuring developments are comfortable and secure for users, including avoiding the creation of adverse local climatic conditions
- Securing sustainable procurement of materials, using local supplies where feasible
- Promoting and protecting biodiversity and green infrastructure

Policy 5.6 Decentralised Energy in Development Proposals requires development proposals to evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.

Major development proposals should select energy systems in accordance with the following hierarchy:

- Connection to existing heating or cooling networks
- Site wide CHP network
- Communal heating and cooling

Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.

Policy 5.7 Renewable Energy requires, within the framework of the energy hierarchy, all major development proposals to provide a reduction in expected CO_2 emissions through the use of on-site renewable energy generation, where feasible.

In the LP there is a presumption that all major development proposals will seek to reduce CO_2 emissions by at least 20% through the use of on-site renewable energy generation, wherever feasible.

Policy 5.15 Water Use and Supplies requires designing all residential developments so that mains water consumption would meet a target of 105 litres/person/day.

The maximum water target for residential buildings is equivalent to the minimum requirement for water consumption for CSH Levels 3 and 4.

The LP also includes Policies 2.18 Green Infrastructure: The Network of Open and Green Spaces, 3.2 Improving Health and Addressing Health Inequalities, 5.9 Overheating and Cooling, 5.10 Urban Greening, 5.11 Green Roofs and Development Site Environs, Policy 5.12 Flood Risk Management, 5.13 Sustainable Drainage, 5.14 Water Quality and Wastewater, 5.15 Water Use and Supplies, 5.17 Waste Capacity, 5.18 Construction, Excavation and Demolition Waste, 5.19 Hazardous Waste, 5.21 Contaminated Land, 5.22 Hazardous Substances and Installations, 6.9 Cycling, 6.10 Walking, 6.13 Parking, 7.14 Improving Air Quality, 7.15 Reducing Noise and Enhancing Soundscapes, 7.19 Biodiversity and Access to Nature, and 7.21 Trees and Woodlands. These policies do not contain any specific environmental sustainability and energy targets.

2.1.3 SUSTAINABLE DESIGN AND CONSTRUCTION SUPPLEMENTARY PLANNING GUIDANCE

The Sustainable Design and Construction Supplementary Planning Guidance (SPG), published in April 2014, provides guidance on the implementation of LP Policy 5.3, as well as a range of policies, primarily in Chapters 5 and 7, that deal with matters relating to environmental sustainability.

In section 2.2 Land, the SPG recommends to:

- Provide space for individual or communal food growing, where possible and appropriate
- Take advantage of existing spaces to grow food, including adapting temporary spaces for food growing

In section 2.5 Renewable Energy, the SPG states that:

- Developers are encouraged to incorporate monitoring equipment, and systems where appropriate to enable occupiers to monitor and reduce their energy use

In section 2.6 Water Efficiency, the SPG states that:

- Developers should maximise the opportunities for water saving measures and appliances in all developments, including the reuse and using alternative sources of water
- Developers should design residential schemes to meet a water consumption rate of 105 litres or less per person per day
- New non-residential developments, including refurbishments, should aim to achieve the maximum number of water credits in a BREEAM assessment or the 'best practice' level of the AECB (Association of Environment

Conscious Building) water standards
- All developments should be designed to incorporate rainwater harvesting
- All residential units, including individual flats/ apartments and commercial units, and where practical, individual leases in large commercial properties should be metered

In section 2.7 Materials and Waste, the SPG states that:
- The design of developments should prioritise materials that:
  - Have a low embodied energy, including those that can be reused intact or recycled - at least three of the key elements of the building envelope (external walls, windows roof, upper floor slabs, internal walls, floor finishes/coverings) are to achieve a rating of A+ to D in the BRE's The Green Guide of Specification
  - Can be sustainably sourced - at least 50% of timber and timber products should be sourced from accredited Forest Stewardship Council (FSC) or Programme for the Endorsement of Forestry Certification (PEFC) source
  - Are durable to cater for their level of use and exposure
  - Will not release toxins into the internal and external environment, including those that deplete stratospheric ozone
- The design of developments should maximise the potential to use pre-fabrication elements
- Developers should maximise the use of existing resources and materials and minimise waste generated during the demolition and construction process through the implementation of the waste hierarchy
- Developers should provide sufficient internal space for the storage of recyclable and compostable materials and waste in their schemes
- The design of developments should meet borough requirements for the size and location of recycling, composting and refuse storage and its removal

In section 2.8 Nature Conservation and Biodiversity, the SPG states that:
- There is no net loss in the quality and quantity of biodiversity
- Developers make a contribution to biodiversity on their development site

In section 3.2 Tackling Increased Temperature and Drought, the SPG states that:
- Developers should include measures, in the design of their schemes, in line with the cooling hierarchy set out in LP Policy 5.9 to prevent overheating over the scheme's lifetime
- The design of developments should prioritise landscape planting that is drought resistant and has a low water demand for supplementary watering

In section 3.3 Increasing Green Cover and Trees, the SPG states that:
- Developers should integrate green infrastructure into development schemes, including by creating links with wider green infrastructure network
- Any loss of a tree(s) resulting from development should be replaced with an appropriate tree or group of trees for the location, with the aim of providing the same canopy cover as that provided by the original tree(s)

In section 3.4 Flooding, the SPG states that:
- Developers should maximise all opportunities to achieve greenfield runoff rates in their developments
- Developers should design Sustainable Drainage Systems (SuDS) into their schemes that incorporate attenuation for surface water runoff as well as habitat, water quality and amenity benefits
- Developments are designed to be flexible and capable of being adapted to and mitigating the potential increase in flood risk as a result of climate change

The document also includes guidance on how to off-set CO_2 where the CO_2 reduction targets set out in Policy 5.2 of the LP cannot be met on-site. Any shortfall should be provided off-site or through a cash-in-lieu contribution to the relevant borough.

The price of carbon should be developed by boroughs based on either:
- A nationally recognised CO_2 pricing mechanism
- The cost of reducing off-setting CO_2 emissions across the borough

Nationally recognised prices for CO_2 include:
- The Zero Carbon Hub price, currently £60 per tonne of CO_2
- The non-trading price of carbon

The overall contribution should be calculated over 30 years. For example, using the Zero Carbon Hub price, the contribution equates to £60 per tonne of CO_2 x 30 years = £1,800 per tonne of CO_2 to be off-set.

The cost of off-setting CO_2 emissions could include an assessment of the CO_2 offsetting measures possible in the borough and dividing it by the anticipated amount of development coming forward over the next 30 years. The price for a locally specific fund should be published in a Supplementary Planning Document.

2.1.4 ENERGY PLANNING GUIDANCE

The Energy Planning Guidance, published in April 2014, provides guidance on preparing energy assessments for major development proposals. Each assessment is required to demonstrate compliance with the carbon reduction targets set out in LP Policy 5.2.

Following the 2013 changes to Part L of the Building Regulations, which came into force from 6th April 2014, the carbon reduction targets set out in LP Policy 5.2 have been revised.

The Energy Planning Guidance requires from 6th July 2014 all new residential and non-domestic buildings to achieve a 35% improvement on 2013 Part L of the Building Regulations. This is deemed to be broadly equivalent to the 40% improvement over 2010 Part L of the Building Regulations, as specified in LP Policy 5.2 for 2013-2016.

2.1.5 LONDON HOUSING STRATEGY

The London Housing Strategy (LHS), published in February 2010, is London's first statutory housing strategy.

Policy 2.2D requires all new publicly funded homes to meet at least CSH Level 4 by 2011.

Policy 2.1B requires all new homes to be built to Lifetime Homes standards and at least 10% to be wheelchair accessible.

The LHS requires all homes developed with public funding to deliver high quality in line with the London Housing Design Guide from 2011.

2.1.6 INTERIM LONDON HOUSING DESIGN GUIDE

The Interim London Housing Design Guide (LHDG), published in August 2010, sets a new benchmark for housing design in London. All housing built on London Development Agency land is expected to meet these standards.

The standards also apply to housing schemes applying for funding from the London Homes and Communities Agency (HCA) from April 2011.

The Interim LHDG requires all new publicly funded housing developments and all new homes on GLA owned land to achieve a minimum of CSH Level 4.

2.1.7 HOUSING SUPPLEMENTARY PLANNING GUIDANCE

The Housing Supplementary Planning Guidance (SPG), published in November 2012, provides guidance on how to implement the housing policies in the 2011 LP. As SPG, it is a material consideration in drawing up development plan documents and in taking planning decisions. Standard 6.1.1 requires all new residential developments to achieve a minimum of CSH Level 4.

In accordance with Policy 5.2 of the LP, Standard 6.2.1 requires all new residential developments to achieve a 40% improvement on Part L of the Building Regulations 2010 by 2013 and be carbon zero by 2016.

In accordance with Policy 5.15 of the LP, Standard 6.4.1 requires all new dwellings to be designed to ensure a maximum water consumption of 105 litres/person/day.

Policy 3.8 – Housing Choice Strategic requires all new housing to be built to Lifetime Homes standards and 10% of new housing to be designed to be wheelchair accessible, or easily adaptable for residents who are wheelchair users.

2.1.8 CAMDEN COUNCIL LOCAL DEVELOPMENT FRAMEWORK

Camden Council's Local Development Framework (LDF) is a suite of planning documents which outline the borough's planning policies, including the Core Strategy, Development Policies and Planning Guidance. It replaced Camden Council's Unitary Development Plan (UDP) in November 2010.

Planning applications in Camden Council are determined in accordance with the Camden Council's Core Strategy, Development Policies and

the London Plan.

2.1.9 CAMDEN CORE STRATEGY

The Camden Core Strategy (CS) was adopted on 8th November 2010 and is part of Camden Council's LDF. This document sets out the key elements of Camden's vision for the borough.

The CS includes Policies CS11 - Promoting sustainable and efficient travel, CS13 - Tackling climate change through promoting higher environmental standards, CS14 - Promoting high quality places and conserving our heritage, CS15 - Protecting and improving our parks and open spaces and encouraging biodiversity, CS16 - Improving Camden's health and well-being, CS17 - Making Camden a safer place, and CS18 - Dealing with our waste and encouraging recycling. These policies provide guidance on:

- Promoting more sustainable travel
- Making Camden more sustainable and tackling climate change, in particular improving the environmental performance of buildings, providing decentralised energy and heating networks, and reducing and managing water use
- Promoting a more attractive local environment through securing high quality places, conserving heritage, providing parks and open spaces, and encouraging biodiversity
- Improving health and well-being
- Making Camden a safer place while retaining its vibrancy
- Dealing with waste and increasing recycling

However, these policies do not contain any specific environmental sustainability and energy targets.

In section CS13, the CS states that the Council expects developments to achieve at 20% reduction in CO_2 emissions through on-site renewable energy generation (which can include sources of site-related decentralised renewable energy) unless it can be demonstrated that such provision is not feasible.

2.1.10 CAMDEN DEVELOPMENT POLICIES

The Camden Development Policies (DP) was adopted on 8th November 2010 and is part of Camden Council's LDF. This document sets out detailed planning criteria that Camden use to determine applications for planning permission in the borough.
The DP includes Policies DP6 - Lifetime Homes and wheelchair housing, DP16 - The transport implications of development, DP17 - Walking, cycling and public transport, DP18 - Parking standards and limiting the availability of car parking, DP19 - Managing the impact of parking, DP20 - Movement of goods and materials, DP21 - Development connecting to the highway network, DP22 - Promoting sustainable design and construction, DP23 - Water, DP24 - Securing high quality design, DP25 - Conserving Camden's heritage, DP26 - Managing the impact of development on occupiers and neighbours, DP28 - Noise and vibration, DP29 - Improving access, DP31 - Provision of, and improvements to, open space and outdoor sport and recreation facilities, and DP32 - Air quality and Camden's Clear Zone. These policies provide guidance on:

- Providing housing suitable for people with mobility difficulties
- Promoting sustainable and efficient transport
- Promoting sustainable design and construction
- Reducing water consumption and the risk of surface water flooding
- Securing high quality design and conserving heritage
- Managing the impact of development and noise and vibration
- Providing and improving open space, sport and recreation
- Improving access, air quality and Camden's Clear Zone

However, these policies do not contain any specific environmental sustainability and energy targets, except for policy DP6 and DP22.

Policy DP6 - Lifetime Homes and wheelchair housing states that all housing developments should meet Lifetime Homes standards. 10% of homes developed should either meet wheelchair housing standards, or be easily adapted to meet them.

Policy DP22 states that the Council will promote and measure sustainable design and construction by:

- Expecting new build housing to meet CSH Level 4 by 2013 and encouraging CSH Level 6 (zero carbon) by 2016
- Expecting new non domestic developments of 500 m^2 of floorspace or above to achieve BREEAM 'Very Good' rating and BREEAM 'Excellent' from 2016, and encouraging zero carbon from 2019

2.1.11 CAMDEN PLANNING GUIDANCE

The Camden Planning Guidance 3 Sustainability (CPG3) was updated on 4th September 2013 and is part of Camden Council's LDF. This document provides advice and information on how Camden apply their planning policies and is an additional "material consideration" in planning decisions.
In section 2 the CPG3 states that developments involving five or more dwellings and/or 500 m^2 (gross internal) floorspace or more are required to submit an energy statement, which demonstrates how CO_2 emissions will be reduced in line with the energy hierarchy.

In section 3 the CPG3 states that a full model of the building should be carried out to ensure that the building design optimises solar gain and daylight without resulting in overheating for developments comprising five dwellings or more or 500 m^2 or more of any floorspace. It also states that appliances which are A+ rated should be specified.

In section 5 the CPG3 states that, where feasible and viable, developments are required to connect to decentralised energy networks or include CHP. The Council expects developments to connect to a decentralised energy network and use the heat unless developers can demonstrate it is not technically feasible or financially viable.

Where there is no connection and or no agreement to connect developments within three years to a decentralised energy network, onsite CHP are expected where the heating demand makes it feasible. Where there is a willing user for the heat, schemes are expected to export heat to at least a similar heat demand, where feasible and viable. Where the development containing the combined heat and power plant has a large electricity demand, a larger amount of heat may be expected to be exported to enable the maximum viable electricity production to be generated on-site. Where there is more than one occupier, use or building a community heating network will be expected.

Developments which fall within proposed within 1 km of an existing decentralised energy network, or one that is likely to be operational within three years of occupation of the development, should assess the feasibility of connecting to the network. A connection should be made unless it can be clearly demonstrated that it would not be viable. Where no connection is made, a financial contribution will be sought.

Size of development	Residential (per dwelling) or per 300 m^2 of non-residential floorspace
Over 20 stories	£ 2,800
8 - 20	£ 2,500
5 - 7	£ 2,800
3 - 4	£ 4,100
2 - 3	£ 5,300
Single dwelling houses or single storey commercial developments	£ 8,600

Source: Community energy: Urban planning for a low carbon future

TABLE 2.1. FINANCIAL CONTRIBUTIONS

Developments which are proposed within 500m of a potential network which have no timetable for delivery should ensure that the development is capable of connecting to a network in the future.

A financial contribution will be sought to fund the future expansion of the network, unless on-site CHP is feasible and included as part of the development.

The financial contribution should be in line with table highlighted in this section:

In section 6 the CPG3 states that all developments are to target at least a 20% reduction in CO_2 emissions through the installation of on-site renewable energy technologies. When assessing the feasibility and viability of renewable energy technology, the Council will consider the overall cost of all the measures proposed and resulting carbon savings to ensure that the most cost-effective carbon reduction technologies are implemented in line with the energy hierarchy.

In section 7 the CPG3 states that at least 50% of water consumed in homes and workplaces does not need to be of drinkable quality. Buildings with gardens or landscaped areas that require regular maintenance are required to be fitted with water butts. Developments over 10 units or 1,000 m^2 are required to include a greywater harvesting system, unless the applicant demonstrates to the Council's satisfaction that this is not feasible.
In section 8 CPG3 states that all developments should aim for at least 10% of the total value of materials used to be derived from recycled and reused sources. This should relate to the WRAP Quick Wins assessments or equivalent. Major developments are anticipated to be able to achieve 15-20% of the total value of materials

used to be derived from recycled and reused sources. A Site Waste Management Plan is required for all developments of a minimum of five dwellings or 500m².

In new-build development projects with either 500m² of any floorspace or more or five dwellings or more the design team should seek to achieve an area weighted average of A+ to B for major building elements (roof, external walls, floor finishes, internal partitions and windows) in accordance with the BRE Green Guide to Specification.

Where demolition is necessary, the developer and contractor are encouraged to optimise the reuse and recycling of demolition materials. The Council strongly encourages the use of the Demolition Protocol where substantial demolition is proposed (over 1,000 m²).

In section 9 the CPG3 states that, if the scheme includes both residential and non-residential uses that total 500 m² of floorspace or more, the Council will require two assessments: a CSH assessment for the residential part and a BREEAM assessment for the non-residential parts.

All new housing is required to achieve CSH Level 4 from 2013 and Level 6 from 2016. In addition, they are required to achieve 50% of the un-weighted credits in the Energy category, 50% of the un-weighted credits in the Water category and 50% of the un-weighted credits in the Materials category of their CSH assessment.

All new non-domestic buildings are required to achieve a BREEAM 'Excellent' rating from 2013 onwards and 60% of the un-weighted credits in the Energy category, 60% of the un-weighted credits in the Water category and 40% of the un-weighted credits in the Materials category of their BREEAM assessment.

In section 10 the CPG3 states that the Council expects all developments to incorporate brown roofs, green roofs and green walls unless it is demonstrated this is not possible or appropriate.

In section 11 the CPG3 states that developments must not increase the risk of flooding, and are required to put in place mitigation measures where there is known to be a risk of flooding.

Within the areas shown on Core Strategy Map 5 (Development Policies Map 2) the Council expects water infrastructure to be designed to cope with a 1 in 100 year storm event in order to limit the flooding of, and damage to, property. Note that the project site is not located within this Map.

All sites in Camden over one hectare or 10,000 m² require a Flood Risk Assessment in line with Planning Policy Statement 25 (PPS25). Note that since 6th March 2014 PPS25 has been superseded by the new Planning Practise Guidance (PPG) published entirely online by the Department for Communities and Local Government (DCLG).

The Council also expects developments to achieve a greenfield surface water run-off rate once SUDS have been installed. As a minimum, surface water run-off rates should be reduced by 50% across the development.

In section 13 the CPG3 states that where, exceptionally, damage or loss to natural habitats is unavoidable and or inadequate mitigation proposed, compensatory measures will be required. This may involve new habitat creation or habitat enhancement, a contribution towards meeting the objectives of the Camden Biodiversity Action Plan (BAP) or improvements to the Boroughs biodiversity. The Council will seek to use planning conditions and planning legal agreements to achieve this.

2.2 Summary of Targets

The most stringent environmental, sustainability and energy targets set out by the current local planning policies are summarised below:

Site-wide:
- The whole development to reduce CO_2 emissions by at least 20% through the use of on-site renewable energy generation
- At least 50% of timber and timber products to be sourced from accredited Forest Stewardship Council (FSC) or Programme for the Endorsement of Forestry Certification (PEFC) source
- All domestic appliances specified to be A+or A-rated as a minimum
- Surface water run-off rates to be reduced by at least 50% across the whole development with a target to achieve greenfield run-off rates
- The water infrastructure to be designed to cope with a 1 in 100 year storm event

Non-Domestic Buildings:
- The non-domestic buildings to achieve a minimum 35% improvement on 2013 Part L of the Building Regulations
- The non-domestic buildings to achieve BREEAM 'Excellent'
- The non-domestic buildings to achieve 60% of the un-weighted credits in the Energy category, 60% of the un-weighted credits in the Water category and 40% of the un-weighted credits in the Materials category of their BREEAM assessment
- The non-domestic buildings to achieve the maximum number of water credits in a BREEAM assessment or the 'best practice' level of the AECB (Association of Environment Conscious Building) water standards if feasible
- All major building elements to be procured using the BRE Green Guide of Specification

Residential Buildings:
The new residential buildings to achieve a minimum 35% improvement on 2013 Part L of the Building Regulations
- All homes to achieve Code for Sustainable Homes (CSH) Level 4
- All homes to achieve 50% of the un-weighted credits in the Energy category, 50% of the un-weighted credits in the Water category and 50% of the un-weighted credits in the Materials category of their CSH assessment
- All homes to meet a maximum water consumption of 105 litres/person/day
- All major building elements to be procured using the BRE Green Guide of Specification
- All homes to be built to Lifetime Homes standards
- At least 10% of all new homes to designed to be wheelchair accessible, or easily adaptable for residents who are wheelchair users

3.0 Benchmarking

3.1 Code for Sustainable Homes

All dwellings as part of the Mansion and Taller residential buildings within the proposed Liddell Road development and Kingsgate Primary School aim to achieve Code for Sustainable Homes (CSH) Level 4.

Atelier Ten has undertaken a CSH preliminary assessment of the residential buildings under the CSH scheme, dated November 2010.

The assessed residential buildings have targeted the following scores at pre-assessment stage, which are beyond the threshold of 68% necessary to achieve CSH Level 4:

- Mansion Block : 69.91%
- Taller Block: 69.91%

In addition to meeting the target threshold, all the dwellings will achieve a minimum un-weighted score for each of the following categories:

- 50% of credits in the Energy category
- 50% of credits in the Water category
- 50% of credits in the Materials category

Considering the worst case scenario, the pre-assessment provides an example of a combination of measures that could be used to achieve the desired CSH level and not an evaluation of the likely level to be achieved under a formal CSH assessment based on the current design.

The pre-assessment only provides an estimate of the CSH level. The predicted score is likely to change after a formal assessment by a licensed CSH assessor which requires documentary evidence to support the awarding of credits in the scheme.

Other dwellings in the same development may achieve different scores but the same CSH level. In fact, each of them will perform in a slightly different manner due to its orientation and size.

There is no set way of achieving the target CSH level and once mandatory standards will be met, the tradable credits will be able to build up the points required to reach the desired level. Hence, not all the same tradable credits will be achieved by each dwelling but it is expected that all the dwellings in the proposed development will achieve the CSH level required by the current local planning policy.

The pre-assessment shows that the proposed residential buildings can achieve a minimum score of 68%, and included in section Section 6 - Appendix A.

The CSH pre-assessment reflects the high aspirations for the proposed development. The resolution of all the credits can only be determined once the full RIBA Stage 4 detailed design and appointment of a contractor has been carried out. As such they should be viewed as aspirational and some credits may not be achieved, in which case alternative credits will be explored. These are presented as a guideline only and are not intended to be a binding approach to the proposed development.

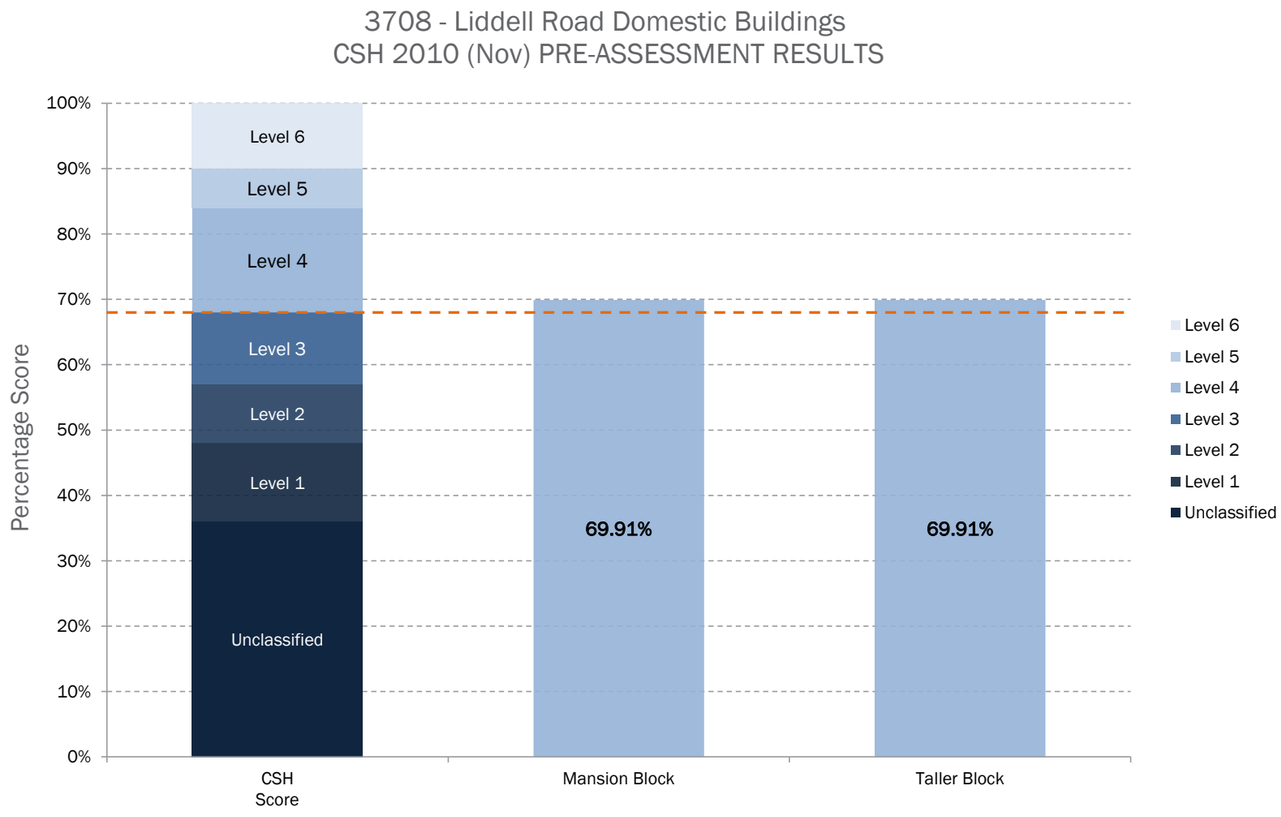


FIGURE 3.1. SUMMARY OF THE CSH LEVELS AND SCORES TARGETED BY EACH HOUSING TYPOLOGY.

3.2 BREEAM

The Kingsgate primary school and workspace buildings of the proposed Liddell Road redevelopment aim to achieve a BREEAM NC Excellent rating.

Atelier Ten has undertaken BREEAM pre-assessments of the school and workspace buildings under the 2011 version of BRE's New Constructions scheme.

The assessed buildings have targeted the following at the pre-assessment stage which are beyond the threshold of 70% required:

- School: 75.38%
- Workspace: 71.55%

In addition to meeting the target threshold, the buildings will achieve a minimum un-weighted score for each of the following categories:

- 60% of credits in the Energy category
- 60% of credits in the Water category
- 40% of credits in the Materials category

The pre-assessment provides an example of a combination of measures that could be used to achieve the desired BREEAM level and not an evaluation of the likely level to be achieved under a formal BREEAM assessment based on the current design. Further, the pre-assessment only provides an estimate of the BREEAM level. The predicted score is likely to change after a formal assessment by a licensed BREEAM assessor which requires documentary evidence to support the awarding of credits in the scheme.

There is no set way of achieving the target BREEAM score and once mandatory standards will be met, the tradable credits will be able to build up the points required to reach the desired level. Hence, not all the same tradable credits will be achieved by each dwelling but it is expected that all the dwellings in the proposed development will achieve the BREEAM level required by the current local planning policy.

The pre-assessment, showing that the proposed workspace and school buildings can achieve a score of 70% are enclosed in section 6 - Appendix B.

The BREEAM pre-assessment reflects the developer's aspirations for the proposed development. The resolution of all the credits can only be determined once the full RIBA Stage 4 design is complete and the appointment of a Contractor has been completed. As such the targeted credits should be viewed as aspirational and are not intended to be a binding approach to sustainability - as some credits may not be achieved, in which case alternative credits will be explored to meet the required BREEAM target.

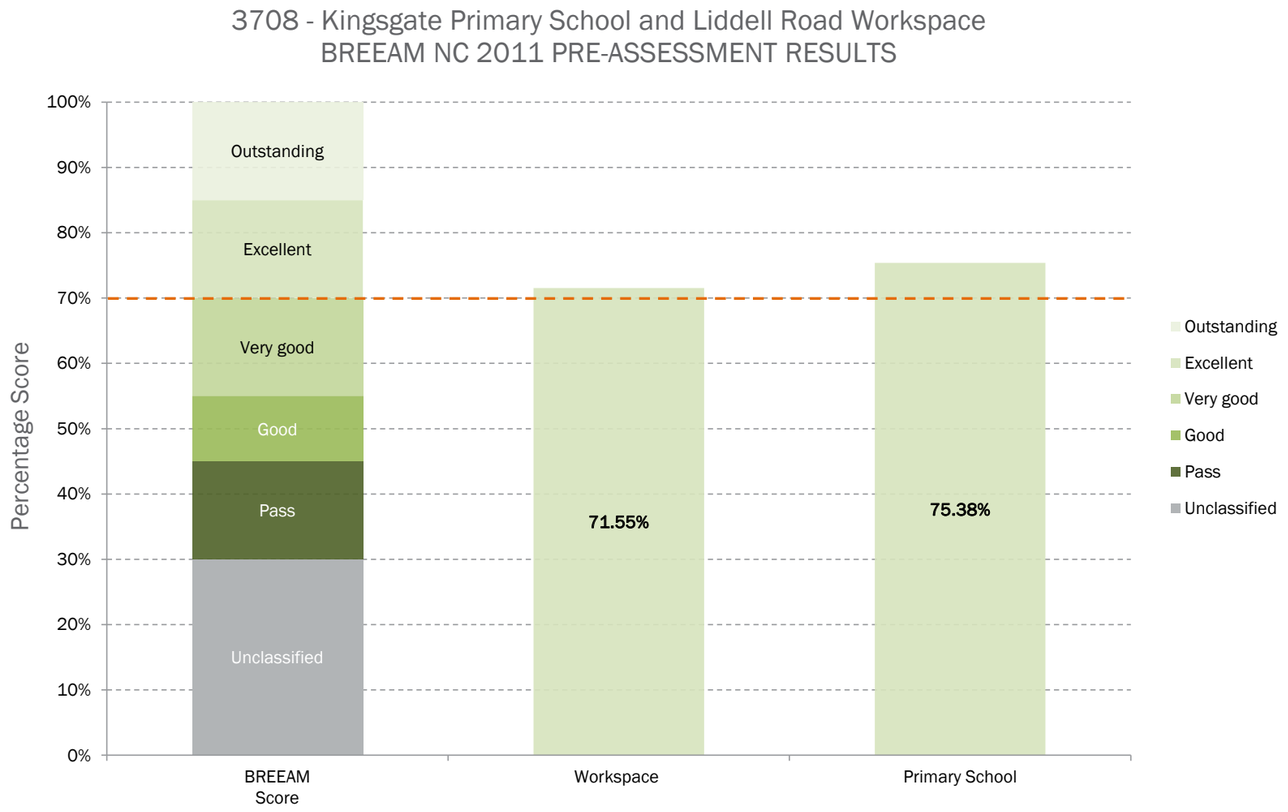


FIGURE 3.2. SUMMARY OF THE BREEAM LEVELS AND SCORES TARGETED BY THE TWO NON-RESIDENTIAL BUILDINGS.

4.0 Sustainability Strategy

4.1 Energy & CO_2 Emissions

The proposed development will be designed to minimise the CO_2 emissions associated with their operational energy consumption. From an initial energy assessment, it has been estimated that all dwellings within both residential blocks will achieve a minimum floor-weighted average 25% improvement over ADL1A 2010 required to achieve CSH Level 4.

From an initial energy assessment of the school and workspace buildings, it has been estimated that a minimum of 6 credits will be achieved for both blocks to ensure the mandatory energy credit requirements for BREEAM Excellent will be achieved.

For further details on the energy strategy adopted, refer to section 5.0 Energy Section.

4.2 Water

The proposed development will minimise the consumption of potable water in sanitary applications and landscape irrigation.

Low water use fixtures and fittings will be installed in the proposed development, where feasible. Fittings, such as flow restrictors, will be fitted to taps and potentially shower heads. WCs will be provided with dual flush cisterns and fitted with delayed action inlet valves.

Rainwater recycling will be implemented in the proposed development for the purpose of landscaping and irrigation. Rainwater will be harvested from appropriate hard outdoor surfaces, including roof catchment areas.

A low-water irrigation strategy, including planting of low maintenance species, will be adopted in the proposed development.

A water meter with a pulsed output to enable connection to a Building Management System (BMS) will be specified on the mains water supply to the proposed development. Additional sub-meters of the same type will be fitted on the supply to individual water-consuming plant or building areas in the school and workspace buildings. This metering strategy will ensure water consumption can be monitored and managed, therefore encouraging reductions in water consumption.

A leak detection system capable of detecting major water leaks on the mains water supply will be installed in the school and workspace buildings to reduce the impact of major water leaks that may otherwise go undetected.

4.3 Surface Water Run-off

The proposed development is situated in Zone 1 - low annual probability of flooding (as defined in Planning Policy Statement 25 (PPS25): Development and Flood Risk), as confirmed by the Flood Risk Assessment (FRA) carried out by Price and Myers.

Surface water run-off storage and attenuation measures and Sustainable Drainage Systems (SuDS), including rainwater harvesting, green/ brown roofs and permeable paving, will be implemented and adopted where appropriate to reduce and delay the discharge of rainfall run-off to public sewers and watercourses.

4.4 Materials

Construction materials with a low environmental impact over the full life cycle of the buildings will be specified, where possible. Materials for key building elements, including thermal insulation materials, will achieve a ‘Green Guide to Specification’ rating of A or A+, wherever technically and economically feasible.

Responsibly sourced materials for key building elements, including thermal insulation materials, and finishing elements, will be specified, wherever feasible. Additionally, any timber used in these elements will be legally sourced (e.g. FSC certified). In particular, the school building will be constructed primarily from cross laminated timber (CLT) to reduce the embodied carbon of the proposed development. The intent of the project is to select suppliers who can provide an environmental management system (EMS) certificate (e.g. EMAS/ISO14001 certificate).

Adequate protection will be given to vulnerable parts of school and workspace buildings and landscape to minimise the frequency of material replacement. Areas exposed to high pedestrian traffic, vehicular and trolley movements will be considered for such treatment.

4.5 Waste

A Site Waste Management Plan (SWMP) will be developed and implemented for each phase according to best practice.This will enable reduction and effective management of construction site waste.

Construction waste materials will be sorted into separate key waste groups either on-site or off-site and diverted from landfill. Wherever feasible, non-hazardous construction waste generated by the project will be reused, salvaged/reclaimed, recovered, recycled, composted on or off site and/ or returned to the supplier.

Recycled and/or secondary aggregates (if this can be reasonably procured) will be used in construction, thereby reducing the demand for virgin material.

Adequate dedicated storage spaces for non-recyclable and recyclable waste generated by the building’s occupants will be provided at lower ground level. This will enable appropriate management of waste disposal during the buildings’ operation.

4.6 Pollution

Insulating materials will only use substances that have Global Warming Potential (GWP) less than five. This will contribute to reduce blowing agent emissions associated with the manufacture, installation, use and disposal of foamed thermal and acoustic insulating materials. I

Night time light pollution will be minimised through the appropriate location and selection of external luminaires and light controls during RIBA Stage 4 detailed design.

Potential noise from the proposed development affecting nearby noise-sensitive buildings will be reduced by adopting noise attenuation measures, where required.

4.7 Health & Wellbeing

The building envelopes will aim to ensure good access to daylight and views out for the building users.

Adequate glare and solar overheating control will be provided to the occupied areas through adequate glazing specifications in all buildings, in conjunction with manually-operated internal blinds and/or curtains.

Internal and external lighting will be designed in line with best practice for visual performance and comfort. Occupants will have easy and accessible control over lighting within each space. Daylighting dimming and/or occupancy sensors will be specified in the school and workspace buildings, and common areas of the residential buildings. A time switch and daylight or occupancy sensors will be applied to external space lighting.

All fluorescent and compact fluorescent lamps will be fitted with high frequency ballasts. This will reduce the risk of health problems related to the flicker of fluorescent lighting.

The buildings will achieve adequate indoor ambient noise levels and appropriate sound insulation levels. For further information, please refer to the Environmental Noise and Vibration report produced by Gilleron Scott.

The specification of internal finishes and fittings will prioritise those with low emissions of volatile organic compounds (VOCs) to ensure healthy internal environments.

The ventilation strategy of the buildings will be designed to supply sufficient fresh air to the occupied spaces. This will remove any pollutants, reduce the risk to health associated with poor indoor air quality and prevent summertime overheating.

The heating strategy of the buildings will be designed to achieve appropriate thermal comfort levels and allow independent adjustment of heating systems within each occupied space.

All water systems in the proposed development will be designed in order to reduce the risk of legionellosis in operation.

Chilled, mains-fed point-of-use water supply or water coolers will be provided to supply accessible, clean and fresh drinking water to the users of the school and workspace throughout the day.

Most of the apartments will also be provided with private gardens, balconies, winter gardens or roof terraces which will meet the principles of inclusive design and accessibility. The aim is to promote quality of life to residents.

The school will provided with a private outdoor playground, and the workspace will have an outdoor terrace area on one of the upper floors.

4.8 Management

Through a consultation process the project team has involved the relevant stakeholders, including the local community, in the design process in order to deliver a functional, accessible and inclusive development which meets the needs of the local community.

The implementation of effective design measures will reduce the opportunity for and fear of crime in the proposed development. The final design will embody the recommendations of the local police Architectural Liaison Officer (ALO) or Crime Prevention Design Advisor (CPDA) on designing out the opportunity for crime, in accordance with the principles and guidance of “Secured by Design” (SbD).

The construction site will be managed in an environmentally and socially considerate and accountable manner by contractually requiring the building contractor to comply with and go significantly beyond best practice principles under a nationally or locally recognised certification scheme such as the Considerate Constructors Scheme (CCS). Within these practices, the contractor must reduce and monitor resource use (including construction materials), energy and water consumption, and air and water pollution. Refer to the Construction Management Plan (CMP) for further details.

An appropriate level of building services commissioning will be carried out in a co-ordinated and comprehensive manner, thus ensuring optimum performance under actual occupancy conditions. Seasonal commissioning will also be carried out over a minimum 12-month period for the school buildings, once they become occupied.

Home/Building User Guides will be provided to the occupants to enable them to understand and operate their homes/buildings efficiently and make the best use of local facilities. These non-technical and simple user guides will cover information on the operation and environmental performance of the proposed development and information relating to the site and its surroundings.

4.9 Ecology & Land Use

The proposed development’s footprint will be on an area of land which has been previously developed.

The site has mostly low ecological value, as stated in the ecological assessment undertaken by The Ecology Consultancy.

It is proposed that the ecological value of the site will be enhanced as a result of the proposed development. The recommendations included in the ecological assessment undertaken by The Ecology Consultancy for enhancement of the site ecology will be implemented.

The long term impact of the proposed development on the biodiversity of the site and surrounding area will be minimised.

4.10 Transport

The buildings will be developed in proximity to a good public transport network to reduce transport-related emissions and traffic congestion.

The proposed development is located in proximity to local amenities, thereby reducing the need for extended travel or multiple trips.

Adequately sized communal cycle storage facilities will be provided for the users of all the buildings at lower ground levels to encourage cycling. Child friendly scooter facilities will be provided as part of the school’s low transport strategy.

The site layout will be designed in order to provide safe and secure pedestrian routes within the proposed development.

A well-planned site layout and access to the site will also ensure that safety is maintained during deliveries and manoeuvring, and disruption due to delivery vehicles minimised.

A green travel plan based on a site-specific travel survey/assessment will be developed to accommodate a range of travel options for building users, thereby encouraging the reduction of user reliance on forms of travel that have the highest environmental impact.

5.0 Energy Strategy

5.1 Energy Hierarchy

The proposed development aims to minimise CO_2 emissions to the atmosphere arising from the operations of, and within, the buildings.

To minimise CO_2 emissions, the following Mayor's energy hierarchy, included in Policy 5.2 of The London Plan 2011, has been applied to the design strategy of the proposed Kingsgate school expansion and Liddell Road redevelopment::

- Minimising energy consumption through passive and active design measures;
- Supplying energy efficiently through a low carbon energy site-wide district energy system;
- Maximising energy generation from on-site renewables.

The three principles outlined above have been applied in sequence and systematically in the proposed development. These are illustrated in the following sections.

Figures 5.1 and 5.2 show the representative energy strategies for the proposed Kingsgate school expansion and Liddell Road redevelopment.

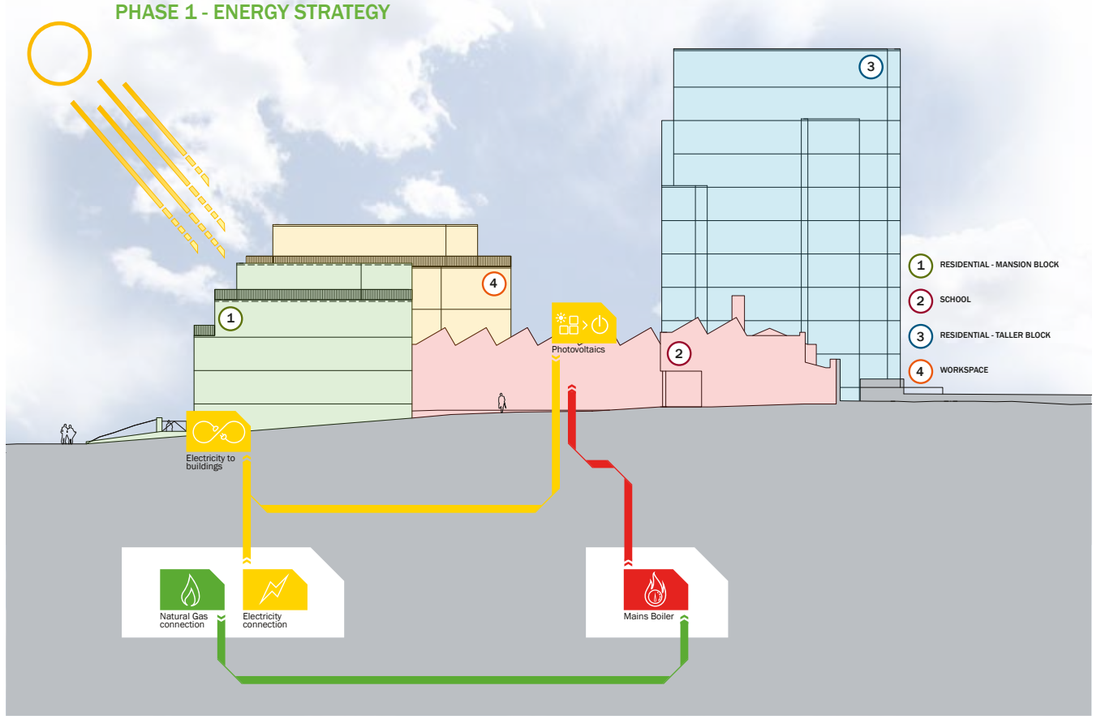


FIGURE 5.1 DIAGRAMMATIC REPRESENTATION OF PHASE 1 ENERGY STRATEGY

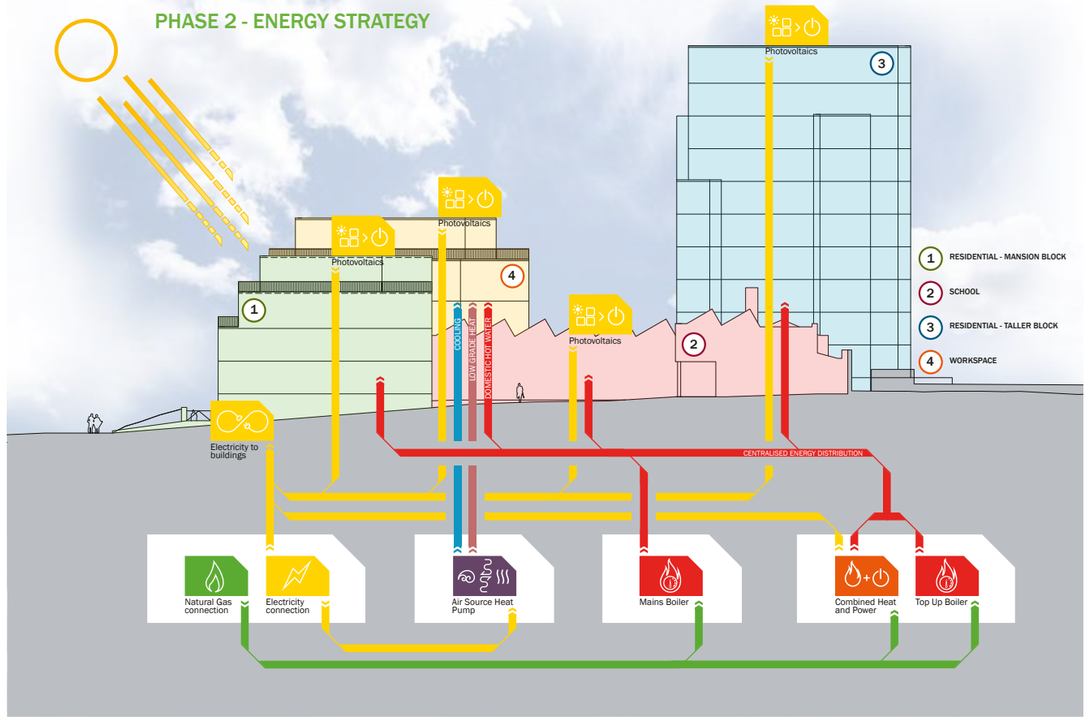


FIGURE 5.2 DIAGRAMMATIC REPRESENTATION OF PHASE 2 ENERGY STRATEGY

5.2 Passive Design Measures

The energy efficient building design of the proposed development will minimise the need for energy in operation while maximising the comfort of users during the lifetime of the buildings. The integration of passive design principles will enable the buildings to be less reliant on heating, cooling, ventilation and air conditioning (HVAC) systems and minimize dependence on artificial lighting. This is achieved by taking advantage of natural energy flows to maintain thermal comfort.

To limit heat losses across the building envelopes a number of measures have been implemented. These include efficient built forms and high levels of insulation and airtightness.

The design of the façades will maximise passive solar gains in wintertime, while minimising excessive sunlight penetration in summertime. This will also allow the buildings to reduce heating loads in winter and cooling loads in summer, while maintaining comfortable indoor environments. In particular, it will allow the classrooms in the school and the workspaces in the workspace to be naturally ventilated in mid-season, thus reducing electricity used for fans and pumps.

To limit excessive solar gain through the windows and rooflights, a solar control strategy has been developed, including adequate glazing specifications in all buildings and manually-operated internal blinds and/or curtains.

The building envelopes will be compliant with the Building Regulations Part L 2013 standards, as described in the Approved Document L2A (ADL2A) 2013 (“Conservation of fuel and power in new buildings other than dwellings”) for the school and workspace buildings, and Building Regulations Part L 2013 standards, as described in the Approved Document L1A (ADL1A) 2013 (“Conservation of fuel and power in new dwellings”) for the residential buildings, and go beyond the limiting U-values and design air permeabilities set out in the ADL2A 2013.

5.3 Active Design Measures

The majority of the supplied energy will be used to operate the buildings. By improving the energy efficiency of HVAC and domestic hot water (DHW) systems, lighting, appliances and equipment the need for energy in operation during the lifetime of the buildings will be minimised.

5.3.1 HVAC Systems

Kingsgate School

Heat from the gas fired boilers in Phase 1, and subsequently from the energy centre in Phase 2, will be supplied to the school though underfloor heating. Such a system will meet the specific requirements of thermal comfort of the occupants and compatibility with the low temperature from the very low temperature hot water (LTHW) circuit coming from the main network.

A mixed mode ventilation strategy for the school will combine the benefits of mechanical ventilation with heat recovery in winter, natural ventilation in mid-season and boosted natural ventilation summer.

Mechanical ventilation with heat recovery is proposed in the classrooms. This will allow the thermal energy extracted from the exhaust air to be used to heat the supply air, thus dramatically minimising the need for additional heating in winter. Heat will be recovered from the air extracted at high level from classrooms through plate heat exchangers installed in the ventilation units and exchanged with the incoming fresh air to be supplied to classrooms at low level.

During summer, fresh air can be brought directly into the classrooms without exchanging heat in order to offer some free cooling. Through careful design of the façades, the classrooms will be fitted with openable windows and attenuated louvred panels to supply outdoor fresh air. This is proposed to be used in connection with stack effect ventilation through a grille at high level which will duct the air to a chimney on the roof of the classrooms.

Due to the constraints of the site, and the areas required for acoustic attenuation, a small boost fan will be located in the chimneys to ensure there is sufficient ventilation provided to meet the fresh air requirement for classrooms.

Natural ventilation will allow energy savings of the electricity used for fans and pumps, while avoiding overheating in summer.

The ventilation strategy for some workspace spaces and kitchens will form part of a localised mechanical ventilation system. Bathrooms and kitchens will require a mechanical extract.

The plantroom and back-of-house storage areas will be provided with mechanical fresh air supply for continuous background ventilation.

The mechanical ventilation systems shall be interlocked with contacts on the window to ensure that they will not operate when the windows are open.

Natural ventilation is proposed for some offices, which will allow additional energy savings of the electricity used for fans and pumps, while avoiding overheating in mid-season. Any meeting rooms will be fitted with an openable window to supply outdoor fresh air and extract indoor exhaust air, while allowing for occupant control over the indoor environment.

Temperature and CO_2 sensors will allow to modulate the amount of fresh air supply to classroom spaces, to ensure compliance with BB101 guidelines for adequate ventilation.

Residential

Heat from the energy centre will be supplied to the dwellings though underfloor heating. Such systems will meet the specific requirements of thermal comfort of the occupants and compatibility with the low temperature from the low temperature hot water (LTHW) circuit coming from the main network.

A mixed mode ventilation strategy for the dwellings will combine the benefits of mechanical ventilation with heat recovery in winter, natural ventilation in mid-season and mechanical ventilation in summer. The latter is proposed for the dwellings on the boundary to the railway.

Mechanical ventilation with heat recovery will allow the thermal energy extracted from the exhaust air to be used to heat the supply air, thus dramatically minimising the need for additional heating in winter. Heat will be recovered from the air extracted at high level from bathrooms and kitchens through plate heat exchangers installed in the ventilation units and exchanged with the incoming fresh air to be supplied to bedrooms and living areas at high level.

The ventilation strategy of bathrooms and kitchens will form part of a balanced mechanical ventilation system. Bathrooms and kitchens would require a mechanical extract. Therefore the extension of this system to a balanced ventilation scheme does not consume much additional electricity.

Fresh air will be ducted from outside to the heat recovery units and then supplied and extracted from grilles located in the ceilings. During summer the fresh air can be brought directly into the dwellings without exchanging heat in order to offer some free cooling.

Natural ventilation will allow energy savings of the electricity used for fans and pumps, while avoiding overheating in summer. Through careful design of the façades, the dwellings will be fitted with openable windows to supply outdoor fresh air and extract indoor exhaust air.

Workspace

As the commercial element of the scheme is a speculative design, certain assumptions regarding the final tenant have been made in terms of what the workspace fit out design will eventually be. The building systems for the speculative design of the workspace are set out below.

Heat from the energy centre will be supplied to all serviced areas of the workspace, to provide heating and hot water. Such a system will meet the specific requirements of flexibility and thermal comfort of the occupants typical of this building type and compatibility with the low temperature from the low temperature hot water (LTHW) circuit coming from the main community energy network.

A mixed mode ventilation strategy is proposed for the workspace building. Where possible this strategy will combine the benefits of mechanical ventilation with heat recovery in winter, natural ventilation in mid-season and mechanical ventilation with cooling in summer.

Natural ventilation will allow additional energy savings of the electricity used for fans and pumps, while avoiding overheating in mid-season.

Additional heating and/or comfort cooling may be provided in the workspace spaces through FCUs.

The toilet blocks will be provided with mechanical fresh air supply and exhaust air extract at high level.

The plantroom and back-of-house storage areas will be provided with mechanical fresh air supply for continuous background ventilation.

5.3.2 Lighting

To further minimise the energy consumption, energy efficient light fittings will be specified for all of the buildings and the external areas, including common areas. The majority of fixed internal light fittings will be dedicated and energy efficient, i.e. fluorescent and light-emitting diode (LED) lamps. In the school and workspace buildings internal light fittings will be controlled through daylight and occupancy sensors according to the space type. All external space light fittings and security light fittings will be dedicated, energy efficient and controlled through a time switch and daylight or occupancy sensors to prevent operation during daylight hours.

5.3.3 Lifts

Energy efficient lifts will be installed in the buildings to reduce transport-related energy consumption.

5.3.4 Appliances & Equipment

School and Workspace

The procurement of energy efficient office equipment and domestic appliances will be encouraged in order to ensure energy savings in operation. Fridges and freezers or fridge-freezers will target an A+ rating, washing machines (if any) and dishwashers an A rating. \

Residential

Energy efficient labelled white goods will be supplied to each dwelling in order to reduce the CO_2 emissions arising from appliance use. If no (or not all) white goods are provided, information on the EU Energy Efficiency Labelling Scheme of efficient white goods will be provided to each dwelling. Fridges and freezers or fridge-freezers will target an A+ rating, washing machines and dishwashers an A rating.

3.3.5 Metering

School

A building energy management systems (BMS) will be installed in the school to monitor and control the building services, thus minimising energy-inefficient operation.

Residential

Energy display devices showing current electricity and gas consumption data will be specified for each dwelling the school to empower occupants to reduce energy use.

Workspace

Separate accessible energy sub-meters will be installed to facilitate the monitoring of substantial energy uses and highly energy demanding function areas, and sub let areas, within the workspace.

A building energy management systems (BMS) will be installed in the workspace to monitor and control the building services, thus minimising energy-inefficient operation.

5.4 Energy Efficient Supply

5.4.1 Phase 1 - Plant Strategy

A localised plant strategy, including highly efficient gas fired modular condensing boilers to provide space heating and domestic hot water, is proposed in Phase 1.

The plant room will be located on the ground level of the school.

The domestic hot water strategy will utilise hot water storage tanks, or buffer vessels, heated by a low temperature hot water circuit fed from the gas boilers. Heat will be stored in highly insulated thermal stores. These stores will retain the heat for use during peak demand, limiting the required plant capacity and therefore preventing oversizing and subsequent inefficient operation of the same plant.

5.4.2 Phase 2 - Side Wide Community Energy System

A centralised plant strategy, including an energy centre and a site-wide community energy system, is proposed in Phase 2 to achieve higher efficiency and security of supply throughout the proposed development. Part of the benefit is due to the diversity of heating and DHW loads related to different residential units, school and workspace buildings resulting in a more constant heating and DHW demand. This allows the heating, and DHW systems to be accurately sized in order to operate at a consistent load and consequently to operate more efficiently.

An energy centre will be located at the ground level of the residential taller block and will serve the residential, workspace and school buildings (Figure 5.2).

The site-wide community energy system will include a combined heat and power (CHP) system, which will provide the majority of the DHW to the whole site and a portion of the space heating across the site.

The DHW strategy will utilise hot water storage tanks, or buffer vessels, heated by a low temperature hot water circuit fed from the CHP plant. Heat will be stored in highly insulated thermal stores. These stores will retain the heat for use during peak demand, limiting the required CHP plant capacity and therefore preventing oversizing and subsequent inefficient operation of the same plant.

High efficiency gas fired modular condensing boilers will provide top-up during periods of peak demand and downtime of the main systems for maintenance.

As part of the programmed works in Phase 2, it is proposed that the community heating scheme is connected it the school plant room, to create a site wide community energy system.

Combined Heat and Power (CHP)

A CHP system will be adopted to provide the majority of the DHW and space heating to the whole site.

The highly efficient CHP system will be located in the energy centre, at ground level of the residential taller block, where potential breakout noise from the plant room will be adequately managed.

The CHP installation is proposed of a size that anticipates satisfying the majority of the estimated DHW of the proposed development.

In order to meet variability in hot water demand across the site, highly insulated thermal stores

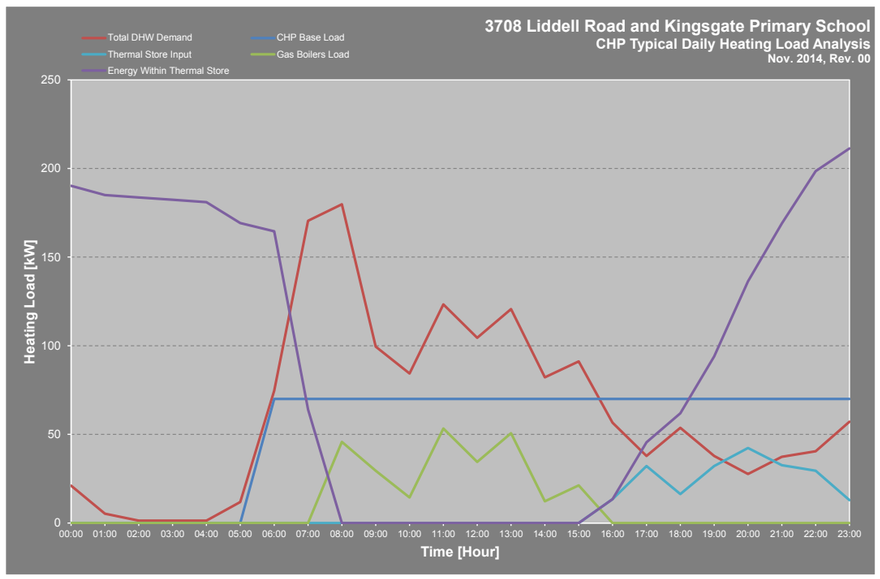


FIGURE 5.3. INDICATIVE DAILY CHP LOAD PROFILE.

will be required to retain a constant heat demand on the CHP plant and therefore ensure as many running hours as possible. It is commonly recommended that a CHP unit needs a minimum of 4,500 running hours a year in order to be seen as economically viable. In an initial feasibility study it is being assumed that the proposed scheme will bring the CHP plant on at 5am and run through until 11pm to ensure that electricity is generated in peak operating hours. This will allow for a period of downtime, while still maintaining running hours well above the recommended threshold.

The initial feasibility study has indicated that the proposed CHP system will include two units, each supplying a thermal output of 70kWt. The size of the CHP system may be subject to minor changes following further optimisation at RIBA Stage 4 detail design stage.

5.4.3 Connection to an Off-Site District Heating System

The opportunities to connect the Kingsgate school expansion and redevelopment of Liddell Road to heating and/or cooling networks has been evaluated.

Based on information obtained from the London Heat Map illustrated in Figures 5.4-5.7, no existing heating and/or cooling networks have been identified in proximity to the Liddell Road site.

However the potential area for development of West Hampstead District Network has been identified near the proposed Liddell Road development and Kingsgate Primary School. Upon review with the London Borough of Camden and the coordinating engineer for the London Heat Map, no firm commitment has been made by a developer to utilise this area for district heating. As a result of reviewing the information presently available, the possibility to connect the Liddell Road site to the proposed energy networks has been discounted.

However allowances and capped off connections will be made within the proposed energy centre for future connections to wider district energy systems.

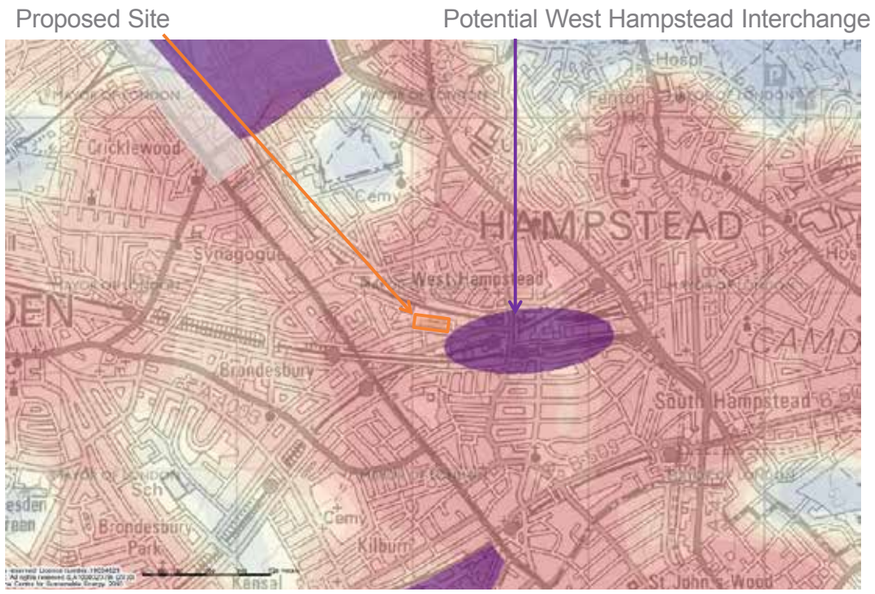


FIGURE 5.4 THE LOCATION OF THE PROPOSED SITE IN RELATION TO THE POTENTIAL WEST HAMPSTEAD DISTRICT HEATING NETWORK (SOURCE: LONDON HEAT MAP)

FIGURE 5.5 COMBINED HEAT AND POWER NETWORK (SOURCE: CORE STRATEGY)

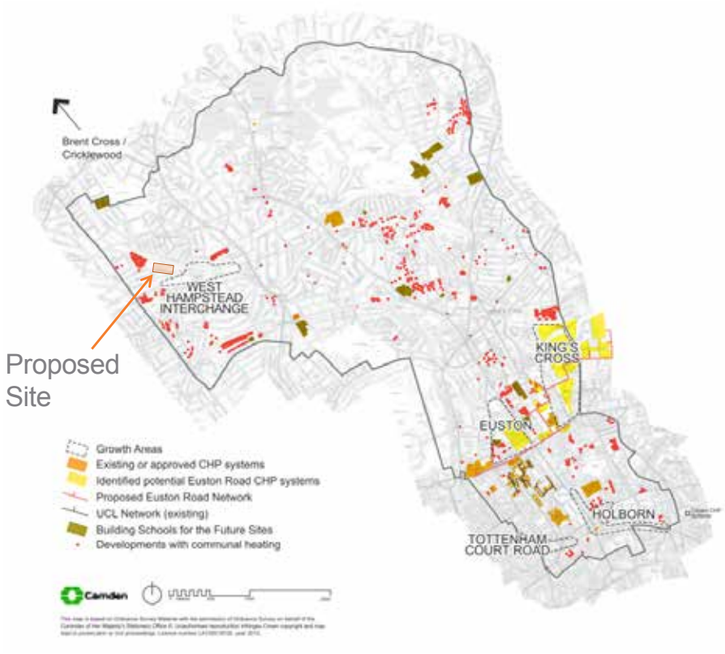


FIGURE 5.6 DISTRICT HEATING - EXISTING OR EMERGING NETWORKS (SOURCE: CORE STRATEGY)

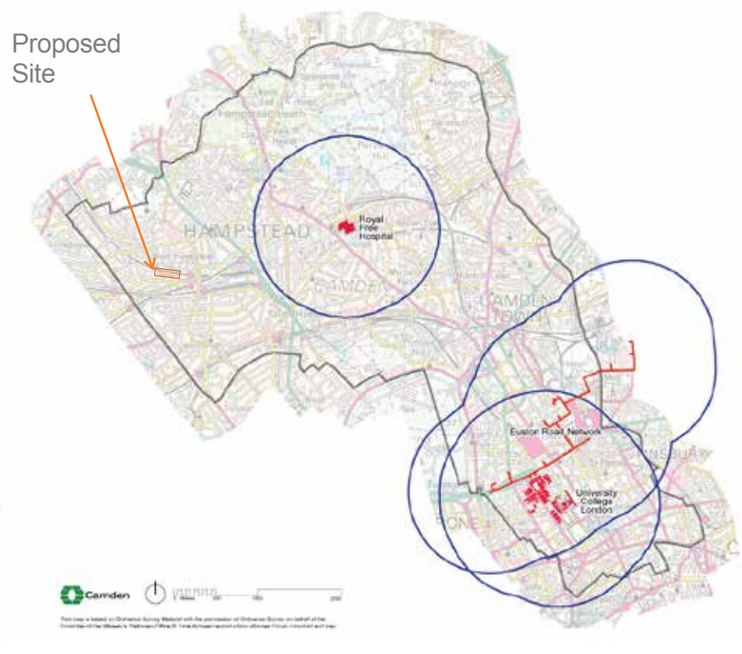
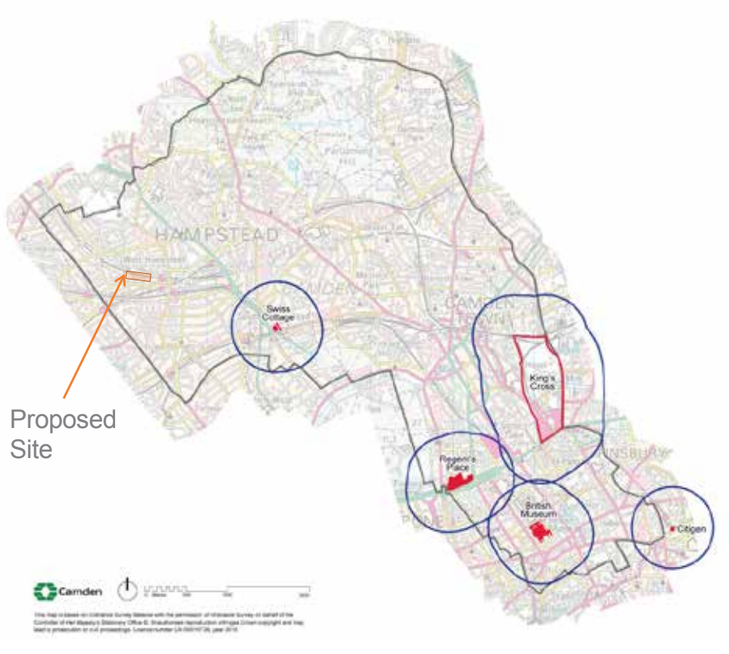


FIGURE 5.7 DISTRICT HEATING - POTENTIAL NETWORKS (SOURCE: CORE STRATEGY)



5.5 Renewable Energy Technologies

In order to reduce the overall CO_2 emissions of the proposed development in use, and meet and exceed the requirements set out by the local planning policy, the opportunities to effectively employ renewable energy technologies on the site have been examined.

Considering the orientation, geometry and predicted energy demand of the buildings, the following renewable energy technologies are proposed for the proposed Kingsgate school expansion and Liddell Road redevelopment:

- Photovoltaic (PV)
- Air source heat pump (ASHP)

The PV panels will be integrated on the roof of the residential, workspace and school buildings to satisfy some of their electricity demand.

An ASHP system will be adopted to satisfy the majority of the space heating and cooling demand of the workspace building.

The use of biomass heating, solar water heating, ground source heat pump system and wind power has been evaluated in detail. Due to technical constraints these technologies are not considered viable for the proposed development.

5.5.1 Discounted Technologies

BIOMASS HEATING

Biomass heating has been discounted due to the biomass/biofuel transportation impact and delivery, access and storage constraints on the site. Adjacency to residential developments with consequent flue implications also represents a potential constraint.

SOLAR WATER HEATING

Solar Water heating would contradict the use of a CHP system, which gives a greater reduction in the carbon emissions associated with DHW.

GROUND SOURCE HEAT PUMP (GSHP)

Ground source heat pumps are not considered appropriate for the scheme due to an unbalanced heating/cooling load of the whole development as the residential and school are not provided water cooling.

WIND POWER

Stand-alone wind turbines taller than 10m height and roof-mounted wind turbines have been discounted as they may also pose vibration issues on the supporting building structure. Furthermore wind turbines are not considered suitable for the site due to accessibility issues to the project site by large delivery vehicles , potential noise impacts, flickering shadows and flashes of reflected light on neighbouring residential buildings. Stand-alone wind turbines lower than 10m height have been discounted due to the high density of the site, which would impact the efficiency of any type of wind turbine applicable to the project site.

5.5.2 Proposed Technologies

PHOTOVOLTAIC (PV)

Photovoltaic (PV) panels will be installed on the roofs of the residential,workspace and school buildings to provide some electricity for cooling (where present), fans, pumps, lighting and small power.

PV modules will be either integrated into the roofs, replacing the conventional roof covering, directly mounted upon the roofs, or mounted on metal frameworks above the green/brown roofs.

If horizontally mounted, the PV panels will receive approximately 90% of the energy of a system with optimum orientation.

If mounted on metal frameworks, the PV panels will be orientated to South at approximate tilt of 30°, so achieving the optimum orientation and tilting for harvesting solar energy.

Due to their locations, the modules will be unshaded at most times of the day. The location of the PV panels has been determined in order to maximise the annual solar radiation on the roofs. The extent of this coverage will be reviewed as part of the RIBA Stage 4 detailed design of the buildings.

Initial feasibility studies have been conducted to indicte the approximate effective PV panel area required for each element of the proposed development. The size of the PV modules may be subject to minor changes following further optimisation at RIBA Stage 4 detailed design.

School
The proposed PV modules will supply an approximate electrical output of 18kWp and have an effective PV panel area of about 120m^2.

Workspace
The proposed PV modules will supply an approximate electrical output of 23kWp and have an effective PV panel area of about 155m^2.

Residential (Mansion Block)
The proposed PV modules will supply an approximate electrical output of 40kWp and have an effective PV panel area of about 267m^2.

Residential (Taller Block)
The proposed PV modules will supply an approximate electrical output of 22kWp and have an effective PV panel area of about 145m^2.

AIR SOURCE HEAT PUMP (ASHP)

Air source heat pumps will be adopted to provide the majority of the space heating and cooling to the workspace building. The heat pumps will be located on the roof and serve the underfloor heating system as FCUs.

The heat pumps will not create any excessive noise issues that would not otherwise be normally managed through building regulations in relation to building plant rooms.

Whilst an ASHP is not clearly a wholly renewable energy source as electricity is required to run the heat pumps, the renewable components are considered as the heat energy extracted from and rejected to the air.

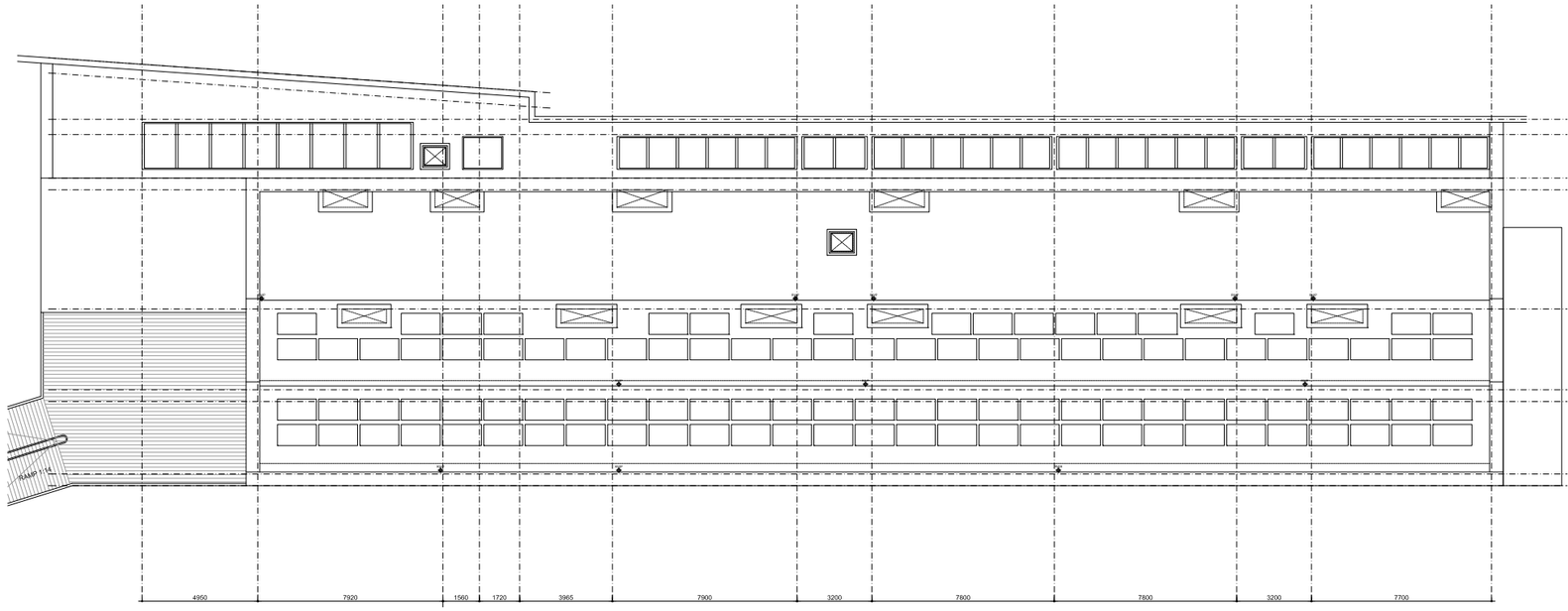


FIGURE 5.8. OVERVIEW OF THE PV ARRANGEMENT ON THE KINGSGATE SCHOOL BUILDING

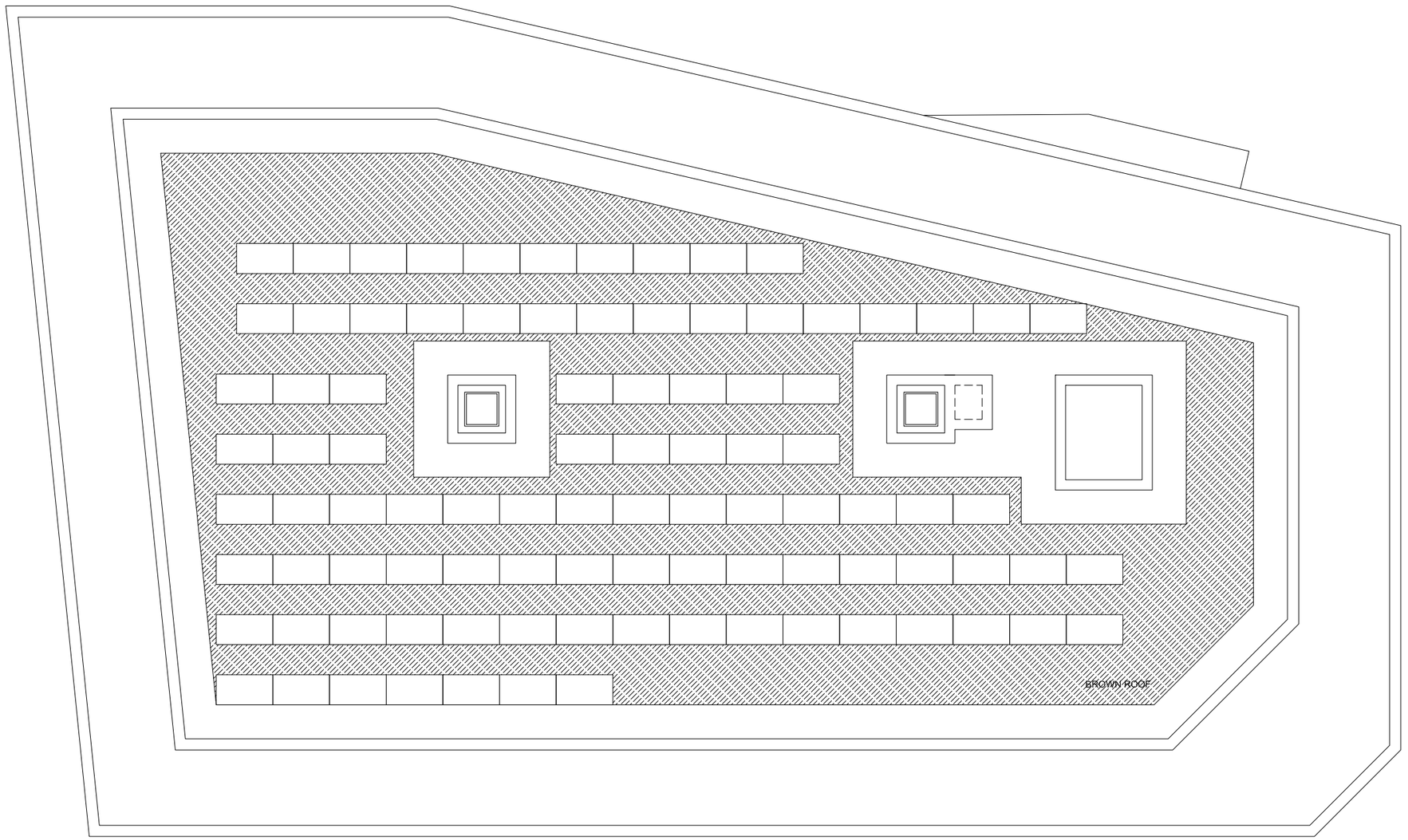


FIGURE 5.9. OVERVIEW OF THE PV ARRANGEMENT ON THE WORKSPACE BUILDING

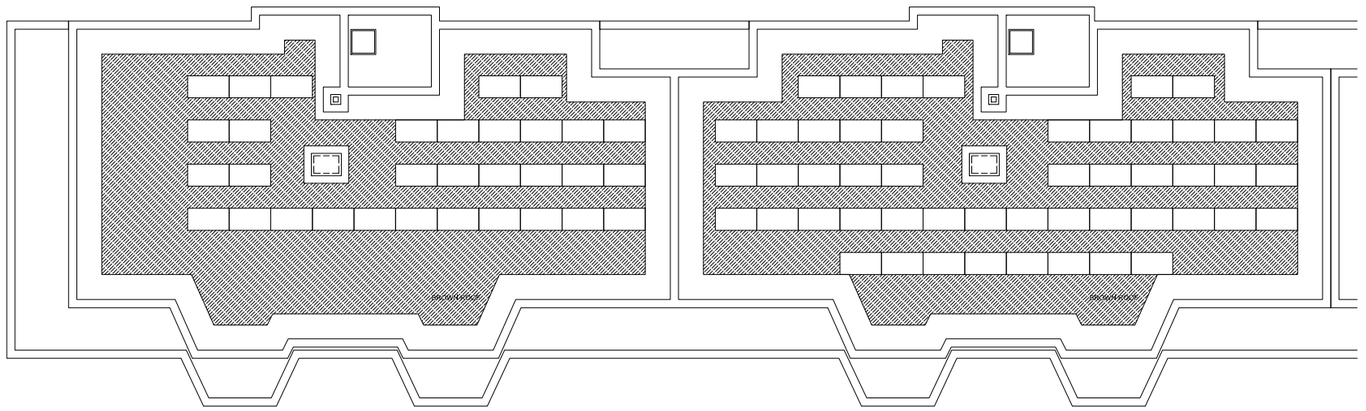


FIGURE 5.10 OVERVIEW OF THE PV ARRANGEMENT ON THE MANSION BLOCK

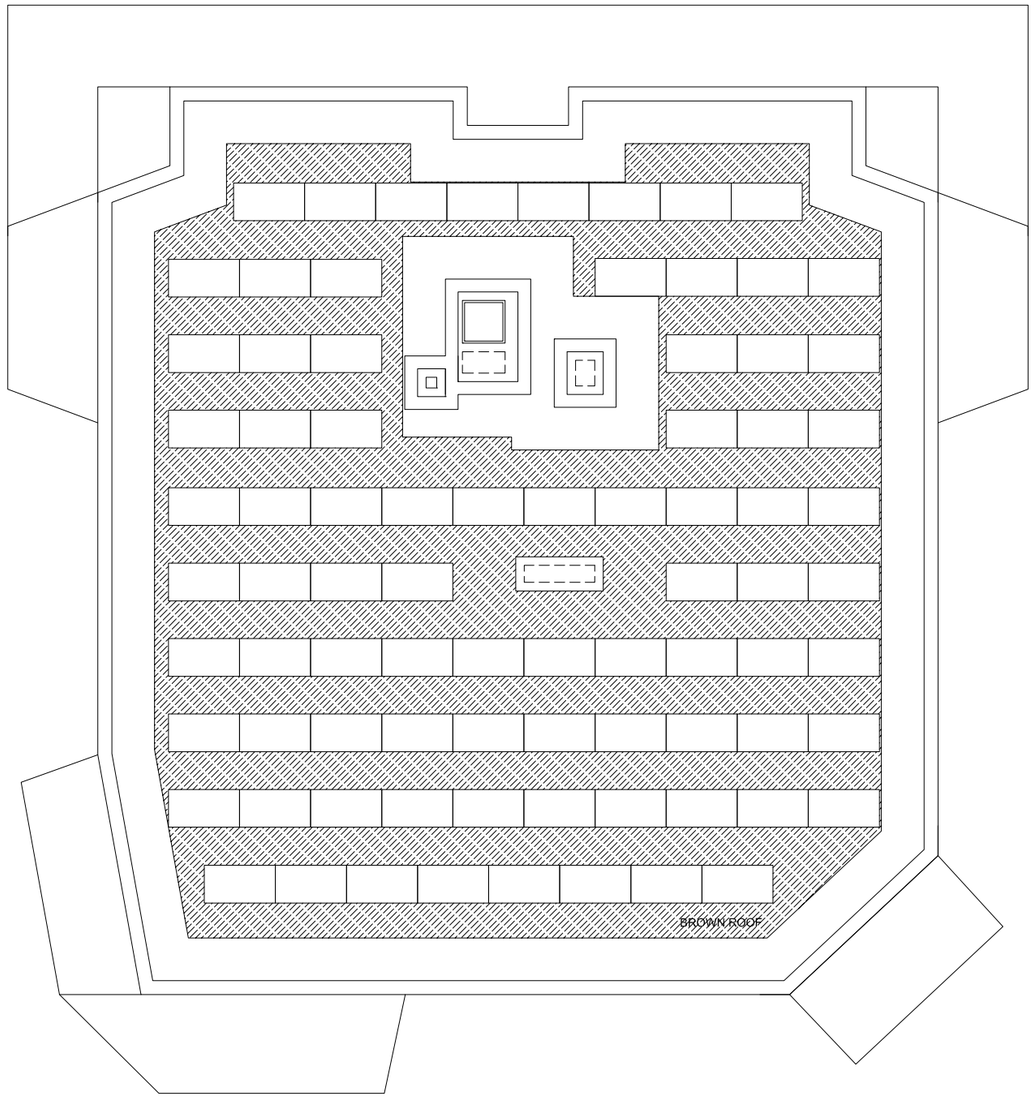


FIGURE 5.11 OVERVIEW OF THE PV ARRANGEMENT ON THE TALLER BLOCK

5.6 Carbon Saving

The carbon savings achieved through the incorporation of the proposed passive design, energy efficient measures and renewable energy technologies as part of Phase 1 of the proposed development have been estimated. Due to the phasing of the development, Phase 1 and Phase 2 have been considered separately to insure that they both comply with regulations independently. A summary of the carbon savings expected for Phase 1 - primary school - is summarised below. The carbon emission reduction calculations for Phase 2 include the two residential elements, the workspace and the school

The improvement over ADL2A 2013 of the school and workspace buildings has been calculated using IES VE 2014 analysis software tool. This software package includes the VE Compliance application, which follows the National Calculation Methodology (NCM) for assessing the energy performance of non-domestic buildings required by the Building Regulations Part L. For further details, refer to 6.0 Appendix D. IES Preliminary Calculations.

The floor-weighted average improvement over ADL1A 2013 of typical dwellings in the worst case scenarios for the residential buildings have been calculated using Stroma FSAP 2012 analysis software tool. This software package follows the Government's Standard Assessment Procedure for Energy Rating of Dwelling (SAP) 2012, which is the national calculation methodology for assessing the energy performance of domestic buildings required by the Building Regulations Part L. For further details, refer to 6.0 Appendix C. SAP Preliminary Calculations.

These estimations are the result of initial calculations based on reasonable assumptions about the performance of the building elements and services. These assumptions as well as the achievements in terms of energy consumption and CO_2 emissions are subject to changes and further refinement as the design develops.

5.6.1 Phase 1

In order to evaluate the CO_2 emissions reduction of the whole of the proposed Phase 1 development through renewable energy technologies, the baseline is the CO_2 emissions of the proposed development with passive and active design measures incorporated but not the renewable energy technologies. (i.e Lean benchmark). Unregulated loads (i.e. small power for appliances, cooking and equipment) are not taken into account in these calculations.

The results, based on Part L 2013 and illustrated in Figure 5.12, show an estimated 23.6% CO_2 emissions reduction of the whole of the proposed phase 1 development over the baseline through renewable energy technologies. Therefore, the whole of Phase 1 of the proposed development demonstrates compliance with the 20% carbon reduction target set by LBC.

FIGURE 5.12. CHART ILLUSTRATING THE ESTIMATED CARBON SAVINGS IN THE WHOLE OF THE PROPOSED PHASE 1 DEVELOPMENT, EXCLUDING UNREGULATED LOADS, ACCORDING TO PART L 2013.

Phase 1 Development	CO_2 Emissions (Tons CO_2 / annum)	
	Regulated	Unregulated
Baseline: Part L 2013. of the building regulations compliant development	42	35
After energy demand reduction	32	35
After renewable energy	25	35

FIGURE 5.13. TABLE SUMMARISING THE RESULTS OF THE IES CALCULATIONS FOR THE SCHOOL BUILDING WITHIN THE PROPOSED PHASE 1 DEVELOPMENT ILLUSTRATED ACCORDING TO THE MAYOR'S ENERGY HIERARCHY AND PART L 2013.

Phase 1 Development	Regulated CO_2 Savings	
	(Tons CO_2 / annum)	(%)
Savings from energy demand reduction	10	23.1%
Savings from renewable energy	8	23.6%
Total cumulative savings	17	41.3%
Total target savings	15	35.0%
Annual surplus	3	-

FIGURE 5.14 TABLE SUMMARISING THE ESTIMATED CARBON SAVINGS OF THE SCHOOL BUILDING WITHIN THE PROPOSED PHASE 1 DEVELOPMENT ILLUSTRATED ACCORDING TO THE MAYOR'S ENERGY HIERARCHY AND PART L 2013.

5.6.2 Phase 2

In order to calculate the CO_2 emissions reductions of the whole of the proposed Phase 2 development through renewable energy technologies, the baseline is the CO_2 emissions of the proposed development with passive and active design measures incorporated as well as the use of a CHP taken into account but not the renewable energy technologies. (i.e Clean benchmark). Unregulated loads (i.e. small power for appliances, cooking and equipment) are not taken into account in these calculations

The results, based on Part L 2013 and illustrated in Figure 5.15 show an estimated 23.7% CO_2 emissions reduction of the whole of the proposed Phase 2 development over the baseline through renewable energy technologies. Therefore, the whole of the proposed development demonstrates compliance with the 20% carbon reduction target set by LBC.

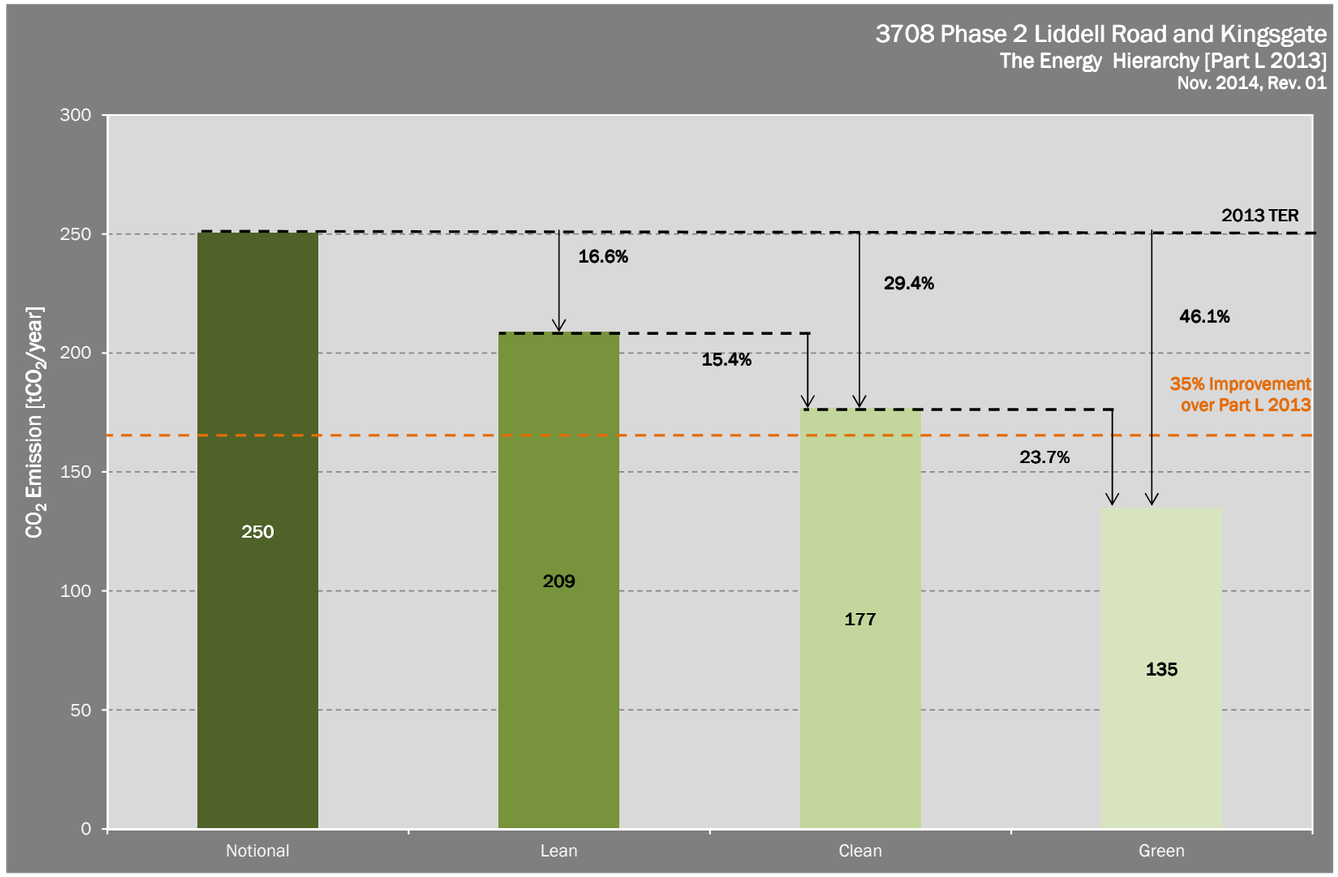


FIGURE 5.15 CHART ILLUSTRATING THE ESTIMATED CARBON SAVINGS IN THE WHOLE OF THE PROPOSED PHASE 2 DEVELOPMENT, EXCLUDING UNREGULATED LOADS, ACCORDING TO PART L 2013.

Phase 2 Development	CO_2 Emissions (Tons CO_2 / annum)	
	Regulated	Unregulated
Baseline: Part L 2013. of the building regulations compliant development	250	263
After energy demand reduction	209	263
After CHP	177	263
After renewable energy	135	263

FIGURE 5.16 TABLE SUMMARISING THE RESULTS OF THE SAP/IES CALCULATIONS FOR THE WHOLE OF THE PROPOSED PHASE 2 DEVELOPMENT ILLUSTRATED ACCORDING TO THE MAYOR'S ENERGY HIERARCHY AND PART L 2013.

Phase 2 Development	Regulated CO_2 Savings	
	(Tons CO_2 / annum)	(%)
Savings from energy demand reduction	42	16.6%
Savings from CHP	32	15.4%
Savings from renewable energy	42	23.7%
Total cumulative savings	115	46.1%
Total target savings	88	35.0%
Annual surplus	28	-

FIGURE 5.17 TABLE SUMMARISING THE ESTIMATED CARBON SAVINGS OF THE WHOLE OF THE PROPOSED PHASE 2 DEVELOPMENT ILLUSTRATED ACCORDING TO THE MAYOR'S ENERGY HIERARCHY AND PART L 2013.

RESIDENTIAL BUILDINGS

The improvements over ADL1A 2013 are calculated as the percentage improvement in the Dwelling CO_2 Emission Rate (DER) over the Target CO_2 Emission Rate (TER) for each dwelling being assessed. Unregulated loads (i.e. small power for appliances and cooking) are not taken into account in these calculations.

The results, illustrated in Figures 5.18 and 5.19, show that the integration of passive and active design measures into each dwelling, the use of CHP and the adoption of renewable energy technologies produce an estimated floor-weighted average improvement of 52.9% over ADL1A 2013. Therefore, the residential building demonstrate compliance with the 35% carbon reduction target over Part L 2013 set by GLA.

According to the Mayor's energy hierarchy, the results can be illustrated as follows:

- Be Lean: The integration of passive and active design measures produces an estimated floor-weighted average improvement of 11.4% over ADL1A 2013.
- Be Clean: The use of CHP increases the estimated floor-weighted average improvement over ADL1A 2013 to 32.9%.
- Be Green: The adoption of renewable energy technologies further increases the estimated floor-weighted average improvement over ADL1A 2013 to 52.9%.

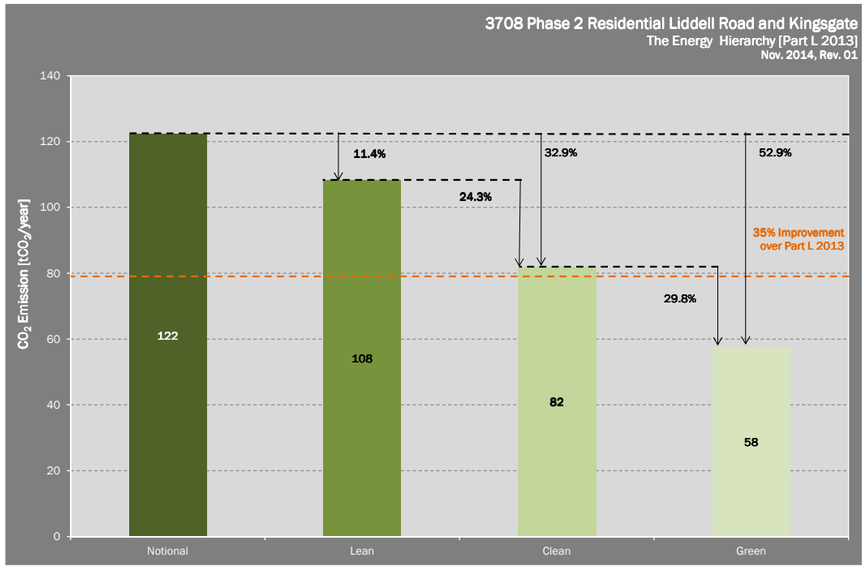


FIGURE 5.18 CHART ILLUSTRATING THE AREA-WEIGHTED AVERAGE CARBON SAVINGS (IN TCO_2/YEAR) IN THE RESIDENTIAL BUILDINGS WITHIN THE PROPOSED PHASE 2 DEVELOPMENT, EXCLUDING UNREGULATED LOADS, ACCORDING TO PART L 2013.

Phase 2 Residential	CO_2 Emissions (Tons CO_2 / annum)	
	Regulated	Unregulated
Baseline: Part L 2013. of the building regulations compliant development	122	139
After energy demand reduction	108	139
After CHP	82	139
After renewable energy	58	139

FIGURE 5.19 TABLE SUMMARISING THE RESULTS OF THE SAP CALCULATIONS FOR THE RESIDENTIAL BUILDINGS WITHIN THE PROPOSED PHASE 2 DEVELOPMENT ILLUSTRATED ACCORDING TO THE MAYOR'S ENERGY HIERARCHY AND PART L 2013.

Phase 2 Residential	Regulated CO_2 Savings	
	(Tons CO_2 / annum)	(%)
Savings from energy demand reduction	14	11.4%
Savings from CHP	26	24.3%
Savings from renewable energy	24	29.8%
Total cumulative savings	65	52.9%
Total target savings	43	35.0%
Annual surplus	22	-

FIGURE 5.20 TABLE SUMMARISING THE AREA-WEIGHTED AVERAGE CARBON SAVINGS OF THE RESIDENTIAL BUILDINGS WITHIN THE PROPOSED PHASE 2 DEVELOPMENT ILLUSTRATED ACCORDING TO THE MAYOR'S ENERGY HIERARCHY AND PART L 2013.

NON-DOMESTIC BUILDINGS

The improvements over ADL2A 2013 are calculated as the percentage improvement in the Building CO_2 Emission Rate (BER) over the Target CO_2 Emission Rate (TER) for all non-domestic buildings being assessed. These include: the school, which will be constructed in Phase 1 but will be connected to the community system in Phase 2, and the workspace, which will be constructed in Phase 2. Unregulated loads (i.e. small power for equipment) are not taken into account in these calculations.

The results, illustrated in Figures 5.21 and 5.22, show that the integration of passive and active design measures into the non-domestic buildings/units, the use of CHP and the adoption of renewable energy technologies produce an estimated improvement of 40.8% over ADL2A 2013. Therefore, the non-domestic buildings/units demonstrate compliance with the 35% carbon reduction target over Part L 2013 set by GLA.

According to the Mayor's energy hierarchy, the results can be illustrated as follows:

- Be Lean: The integration of passive and active design measures requires an estimated 21.8% offset over ADL2A 2013.
- Be Clean: The use of CHP increases the estimated improvement over ADL2A 2013 to 26.7%.
- Be Green: The adoption of renewable energy technologies further increases the estimated improvement over ADL2A 2013 to 40.8%.

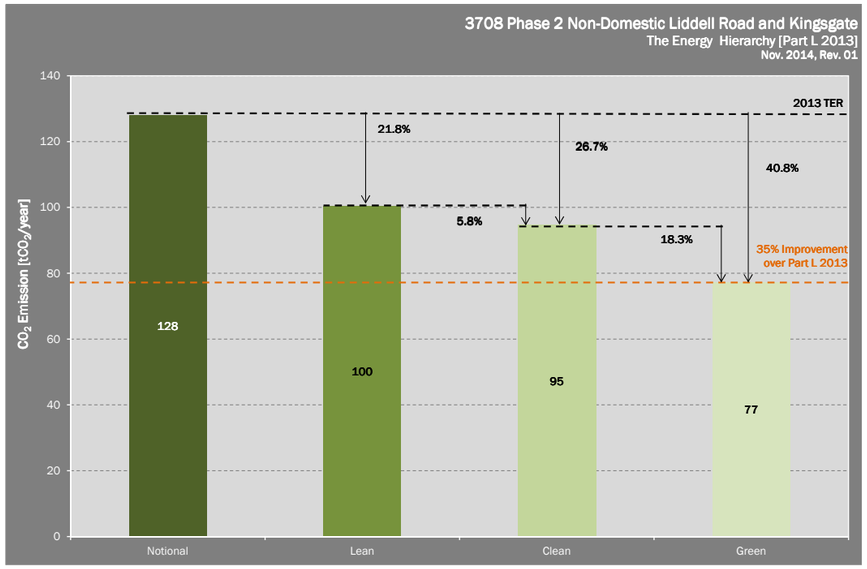


FIGURE 5.21. CHART ILLUSTRATING THE ESTIMATED CARBON SAVINGS (IN TCO_2/YEAR) IN THE NON-DOMESTIC BUILDINGS WITHIN THE PROPOSED PHASE 2 DEVELOPMENT, EXCLUDING UNREGULATED LOADS, ACCORDING TO PART L 2013.

Phase 2 Non-Domestic	CO_2 Emissions (Tons CO_2 / annum)	
	Regulated	Unregulated
Baseline: Part L 2013. of the building regulations compliant development	128	124
After energy demand reduction	100	124
After CHP	95	124
After renewable energy	77	124

FIGURE 5.22 TABLE SUMMARISING THE RESULTS OF THE IES CALCULATIONS FOR THE NON-DOMESTIC BUILDINGS WITHIN THE PROPOSED PHASE 2 DEVELOPMENT ILLUSTRATED ACCORDING TO THE MAYOR'S ENERGY HIERARCHY AND PART L 2013.

Phase 2 Non-Domestic	Regulated CO_2 Savings	
	(Tons CO_2 / annum)	(%)
Savings from energy demand reduction	28	21.6%
Savings from CHP	6	5.8%
Savings from renewable energy	17	18.3%
Total cumulative savings	51	39.7%
Total target savings	45	35.0%
Annual surplus	6	-

FIGURE 5.23 TABLE SUMMARISING THE ESTIMATED CARBON SAVINGS OF THE NON-DOMESTIC BUILDINGS WITHIN THE PROPOSED PHASE 2 DEVELOPMENT ILLUSTRATED ACCORDING TO THE MAYOR'S ENERGY HIERARCHY AND PART L 2013.