Lower Teddington Road,

Hampton

Energy Statement

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Contents

1.0 Executive Summary

This preliminary report considers the predicted energy demand for the proposed redevelopment at Lower Teddington Road, Hampton.

This document complies with the requirements at both national and local level, as set out in the National Planning Policy Framework (2018), The London Plan (2016) and London Borough of Richmond Upon Thames: Adopted Local Plan (July 2018).

The energy requirements of the development have been modelled in compliance with Part L of the Building Regulations 2013 and are based on the site layout plans provided by PRC Architecture and Planning.

This report includes annualised baseline calculations which predict the likely energy consumption and associated CO_2 emissions for the development. The total baseline energy and carbon emissions for the entire development, taking into account regulated energy demands are:

- **449,497 kWh/annum**
- **116.24 Tonnes CO_2/annum**

Unregulated energy use is not covered by existing regulations and includes energy consumed by the occupants through activities and appliances; in this case it would typically be small power usage (computers, equipment, appliances *etc.*). The following unregulated energy use for the development was calculated:

- **171,547 kWh/annum**
- **71.40 Tonnes CO_2/annum**

The following energy hierarchy has been adhered to in order to determine the most appropriate strategy for the development:

1. Be Lean, Reduce energy and carbon emissions through the use of passive design and energy efficiency measures;
2. Be Clean, Reduce energy and carbon emissions by investigating the possibility of installing a site wide CHP system or connecting to an existing decentralised Combined Heat and Power (CHP) network;
3. Be Green, Reduce energy and carbon emissions by installing Low or Zero Carbon (LZC) Technologies such as Solar panels, Photovoltaics, Wind Turbines etc.

Be Lean

In order to initially reduce carbon emissions from a base Part L 2013 compliant development, the following passive design and energy efficiency measures have been incorporated:

- Additional improvements to the thermal performance of the fabric of the buildings;
- The provision of energy efficient lighting;
- The provision of time and temperature zone controls.

Further examples of the proposed measures to be provided are in Section 7.0 'Passive Design and Energy Efficiency Measures' of this report.

Following the incorporation of the above measures the total baseline energy and carbon emissions for the development, taking into account regulated energy demands, are reduced to:

- **437,377 kWh/annum**
- **122.49 Tonnes CO_2/annum**

Be Clean

The following two energy strategies have been considered for the development:

1. Connection to an existing Combined Cooling Heat and Power (CCHP) / Combined Heat and Power (CHP) distribution Networks

   - There are currently no existing CHP distribution networks available to connect to.

2. A Gas fired site-wide CCHP/CHP

   - In order to economically justify installing a CHP unit on site, a minimum requirement of 4000 hours running time per year is necessary. Based on the number of proposed units and the resulting heating and the hot water demand, it is not recommended to install a central CHP plant.

Be Green

A range of low or zero carbon technologies have been considered for incorporation within the proposed development; it has been proposed that Air Source Heat Pumps (ASHP) and Solar PV panels at roof level are incorporated into the development.

Further details of the feasibility analysis of low or zero carbon technologies are detailed within Section 10.0 'Renewable Energy' of this report.

Following the inclusion of PV at roof level, the total baseline energy and carbon emissions for the development, taking into account regulated energy demands have further reduced to:

- **365,157 kWh/annum**
- **75.00 Tonnes CO_2/annum**

Proposed Energy Strategy for Lower Teddington Road, Hampton:

In summary the energy strategy comprises of:

- Passive Design and Energy Efficient Measures (Section 7.0);
- Air Source Heat Pumps (ASHP) within the gym (Section 9.0).
- Solar PV Panels (Section 9.0)

The strategy takes into consideration the site layout and requirements for the building type to produce a design that incorporates the most appropriate technologies available to the site. This provides a

scheme that is commercially viable whilst targeting compliance with all policies applicable to this development. The Energy Strategy consists of passive design and energy efficient measures such as the provision of energy efficient lighting, the provision of time and temperature zone heating controls, and accredited construction details for the development. The use of further/ emerging technologies may be included for use within this development if their feasibility increases in the future, in line with best practice.

This review has resulted in the formulation of an Energy Strategy to be adopted for the development involving the use of passive design and energy efficiency measures, the installation of Air Source Heat Pumps and the installation of a 100.375 kWp PV array; which is anticipated to achieve compliance with Part L 2013, The London Plan (2016) and London Borough of Richmond Upon Thames: Adopted Local Plan (2018). The following Table 1.1 and 1.2 highlights the carbon and energy savings that are currently anticipated for the development from a base Part L 2013 compliant build:

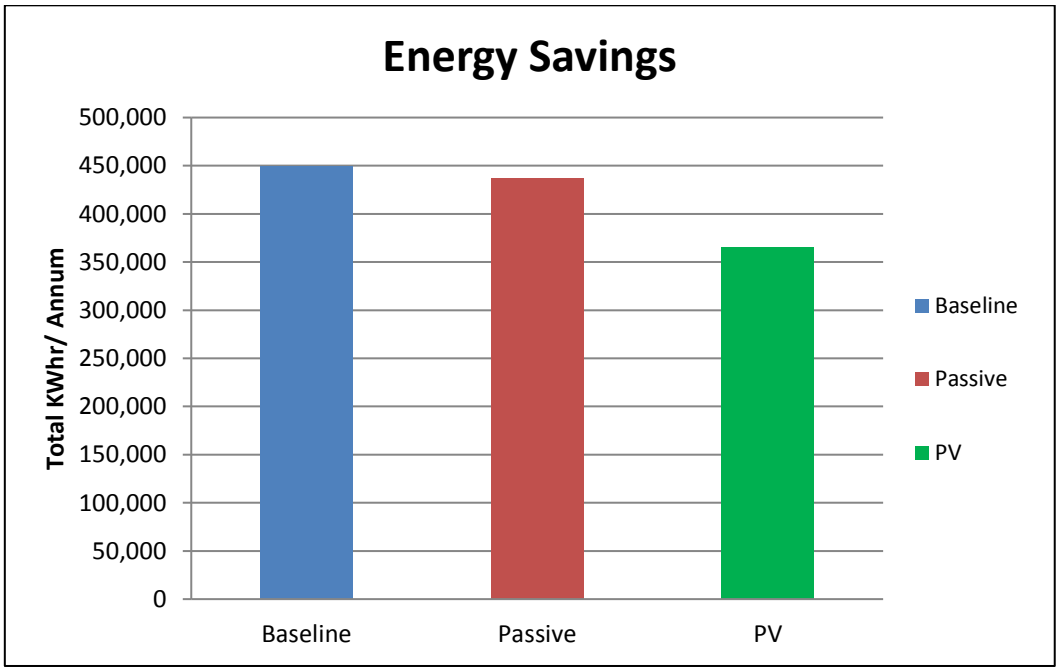
Development	Carbon Dioxide Emissions (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	116.24	71.40
After Energy Demand Reduction	112.49	It is anticipated that a circa 3% saving can be achieved through the use of energy efficient fittings, for example A or A+ appliances. This would reduce the unregulated carbon emissions to: 69.29
After PV	75.00	

Table 1.1 Carbon Dioxide Emissions of Development

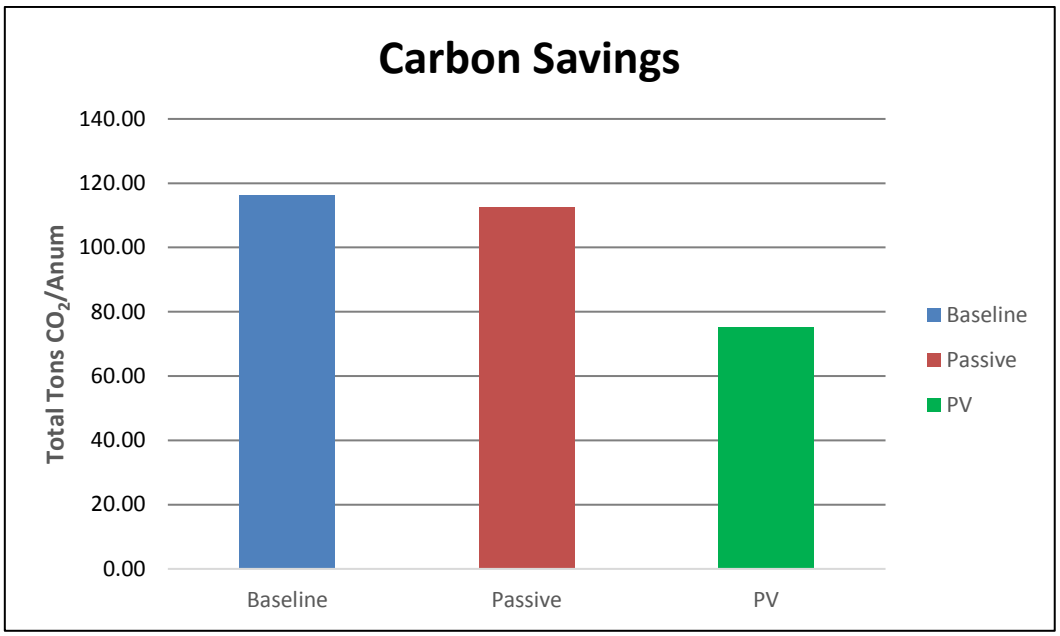
Development	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per annum	%
Savings from energy demand reduction	3.76	3.23
Savings from PV	37.48	32.25
Total Cumulative Savings	41.24	35.48
Total Target Savings	40.68	**35%**
Annual Surplus	0.56	0.48%

Table 1.2 Regulated Carbon Savings of Development

The development shall have an anticipated CO_2 improvement of 35.48% beyond Part L 2013, complying with local policy requirements. The energy and carbon savings achieved can be visually represented as per graphs 1.1 and 1.2 below:



Graph 1.1: Annual Energy Savings



Graph 1.2: Annual Carbon Savings

2.0 Introduction

This report has been prepared by Cudd Bentley Consulting for The Sons of Divine Providence Developments Ltd to develop an energy strategy for the proposed redevelopment of Lower Teddington Road, Hampton. Full planning permission is sought for the Erection of an Independent Senior Living Extra Care building comprising 28 units (following demolition of the existing care home) at 12-14 Station Road; the refurbishment and renovation of Nos.13 and 23-33 Lower Teddington Road (including the erection of a single storey rear extension to No.23 and the change of use of No.13 from office to residential); the erection of a temporary sales building to the rear of Nos 31-33 Lower Teddington Road; and associated landscape planting and car parking. This document will be considered as part of the planning application.

Government policies now require significant energy reductions from proposed buildings. Building a greener future sets a planned trajectory outlined via Part L 2013 of the Building Regulations. These commitments have been the key focus point in addressing policies and strategies to reduce energy use and carbon emissions through energy efficiency and low or zero carbon technologies (LZC).

In line with best practice the following approach has been adopted in forming the energy strategy for the development:

1. To propose to improve the building fabric from minimum Part L 2013 Building Regulations requirements; (BE LEAN)

2. To propose to reduce energy consumption and carbon dioxide emissions through passive and energy efficiency measures; (BE LEAN)

3. Investigate the feasibility of connecting into an existing district heat network and where this is not available investigate the feasibility of providing a central CHP Plant to serve the base heating and hot water requirements for the development; (BE CLEAN)

4. To propose to reduce energy consumption and carbon dioxide emissions further through the use of on-site renewable / LZC energy technologies. (BE GREEN)

The recommended strategy takes into consideration the site layout and requirements for the building to produce a design that incorporates the most appropriate technologies available to the site that are commercially viable, whilst targeting compliance with all policies applicable to this development.

3.0 Policy Review

National Planning Policy

An effective planning system is required to contribute to achieving sustainable development. The ***National Planning Policy Framework*** (NPPF), 2018, outlines what the government deems as sustainable development in England.

Sustainable development is defined as having the following three overarching objectives which are interdependent and need to be pursued in mutually supportive ways: an economic objective, a social objective, and an environmental objective.

1. Economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;

2. Social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and

3. Environmental objective – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

The above objectives can be described as an energy trilemma, this is demonstrated in Figure 4.1 below. Each dimension is dependent on each other and sustainable development proposals should adhere to each role. This energy statement shall ensure the proposed Development is one that contributes economically, socially and environmentally in accordance with the NPPF, 2018.

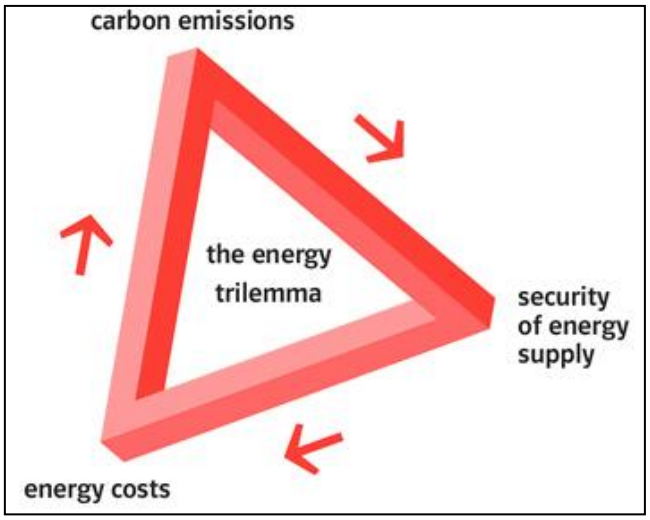


Figure 4.1 The Energy Trilemma

Guidance has been followed from the (NPPF), 2018, to provide an energy strategy which reduces energy use and carbon emissions, in line with best practice. This will provide a balanced scheme which focuses on optimal use of non-renewable resources (energy efficiency measures) whilst providing a renewable energy strategy best suited to the sites and their building uses. Below are some key extracts relevant to the development from Chapter fourteen 'Meeting the Challenge of Climate Change, Flooding & Coastal Change':

Paragraph 149

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

Paragraph 150

New development should be planned for in ways that:

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

Paragraph 151

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

a. provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);
b. consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and
c. identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

Paragraph 152

Local planning authorities should support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.

Paragraph 153

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

a. comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
b. take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

Local Planning Policy

The London Plan (2016)

The London plan states that:

"*Tackling climate change will also require a move towards more sustainable energy sources, and the London Plan seeks to support the development of decentralised energy systems, including the use of low carbon and renewable energy and the greater utilisation of energy generated from waste*" (Chapter 5, Paragraph 5.9).

The following policies outline requirements made by the Greater London Authority in relation to climate change and energy use.

Policy 5.1 Climate Change Mitigation

The Mayor seeks to achieve an overall reduction in London's carbon dioxide emissions of 60 per cent (below 1990 levels) by 2025. It is expected that the GLA Group, London boroughs and other organisations will contribute to meeting this strategic reduction target, and the GLA will monitor progress towards its achievement annually.
Within LDFs boroughs should develop detailed policies and proposals that promote and are consistent with the achievement of the Mayor's strategic carbon dioxide emissions reduction target for London.

Policy 5.2 Minimising Carbon Dioxide Emissions

Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

- Be Lean: use less energy –This involves the use of passive and energy efficiency design measures to reduce the energy requirement and subsequent carbon footprint of the site. These provide a footprint which delivers compliance with Building Regulations Part L (2013) and the Baseline Energy and Carbon emission figures for the development.
- Be Clean: supply energy efficiently – The use of a central energy centre has been considered to serve the development, to provide the primary heating and cooling requirements for the development.
- Be Green: use renewable energy – The use of renewable energy has been investigated in the context of the site and the overall usage patterns of energy throughout the development.

The Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.

Residential Buildings:

Year	Improvement on 2010 Building Regulations
2010 – 2013	25 per cent (Code for Sustainable Homes level 4)t
2013 – 2016	40 per cent
2016 – 2031	Zero Carbon

Major development proposals should include a detailed energy assessment to demonstrate how the targets for carbon dioxide emissions reduction outlined above are to be met within the framework of the energy hierarchy.
As a minimum, energy assessments should include the following details:

- calculation of the energy demand and carbon dioxide emissions covered by Building Regulations and, separately, the energy demand and carbon dioxide emissions from any other part of the development, including plant or equipment, that are not covered by the Building Regulations (see paragraph 5.22) at each stage of the energy hierarchy
- proposals to reduce carbon dioxide emissions through the energy efficient design of the site, buildings and services c proposals to further reduce carbon dioxide emissions through the use of decentralised energy where feasible, such as district heating and cooling and combined heat and power (CHP)
- proposals to further reduce carbon dioxide emissions through the use of on-site renewable energy technologies.

The carbon dioxide 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 carbon dioxide savings elsewhere.

The GLAs Energy Planning guidance requires carbon reduction for schemes received on or after the 1st October 2016 to be zero carbon for residential development and 35% below Part L 2013 for commercial development.
The carbon dioxide 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 carbon dioxide savings elsewhere.

Policy 5.3 Sustainable Design and Construction

The highest standards of sustainable design and construction should be achieved in London to improve the environmental performance of new developments and to adapt to the effects of climate change over their lifetime.
Development proposals should 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 and this should be clearly demonstrated within a design and access statement. The standards include measures to achieve other policies in this Plan and the following sustainable design principles:

- minimising carbon dioxide emissions across the site, including the building and 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 runoff)
- 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, and i promoting and protecting biodiversity and green infrastructure.

Within LDFs boroughs should consider the need to develop more detailed policies and proposals based on the sustainable design principles outlined above and those which are outlined in the Mayor's supplementary planning guidance that are specific to their local circumstances

Policy 5.5 Decentralised Energy Networks

The Mayor expects 25 per cent of the heat and power used in London to be generated through the use of localised decentralised energy systems by 2025. In order to achieve this target, the Mayor prioritises the development of decentralised heating and cooling networks at the development and area wide levels, including larger scale heat transmission networks.

Within LDFs boroughs should develop policies and proposals to identify and establish decentralised energy network opportunities. Boroughs may choose to develop this as a supplementary planning document and work jointly with neighbouring boroughs to realise wider decentralised energy network opportunities. As a minimum, boroughs should:

- identify and safeguard existing heating and cooling network
- identify opportunities for expanding existing networks and establishing new networks. Boroughs should use the London Heat Map tool and consider any new developments, planned major infrastructure works and energy supply opportunities which may arise
- develop energy master plans for specific decentralised energy opportunities which identify:
    - major heat loads (including anchor heat loads, with particular reference to sites such as universities, hospitals and social housing)
    - major heat supply plant
    - possible opportunities to utilise energy from waste
    - possible heating and cooling network routes
    - implementation options for delivering feasible projects, considering issues of procurement, funding and risk and the role of the public sector
- require developers to prioritise connection to existing or planned decentralised energy networks where feasible.

Policy 5.6 Decentralised Energy in Development Proposals

Development proposals should 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:

1. Connection to existing heating or cooling networks.
2. Site wide CHP network.
3. Communal heating and cooling.

Policy 5.7 Renewable Energy

The Mayor seeks to increase the proportion of energy generated from renewable sources and expects that the projections for installed renewable energy capacity outlined in the Climate Change Mitigation and Energy Strategy and in supplementary planning guidance will be achieved in London.
Within the framework of the energy hierarchy (see Policy 5.2), major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.
Within LDFs boroughs should, and other agencies may wish to, develop more detailed policies and proposals to support the development of renewable energy in London – in particular, to identify broad areas where specific renewable energy technologies, including large scale systems and the large-scale deployment of small-scale systems, are appropriate. The identification of areas should be consistent with any guidelines and criteria outlined by the Mayor.
All renewable energy systems should be located and designed to minimise any potential adverse impacts on biodiversity, the natural environment and historical assets, and to avoid any adverse impacts on air quality.

Policy 5.8 Innovative Energy Technologies

The Mayor supports and encourages the more widespread use of innovative energy technologies to reduce use of fossil fuels and carbon dioxide emissions. In particular the Mayor will seek to work with boroughs and other partners in this respect, for example by stimulating:

- the uptake of electric and hydrogen fuel cell vehicles
- hydrogen supply and distribution infrastructure
- the uptake of advanced conversion technologies such as anaerobic digestion, gasification and pyrolysis for the treatment of waste.

Within LDFs boroughs may wish to develop more detailed policies and proposals to support the use of alternative energy technologies (particularly in infrastructure and master planning opportunities).

Policy 5.9 Overheating and Cooling

The Mayor seeks to reduce the impact of the urban heat island effect in London and encourages the design of places and spaces to avoid overheating and excessive heat generation, and to reduce overheating due to the impacts of climate change and the urban heat island effect on an area wide basis.

Major Development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

1. Minimise internal heat generation through energy efficient design
2. Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
3. Manage the heat within the building through exposed internal thermal mass and high ceilings
4. Passive ventilation
5. Mechanical ventilation
6. Active cooling systems (ensuring they are the lowest carbon options).

Major Development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs. New development in London should also be designed to avoid the need for energy intensive air conditioning systems as much as possible. Further details and guidance regarding overheating and cooling are outlined in the London Climate Change Adaptation Strategy.

Within LDFs boroughs should develop more detailed policies and proposals to support the avoidance of overheating and to support the cooling hierarchy.

London Borough of Richmond Upon Thames: Adopted Local Plan (July 2018)

Policy LP 20: Climate Change Adaption

A. The Council will promote and encourage development to be fully resilient to the future impacts of climate change in order to minimise vulnerability of people and property.
B. New development, in their layout, design, construction, materials, landscaping and operation, should minimise the effects of overheating as well as minimise energy consumption in accordance with the following cooling hierarchy:
    1. minimise internal heat generation through energy efficient design
    2. reduce the amount of heat entering a building in summer through shading, reducing solar reflectance, fenestration, insulation and green roofs and walls
    3. manage the heat within the building through exposed internal thermal mass and high ceilings
    4. passive ventilation
    5. mechanical ventilation
    6. active cooling systems (ensuring they are the lowest carbon options).
C. Opportunities to adapt existing buildings, places and spaces to the likely effects of climate change should be maximised and will be supported.

Policy LP 22: Sustainable Design and Construction

A. Developments will be required to achieve the highest standards of sustainable design and construction to mitigate the likely effects of climate change. Applicants will be required to complete the following:
    1. Development of 1 dwelling unit or more, or 100sqm or more of non-residential floor space (including extensions) will be required to complete the Sustainable Construction Checklist SPD. A completed Checklist has to be submitted as part of the planning application.

2. Development that results in a new residential dwelling, including conversions, change of use, and extensions that result in a new dwelling unit, will be required to incorporate water conservation measures to achieve maximum water consumption of 110 litres per person per day for homes (including an allowance of 5 litres or less per person per day for external water consumption).
3. New non-residential buildings over 100sqm will be required to meet BREEAM 'Excellent' standard.
4. Proposals for change of use to residential will be required to meet BREEAM Domestic Refurbishment 'Excellent' standard (where feasible).

Reducing Carbon Dioxide Emissions

B. Developers are required to incorporate measures to improve energy conservation and efficiency as well as contributions to renewable and low carbon energy generation. Proposed developments are required to meet the following minimum reductions in carbon dioxide emissions:
    1. All new major residential developments (10 units or more) should achieve zero carbon standards in line with London Plan policy.
    2. All other new residential buildings should achieve a 35% reduction.
    3. All non-residential buildings over 100sqm should achieve a 35% reduction. From 2019 all major non-residential buildings should achieve zero carbon standards in line with London Plan policy. Targets are expressed as a percentage improvement over the target emission rate (TER) based on Part L of the 2013 Building Regulations.
C. This should be achieved by following the Energy Hierarchy:
    1. Be lean: use less energy
    2. Be clean: supply energy efficiently
    3. Be green: use renewable energy

Decentralised Energy Networks

D. The Council requires developments to contribute towards the Mayor of London target of 25% of heat and power to be generated through localised decentralised energy (DE) systems by 2025. The following will be required:
    1. All new development will be required to connect to existing DE networks where feasible. This also applies where a DE network is planned and expected to be operational within 5 years of the development being completed.
    2. Development proposals of 50 units or more, or new non-residential development of 1000sqm or more, will need to provide an assessment of the provision of on-site decentralised energy (DE) networks and combined heat and power (CHP).
    3. Where feasible, new development of 50 units or more, or new non-residential development of 1000sqm or more, as well as schemes for the Proposal Sites identified in this Plan, will need to provide on-site DE and CHP; this is particularly necessary within the clusters identified for DE opportunities in the borough-wide Heat Mapping Study. Where on-site provision is not feasible, provision should be made for future connection to a local DE network should one become available.

Applicants are required to consider the installation of low, or preferably ultra-low, NOx boilers to reduce the amount of NOx emitted in the borough.
Local opportunities to contribute towards decentralised energy supply from renewable and low-carbon technologies will be encouraged where appropriate.

Retrofitting

E. High standards of energy and water efficiency in existing developments will be supported wherever possible through retrofitting. Householder extensions and other development proposals that do not meet the thresholds set out in this policy are encouraged to complete and submit the Sustainable Construction Checklist SPD as far as possible, and opportunities for micro-generation of renewable energy will be supported in line with other policies in this Plan.

4.0 Development Approach

This report adopts the following approach to provide compliance with the Local and National Planning Policies:

1. To propose to improve building fabric from minimum Part L (2013) Building Regulations requirements;
2. To propose to reduce energy consumption and carbon dioxide emissions through passive and energy efficiency measures;
3. Investigate the feasibility of connecting into an existing district heat network and where this is not available investigate the feasibility of providing a Central CHP Plant to serve the base heating and hot water requirements for the development;
4. To propose to reduce energy consumption and carbon dioxide emissions further through the use of on-site renewable / LZC energy technologies.

Table 4.1 below outlines the Part L Building Regulations that the development shall be assessed under:

Building Element	Part L Building Regulations Applicable
Care home and Orion House	Part L1A (2013)
Office to Residential Refurbishment	Part L1B (2013)
Residential units 13, 27, 27 and 29	Part L1B (2013)
Orion House communal areas	Part L2A (2013)
Sui Generis (Chapel)	Part L2B (2013)

Table 4.1: Part L Building Regulations Applicable

5.0 Details of Proposed Development

The proposed redevelopment of Lower Teddington Road is located in within the London Borough of Richmond Upon Thames. The proposed development is to provide the erection of an Independent Senior Living Extra Care building comprising 28 units (following demolition of the existing care home) at 12-14 Station Road; the refurbishment and renovation of Nos.13 and 23-33 Lower Teddington Road (including the erection of a single storey rear extension to No.23 and the change of use of No.13 from office to residential); the erection of a temporary sales building to the rear of Nos 31-33 Lower Teddington Road; and associated landscape planting and car parking.

Typical floor plans for the Orion House element of the Lower Teddington Road development can be seen below in Figures 5.1 to 5.4.

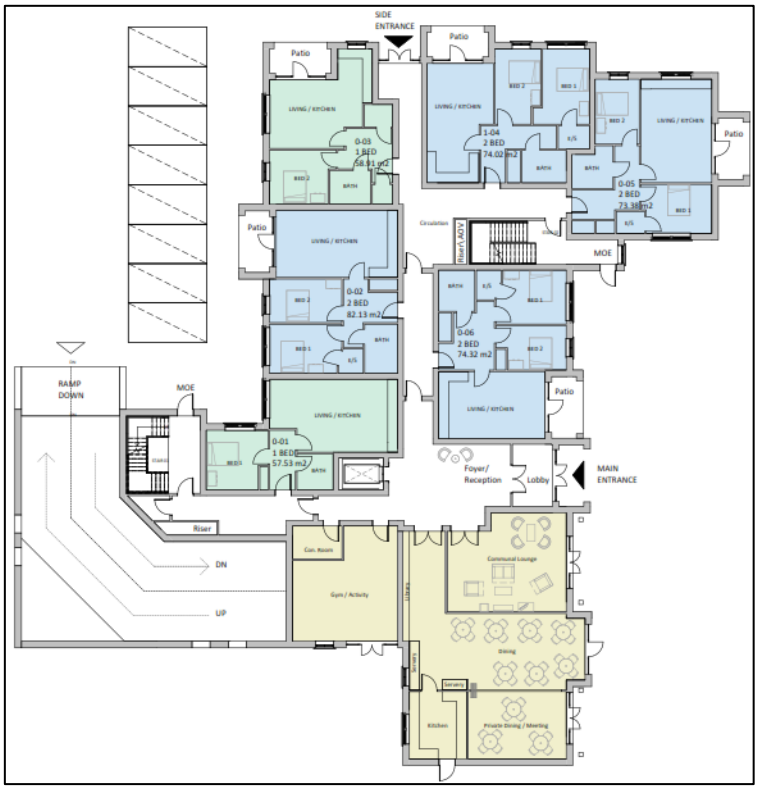


Figure 5.1 Proposed Ground Floor Plan

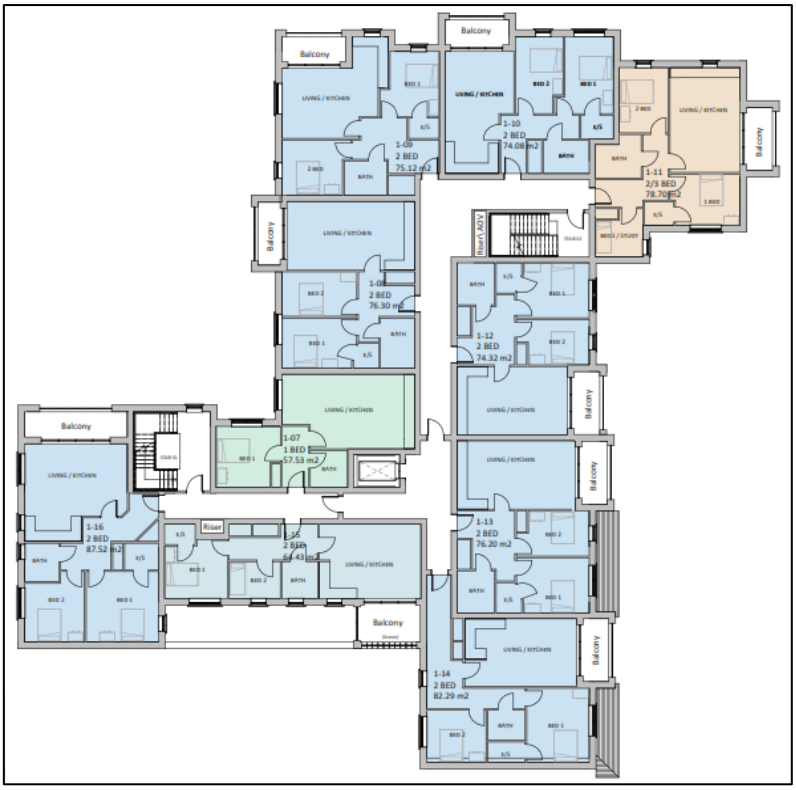


Figure 5.2 Proposed First Floor Plan

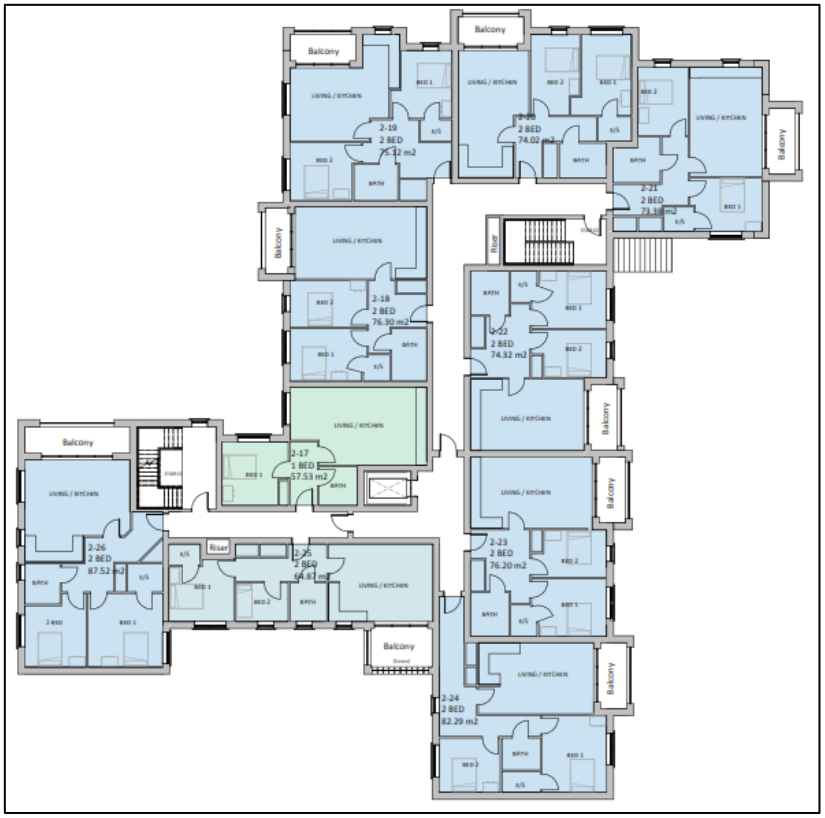


Figure 5.3 Proposed Second Floor Plan

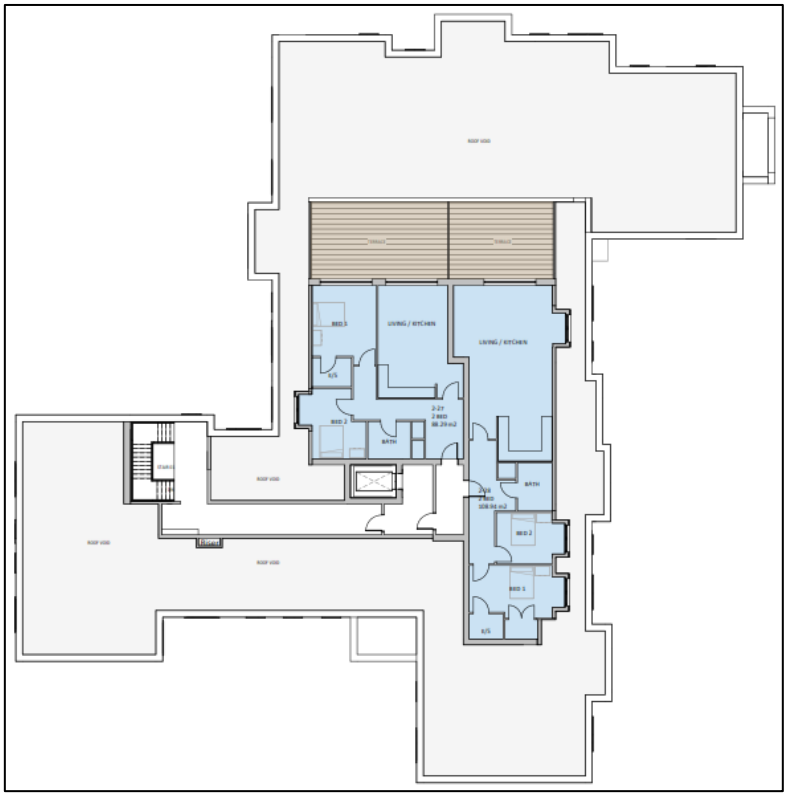


Figure 5.3 Proposed Second Floor Plan

6.0 Assessment of Baseline Energy Demand

The primary energy demands of the Lower Teddington Road redevelopment will be:

- Heating;
- Lighting;
- Hot Water;
- General Power;
- Cooling;
- Ventilation.

To assess the preliminary energy consumption of the proposed development, computer calculations have been completed using approved SBEM software (Hevacomp V8i SS1 SP1) and SAP software (JPA Designer, Version 9.92) for the residential element. The calculations generate annualised energy consumption for the buildings, from which the "carbon footprint" can be assessed.

The assessment of the energy demand for the site has been based on the notional development according to the building's uses, through the construction of a building model in compliance with the requirements of Part L 2013 of the Building Regulations.

The following 'U' values were modelled within the baseline calculations of the new build elements in accordance with the threshold values of Part L1A (2013).

- External Walls - U = 0.18 W/m².K;
- Exposed Floors - U = 0.13 W/m².K;
- Exposed Roofs - U = 0.13 W/m².K;
- Glazing - U = 1.2 W/m².K;
- Air Permeability - 3 m^3/hr/m^2@ 50 Pa.

The following 'U' values were modelled within the baseline calculations of the existing built elements in accordance with the year of build.

- External Walls - U = 1.7 W/m².K;
- Exposed Floors - U = 1.42 W/m².K;
- Exposed Roofs - U = 1.42 W/m².K;
- Glazing - U = 2.2 W/m².K;
- Air Permeability - 15 m^3/hr/m^2@ 50 Pa.

The total baseline energy and carbon emissions for the entire development, taking into account regulated energy demands are:

- **449,497 kWh/annum**
- **116.24 Tonnes CO_2/annum**

(A full set of calculations supporting these figures included in Appendix A of this document)

7.0 Passive Design and Energy Efficient Measures

To provide carbon savings beyond a base Part L 2013 build; in compliance with the local and national policies, the following passive design and energy efficiency measures are recommended.

- The provision of energy efficient lighting and display lighting;
- Photoelectric and occupancy sensor lighting controls within relevant building areas;
- The provision of time and temperature zone control;
- The provision of metering on the HVAC system;
- Specific Fan Powers improved beyond Part L requirements.

Accredited construction details in line with Table K1 of Part L of the Building Regulations.

From the utilisation of the above measures the total energy and carbon emissions for the development (built to Part L 2013) are reduced to:

- **437,377 kWh/annum**
- **112.49 Tonnes CO_2/annum**

(A full set of calculations supporting these figures included in Appendix A of this document)

8.0 Decentralised Energy

Combined heat and power (CHP), also known as co-generation, is the simultaneous generation of both usable heat and electrical power from the same source. CHP provides heat and electricity at a reduced carbon cost and can therefore offer energy efficiency for developments that have a large and constant heat demand.

8.1 Existing Community Heating Network

The Department of Energy and Climate Change (DECC) CHP Focus Database has been used to investigate the possibility of connecting to an existing CHP system. Results from the database (displayed in Appendix D) confirm that there are currently no existing CHP systems available for the development to connect to.

To enable the possible growth of district heating within the Reading area, the energy strategy for the development proposes a central gas boiler that shall be designed to be capable of connection to an off-site district network in the future.

8.2 Site Wide CHP

The technical viability of installing a single site wide CHP system has been explored to deliver the heating and hot water demand of the residential units. However, it is considered unviable for the following reasons:

- For the provision of a CHP system to be commercially viable, a base load (in this case heating and domestic hot water) must extend for a minimum operational period of 4,000 – 5,000 hours per annum, the anticipated individual CHP operation hours can be seen in Table 8.1 to be lower than the required minimum operation period.
- According to GLA guidance on preparing energy assessments, for small to medium sized residential developments containing fewer than 500 apartments, CHP systems are not considered economically feasible in residential led, mixed use developments.

Months	Load per Day (hrs)	Load per week (hrs)	Load per month (hrs)	Load for 6 months (hrs)	
April to Sept	8	56	224	1344	
October to March	12	84	336	2016	
		Total approximate Load for a year		3360	hours
		Minimum required hours		4000	hours

Table 8.1 Anticipated CHP Operation Hours

9.0 Renewable Energy

The use of renewable and low or zero carbon (LZC) technologies within the development has been addressed and the following, Table 9.1, reviews the primary options for generation of on-site renewable / LZC energy and considers their suitability for use on the development.

<table>
<tr><th colspan="2">Renewable Technology Feasibility Assessment</th><th>Feasible?</th></tr>
<tr><td>Bio Fuel Boilers
  </td><td>Bio-fuel boilers are specifically designed to burn solid biomass or liquid bio-fuel in order to heat water or raise steam. This can then be used for space heating or domestic hot water (DHW) supply.

Bio-fuel boilers are not proposed for use within the development for the following reasons

1. Biomass boilers generate increased Oxides of Nitrogen (NOx) and particulates (PM10) which would affect air quality;

2. The requirement of bio-fuel would involve a vehicular movement of articulated lorries fortnightly delivering to the site. As this is a city centre location, this would not be desirable;

3. The storage requirements for the biofuel would require a large plant space, with an auxiliary storage facility to allow for a two-week period where delivery of fuel might not be available;</td><td rowspan="2">No</td></tr>
<tr><td colspan="2"><u>Land Use</u>

Large volumes of storage are required for fuel at ground level or basement level with sufficient vehicular access for fuel delivered.

<u>Noise</u>

Noise levels are generated by the operation of the bio-fuel boiler and associated deliveries of the bio-fuel. The plant room enclosure would have to be attenuated to acceptable levels imposed by planning and Acoustician recommendations. Delivery schedules would have to be scheduled to minimise potential noise issues.</td></tr>
</table>

<table>
<tr><th colspan="2">Renewable Technology Feasibility Assessment</th><th>Feasible?</th></tr>
<tr><td>Wind Turbines
  </td><td>Wind turbines convert the kinetic energy in the wind into mechanical energy which is then converted into electricity. Wind turbines can provide electrical power either directly to a load or via a battery system

Wind Turbines are not proposed for use within the development for the following reasons:

1. Wind turbines are considered inappropriate on spatial, planning, aesthetic and noise grounds due to the urban location. Noise pollution from commercial wind turbines can be quite significant within a few hundred metres;

2. The site is not ideal; an ideal site is a hill with a flat, clear exposure. It should be free from strong turbulence and obstructions like large trees, houses or other buildings. As the building is located in an urban area, other buildings will produce turbulence;

3. The financial viability of a small-scale installation on the site would be compromised by the operational efficiency of the units (circa 30%);

4. Wind turbines can cause electrical interference within a 2km radius;

5. Wind speeds for the site can be seen in Appendix B, which shows that at 10m the site has a wind speed of 4.6mph and at 25m the wind speed is 5.3mph, a minimum of 5.5mph is recommended.</td><td rowspan="2">No</td></tr>
<tr><td colspan="2"><u>Land Use</u>

The site plans demonstrate that there is in-sufficient space for the allocation of a suitably sized wind turbine.

<u>Noise</u>

Noise levels are generated by the rotating blades; these noise levels will vary dependent on wind velocity and will need to be in acceptable levels imposed by planning and Acoustician recommendations.</td></tr>
</table>

<table>
<tr><th colspan="2">Renewable Technology Feasibility Assessment</th><th>Feasible?</th></tr>
<tr><td>Ground Source Heat Pumps
  </td><td>Space heating & cooling can be provided by circulating water heated or cooled directly by the ground or via subterranean water. Ground water cooling through the use of aquifers makes use of the relatively stable ground/ water temperature which is available at a temperature range of 10 – 14°C.

Ground Source Heat Pumps are not proposed for use within the development for the following reasons:

1. The installation of ground source heat pumps for this development would involve extensive excavation works which is not appropriate as it is an existing building within a semi-urban London Borough;</td><td rowspan="2">No</td></tr>
<tr><td colspan="2"><u>Land Use</u>

This installation would require Environmental Agency approval (if an open loop system connecting to an aquifer is selected). Ground and Hydrology analysis would be required to investigate if favourable conditions exist.

<u>Noise</u>

There are no noise issues generated by this technology.</td></tr>
<tr><td>Solar Water Heating
  </td><td>Solar Water Heating systems use radiant energy from the sun to heat water. Systems comprise of a roof mounted heat collector piped to a coil located within a hot water storage cylinder. Solar Panels are not proposed for use within the proposed development for the following reasons:

1. Roof space is better utilised for a PV installation.</td><td rowspan="2">No</td></tr>
<tr><td colspan="2"><u>Land Use</u>

Roof space is required for the installation of solar panels; optimum installation is south facing at an angle of 30 degrees.

<u>Noise</u></td></tr>
</table>

<table>
<tr><th colspan="2">Renewable Technology Feasibility Assessment</th><th>Feasible?</th></tr>
<tr><td colspan="2">Noise levels are generated by pumps at roof level, these are insignificant so should pose no issues.</td><td></td></tr>
<tr><td>Air Source Heat Pumps
  </td><td>An Air Source Heat Pump extracts heat from the outside air in the same way that a fridge extracts heat from its inside. It can extract heat from the air even when the outside temperature is as low as minus 15°C.

Air Source Heat Pumps (ASHP) are proposed for use within the commercial new build element of Orion House to provide the cooling requirements of the zone. The benefits of ASH{ are as follows:

1. Air Source Heat Pumps are to be utilised on this development, as it is the most efficient way to meet the heating and cooling demands of the development.
2. They are ideally suited to serve the individual commercial tenant areas during periods when heating and cooling may be required;
3. Air to Air or Air to Water applications can be used to suit the tenant’s bespoke environmental requirements; and
4. The heat pump units can be configured to provide internal heat reclaim from dissimilar environmental zones, reducing energy consumption and carbon emissions.</td><td rowspan="2">Yes</td></tr>
<tr><td colspan="2"><u>Land Use</u>

Air Source Heat Pumps can be installed on ground mounted, roof mounted or wall mounted frames. When installing Air Source Heat Pumps there are various factors to consider; Heat Pumps should be positioned to provide shelter from high winds which can reduce efficiency by causing defrost problems and be kept free from leaves and debris.

<u>Noise</u>

Noise levels are generated by fans, and compressors causing vibrations. The noise levels are dependent on manufacturer and vary accordingly, these will need to be in acceptable levels imposed by planning and Acoustician recommendations.</td></tr>
</table>

Renewable Technology Feasibility Assessment		Feasible?
Photovoltaics 	Photovoltaic (PV) modules convert sunlight directly to DC electricity. The solar cells consist of a thin piece of semiconductor material, in most cases silicon. A solar PV array totalling 100.375 kWp, comprising of 365 panels spanning circa 584 sq.m of roof space, is proposed for the development, due to the following advantages: 1. Photovoltaic panels can be situated at roof level to provide a source of renewable energy. 2. Panels can be grid connected to sell surplus electricity produced. 3. Low maintenance issues. 4. Visual use of renewable energy can be seen by public. The installation of a Photovoltaic system, if registered, would further benefit from the Feed in Tariff (FIT) scheme. A copy of the financial benefits available is provided in Appendix B.	Yes
Land Use There are no land issues or adverse visual impacts as the photovoltaics are roof mounted. Noise There are no noise issues generated by this technology.		

Table 9.1 Renewable Technology Feasibility Assessment

10.0 Summary of Proposed Scheme

Consideration has been given in Sections 8.0 and 9.0, of this document, to the options that are available for the development in relation to Low Zero Carbon technologies and renewable energy. The technologies considered are as follows:

- Decentralised Gas fired CHP;
- Bio-fuel boilers;
- Wind Turbine;
- Ground Source Heat Pump;
- Solar Water Heating;
- Air Source Heat Pump;
- Photovoltaics.

This review has resulted in the formulation of an Energy Strategy to be adopted for the development involving the installation of high efficiency condensing gas boilers within the residential areas, and a 100.375 kWp Solar PV system.

The available roof space at the development was identified and is displayed below in Table 10.1. The breakdown of the 100.375 kWp array can be seen below in Table 10.2 as required by the different elements of the development, along with the required area and proposed location of the required PV panels.

Roof Space Avaliable	Area (sq.m)
South Facing	120.24
East Facing	146
West	185
Flat	332.35
Total	783.59

Table 10.1 Available Roof Space for PV Array

PV Requirement	kWp	Area (Sq.m)
Chapel	21.725	115.2 South
		11.2 East
Orion House (Commercial)	5.775	33.6 East
Residential (New Build)	26.4	155.6 Flat
Residential (Existing)	46.475	175 Flat
		95.4 East
Total	100.375	586

Table 10.2 Solar PV Breakdown

The following Tables 10.3 to 10.8 highlight the carbon emissions and savings that are currently anticipated for the development from a base Part L 2013 compliant build. Based on the analysis within this report, it is confirmed that the development achieves Part L 2013 compliance and with the local planning requirements.

Commercial Element	Carbon Dioxide Emissions (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	32.08	34.74
After Energy Demand Reduction	28.76	It is anticipated that a circa 3% saving can be achieved through the use of energy efficient fittings, for example A or A+ appliances. This would reduce the unregulated carbon emissions to: 33.70
After PV	20.79	

Table 10.3 Carbon Dioxide Emissions of Commercial Element

Commercial	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per annum	%
Savings from energy demand reduction	3.33	10.35
Savings from PV	7.97	24.84
Total Cumulative Savings	11.30	35.21
Total Target Savings	11.23	35%
Annual Surplus	0.7	**0.21%**

Table 10.4 Regulated Carbon Savings of Commercial Element

Residential Element	Carbon Dioxide Emissions (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	84.16	37
After Energy Demand Reduction	83.72	It is anticipated that a circa 3% saving can be achieved through the use of energy efficient fittings, for example A or A+ appliances. This would reduce the unregulated carbon emissions to: 34.92
After PV	54.22	

Table 10.5 Carbon Dioxide Emissions of Residential Element

Residential Element	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per annum	%
Savings from energy demand reduction	0.44	0.52
Savings from PV	29.5	35.05
Total Cumulative Savings	29.94	35.57
Total Target Savings	29.45	35%
Annual Surplus	0.49	0.58%

Table 10.6 Regulated Carbon Savings of Residential Element

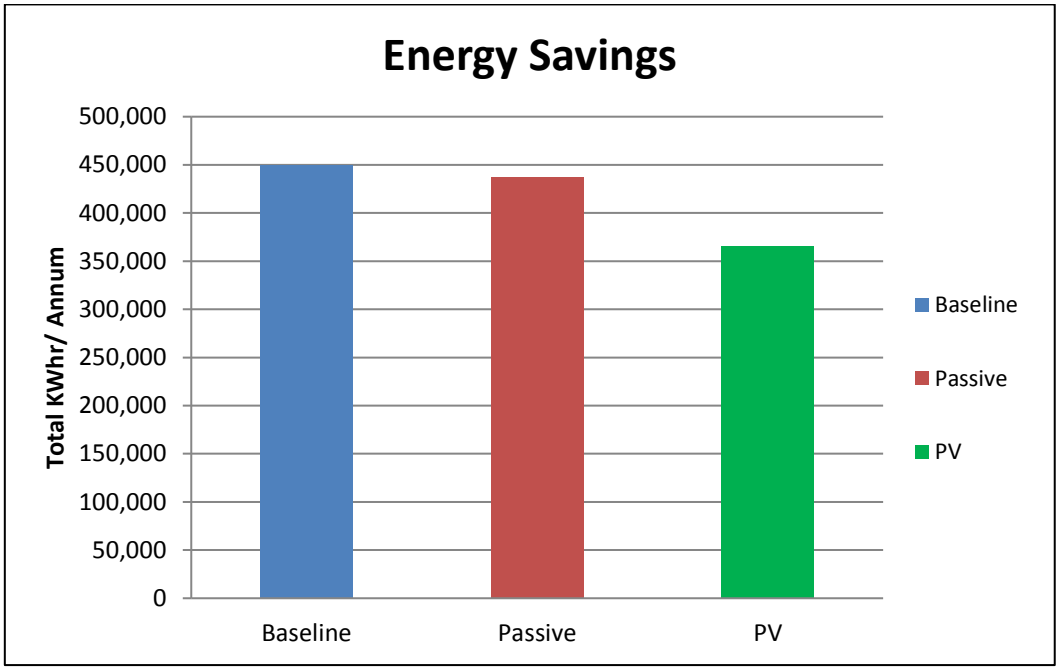
Development	Carbon Dioxide Emissions (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	116.24	71.40
After Energy Demand Reduction	112.49	It is anticipated that a circa 3% saving can be achieved through the use of energy efficient fittings, for example A or A+ appliances. This would reduce the unregulated carbon emissions to: 69.29
After PV	75.00	

Table 10.7 Carbon Dioxide Emissions of Development

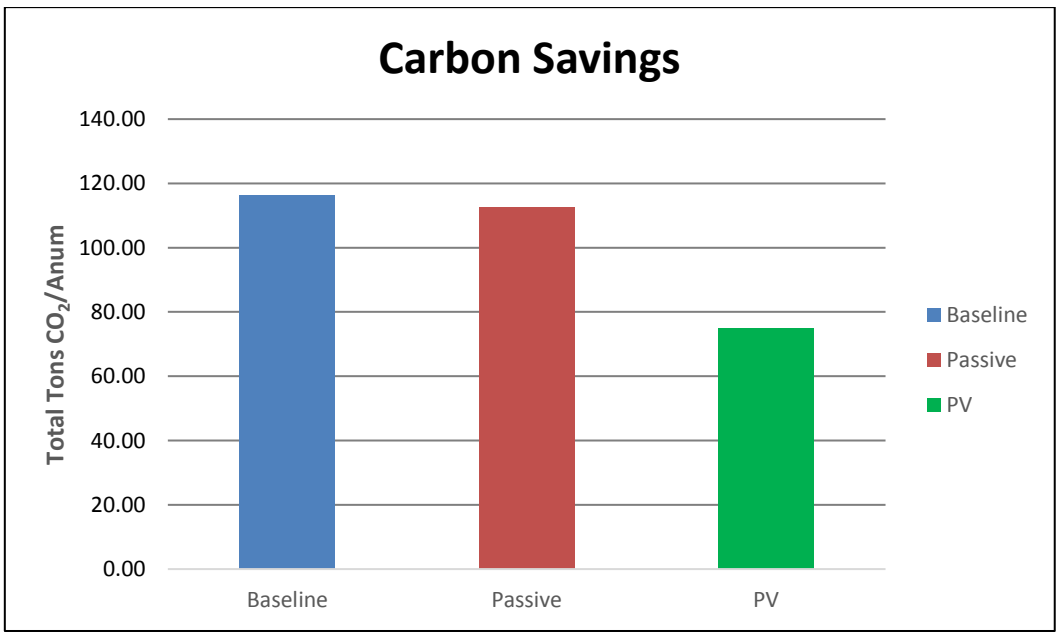
Development	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per annum	%
Savings from energy demand reduction	3.76	3.23
Savings from PV	37.48	32.25
Total Cumulative Savings	41.24	35.48
Total Target Savings	40.68	**35%**
Annual Surplus	0.56	0.48%

Table 10.8 Regulated Carbon Savings of Development

The development shall have an anticipated CO_2 improvement of 35.48% beyond Part L 2013, complying with local policy requirements. The energy and carbon calculations for the development, as well as the building rating at each stage (baseline, passive measures, and PV), are displayed in full within Appendix A. Furthermore, sample SAP calculations for the residential element are displayed in Appendix D. The energy and carbon savings achieved are visually represented as per graphs 10.1 and 10.2 below:



Graph 10.1: Annual Energy Savings



Graph 10.2: Annual Carbon Savings

Appendix A – Energy Calculations

Commercial Element

kWh/m²/annum Baseline											
Typical Unit	Area	Heating	Cooling	Auxillary	Lighting	Hotwater	Total	kWh/Annum	kgCO2/m²/ Annum	Total kgCO2/ Annum	Total TonsCO2/ Annum
Chapel Building	475.00m²	109.94	0	3.21	23.23	63.05	199.43	94729.25	51.1	24272.50	24.27
Orion House Commercial	191.44m²	38.58	0	4.93	20.72	88.68	152.92	29275.00	40.80	7810.75	7.81
Total	666							124,004		32,083	32.08

kWh/m²/annum Baseline with Passive/Energy Efficiency Measures											
Typical Unit	Area	Heating	Cooling	Auxillary	Lighting	Hotwater	Total	kWh/Annum	kgCO2/m²/ Annum	Total kgCO2/ Annum	Total TonsCO2/ Annum
Chapel Building	475.00m²	101.3	0	3.21	18.94	57.68	181.13	86036.75	45.8	21755.00	21.76
Orion House Commercial	191.44m²	38.66	0	4.29	13.95	86.78	143.69	27508.01	36.6	7006.70	7.01
Total	666							113,545		28,762	28.76

kWh/m²/annum Baseline with Passive/Energy Efficiency Measures & PV											
Typical Unit	Area	Heating	Cooling	Auxillary	Lighting	Hotwater	Total	kWh/Annum	kgCO2/m²/ Annum	Total kgCO2/ Annum	Total TonsCO2/ Annum
Chapel Building	475.00m²	98.65	0	3.21	18.94	57.68	178.49	74504.96	33.2	15770.00	15.77
Orion House Commercial	191.44m²	38.66	0	4.29	13.95	86.78	143.69	23671.84	26.20	5015.73	5.02
Total	666							98,177		20,786	20.79

Unregulated Energy Demand

Typical Unit	Total Area	Energy from Equipment kWh/m2/ Annum	Total Energy kWh/annum	Gas %	Electricity %	KgCO2/m2	Total KgCO2/m2	Total TonsCO2/m²
Chapel Building	475.00m²	90	42750.00	60	40	30.17	14329.80	14.33
Orion House Commercial	191.44m²	196	37522.24	0	100	106.62	20412.10	20.41
Total	**666**		**80,272**				**34,742**	**34.74**

Energy Calculations (Regulated Energy Demands) Carbon

Typical Unit	Total Area	BaselineTotal kWh/annum	Baseline kgCO2/annum	Improved Emissions after Passive Energy Efficiency kgCO2 /annum	Improved Emissions after PV kgCO2/ annum	Total kgCO2/ annum displaced	Total TonsCO2/ annum displaced	Total % TonsCO2/ annum displaced
Chapel Building	475.00m²	94,729	24272.50	21755.00	15770.00	8502.50	8.50	35.03
Orion House Commercial	191.44m²	29,275	7810.75	7006.70	5015.73	2795.02	2.80	35.78
Total	**666**	**124,004**	**32,083**	**28,762**	**20,786**	**11,298**	**11.30**	**35.21**

Energy Calculations (Regulated Energy Demands) Energy

Typical Unit	Total Area	BaselineTotal kWh/annum	Baseline kgCO2/annum	Passive Energy Efficiency kwh /annum	PV kwh/annum	Total kwh/annum displaced	Total % kwh/annum displaced
Chapel Building	475.00m²	94,729	24272.50	86036.75	74504.96	20224.29	21.35
Orion House Commercial	191.44m²	29,275	7810.75	27508.01	23671.84	5603.17	19.14
Total	**666**	**124,004**	**32,083**	**113,545**	**98177**	**25,827**	**20.83**

Residential New Build

kWh/annum Baseline													
Typical Unit	Area m^2	Quantity	Total Area m^2	DER	TER	Heating	Cooling	Auxillary	Lighting	Hot Water	Total Kwh/Annum	Carbon kg Co2 / Annum	Tonnes
1 Bed Ground Floor	59.1	2	118.2	18.03	18.03	1336.64	0	13.37	269.15	2077.86	7394.04	2131.146	2.13
1 Bed Mid Floor	57.53	2	115.06	16.35	16.35	997.06	0	9.97	269.15	2077.86	6708.08	1881.231	1.88
2 Bed Ground Floor	76.2	4	304.8	15.18	15.18	1316.57	0	13.17	348.79	2248.99	15710.08	4626.864	4.63
2 Bed Mid Floor	77.7	18	1398.6	13.54	13.54	910.09	0	9.1	348.79	2248.99	63305.46	18937.044	18.94
2 Bed Top Floor	99.7	2	199.4	15.18	15.18	1419.22	0	14.19	384.79	2248.99	8134.38	3026.892	3.03
Total		28	2136.06								101252.04	30603.18	30.60

kWh/annum Baseline + Passive/Energy Efficiency Measures													
Typical Unit	Area m^2	Quantity	Total Area m^2	DER	TER	Heating	Cooling	Auxillary	Lighting	Hot Water	Total Kwh/Annum	Carbon kg Co2 / Annum	Tonnes
1 Bed Ground Floor	59.1	2	118.2	17.81	18.03	1284.84	0	12.85	269.15	2077.86	7289.4	2105.14	2.11
1 Bed Mid Floor	57.53	2	115.06	15.91	16.35	896.71	0	8.97	269.15	2077.86	6505.38	1830.60	1.83
2 Bed Ground Floor	76.2	4	304.8	15.11	15.18	1295.41	0	12.95	348.79	2248.99	15624.56	4605.53	4.61
2 Bed Mid Floor	77.7	18	1398.6	13.31	13.54	846.68	0	8.47	348.79	2248.99	62152.74	18615.37	18.62
2 Bed Top Floor	99.7	2	199.4	15.11	15.18	1397.91	0	13.98	348.79	2248.99	8019.34	3012.93	3.01
Total		28	2136.06								99591.42	30169.5746	30.17

kWh/annum Baseline + Passive/Energy Efficiency Measures + PV													
Typical Unit	Area m^2	Quantity	Total Area m^2	DER	TER	Heating	Cooling	Auxillary	Lighting	Hot Water	Total Kwh/Annum	Carbon kg Co2 / Annum	Tonnes
1 Bed Ground Floor	59.1	2	118.2	11.58	18.03	1284.84	0	12.85	269.15	2077.86	5870.54	1368.76	1.37
1 Bed Mid Floor	57.53	2	115.06	10.55	16.35	896.71	0	8.97	269.15	2077.86	5317.09	1213.88	1.21
2 Bed Ground Floor	76.2	4	304.8	9.72	15.18	1295.41	0	12.95	348.79	2248.99	12459.10	2962.66	2.96
2 Bed Mid Floor	77.7	18	1398.6	8.65	13.54	846.68	0	8.47	348.79	2248.99	49594.98	12097.89	12.10
2 Bed Top Floor	99.7	2	199.4	9.72	15.18	1397.91	0	13.98	348.79	2248.99	5948.50	1938.17	1.94
Total		28	2136.06								79190.22	19581.353	19.58

Unregulated Energy Demand									
Typical Unit	Area m^2	Quantity	Total Area	No of Occupants	Carbon from Appliances & Cooking per flat Tonnes Co2/Annum	Total Tonnes Co2 / Annum Cooking	Total kWH cooking	Total kWh Appliances	Total Tonnes Co2 / Annum Appliances
1 Bed Ground Floor	59.1	2	118.2	1.17	0.15	0.29	1500.82	2856.04	1.50
1 Bed Mid Floor	57.53	2	115.06	1.17	0.15	0.29	1500.82	2856.04	1.50
2 Bed Ground Floor	76.2	4	304.8	2.26	0.17	0.69	3535.51	5712.08	3.00
2 Bed Mid Floor	77.7	18	1398.6	2.26	0.17	3.12	15909.80	25704.36	13.48
2 Bed Top Floor	99.7	2	199.4	2.26	0.17	0.35	1767.76	2856.04	1.50
Total		28	2,136			5	24,215	39,985	21

Carbon Calculations													
Typical Unit	Total Area	Quantity	Total Area	BaselineTotal kWh/annum	Baseline kgCO2/annum	Improved Emissions after Passive Energy Efficiency kgCO2 /annum	Improved Emissions after PV kgCO2/annum	Total kgCO2/annum displaced	Total TonsCO2/annum displaced	Total % TonsCO2/annum displaced	kgCO2/annum displaced by PV	TonsCO2/annum displaced by PV	% TonsCO2/annum displaced by PV
1 Bed Ground Floor	59.1	2	118.2	7,394	2,131	2105.14	1,369	762.39	0.76	35.77	736.39	0.72	34.55
1 Bed Mid Floor	57.53	2	115.06	6,708	1,881	1830.60	1,214	667.35	0.67	35.47	616.72	0.61	32.78
2 Bed Ground Floor	76.2	4	304.8	15,710	4,627	4605.53	2,963	1664.21	1.66	35.97	1642.87	1.62	35.51
2 Bed Mid Floor	77.7	18	1398.6	63,305	18,937	18615.37	12,098	6839.15	6.84	36.12	6517.48	6.41	34.42
2 Bed Top Floor	99.7	2	199.4	8,134	3,027	3012.93	1,938	1088.72	1.09	35.97	1074.77	1.06	35.51
Total		28	2,136	101,252.04	30,603.18	30,169.57	19,581	11,022	11.02	36.02	10588.22	10.42	34.60

Energy Calculations												
Typical Unit	Total Area	Quantity	Total Area	BaselineTotal kWh/annum	Baseline kgCO2/annum	Passive Energy Efficiency kwh /annum	PV kwh/ annum	Total kwh/annum displaced	Total % kwh/annum displaced	Total Kwh / annum displaced by PV	Total % kwh/annum displaced by PV	kWp of PV required
1 Bed Ground Floor	59.1	2	118.2	7,394	2,131	7289	5,871	1,523	20.60	1419	19.19	1.925
1 Bed Mid Floor	57.53	2	115.06	6,708	1,881	6505	5,317	1,391	20.74	1188	17.71	1.65
2 Bed Ground Floor	76.2	4	304.8	15,710	4,627	15625	12,459	3,251	20.69	3165	20.15	4.4
2 Bed Mid Floor	77.7	18	1398.6	63,305	18,937	62153	49,595	13,710	21.66	12558	19.84	16.225
2 Bed Top Floor	99.7	2	199.4	8,134	3,027	8019	5,948	2,186	26.87	2071	25.46	2.2
Total		28	2,136	101,252	30,603.18	99591	79,190	22,062	21.79	20401	20.15	26.4

Residential (Existing)

kWh/annum Baseline

Typical Unit	Area m²	Quantity	Total Area m²	DER	TER	Heating	Cooling	Auxillary	Lighting	Hot Water	Total Kwh/Annum	Carbon kg Co2 / Annum	Tonnes
1 Bed Block 13	69.3	3	207.9	67.75	20.14	13295.89	0	150	241.87	1695.69	46150.35	14085.225	14.09
1 Bed Block 27 & 29	62.5	2	125	58.62	19.65	15788.39	0	150	314.29	1912.87	36331.1	7327.5	7.33
2 Bed Block 13	80	3	240	47.25	16.56	15908.67	0	150	387.31	2066.98	55538.88	11340	11.34
2 Bed Block 27 & 29	92.75	4	371	56.07	18.51	18985.71	0	150	370.54	2048.93	86220.72	20801.97	20.80
Total		12	943.9								224241.05	53554.70	53.55

kWh/annum Baseline + PV

Typical Unit	Area m²	Quantity	Total Area m²	DER	TER	Heating	Cooling	Auxillary	Lighting	Hot Water	Total Kwh/Annum	Carbon kg Co2 / Annum	Tonnes
1 Bed Block 13	69.3	3	207.9	43.85	20.14	13295.89	0	150	241.87	1695.69	36576.53	9116.42	9.12
1 Bed Block 27 & 29	62.5	2	125	38.05	19.65	15788.39	0	150	314.29	1912.87	31376.86	4756.25	4.76
2 Bed Block 13	80	3	240	30.34	16.56	15908.67	0	150	387.31	2066.98	47719.23	7281.60	7.28
2 Bed Block 27 & 29	92.75	4	371	36.34	18.51	18985.71	0	150	370.54	2048.93	72117.00	13482.14	13.48
Total		12	943.9								187789.62	34636.405	34.64

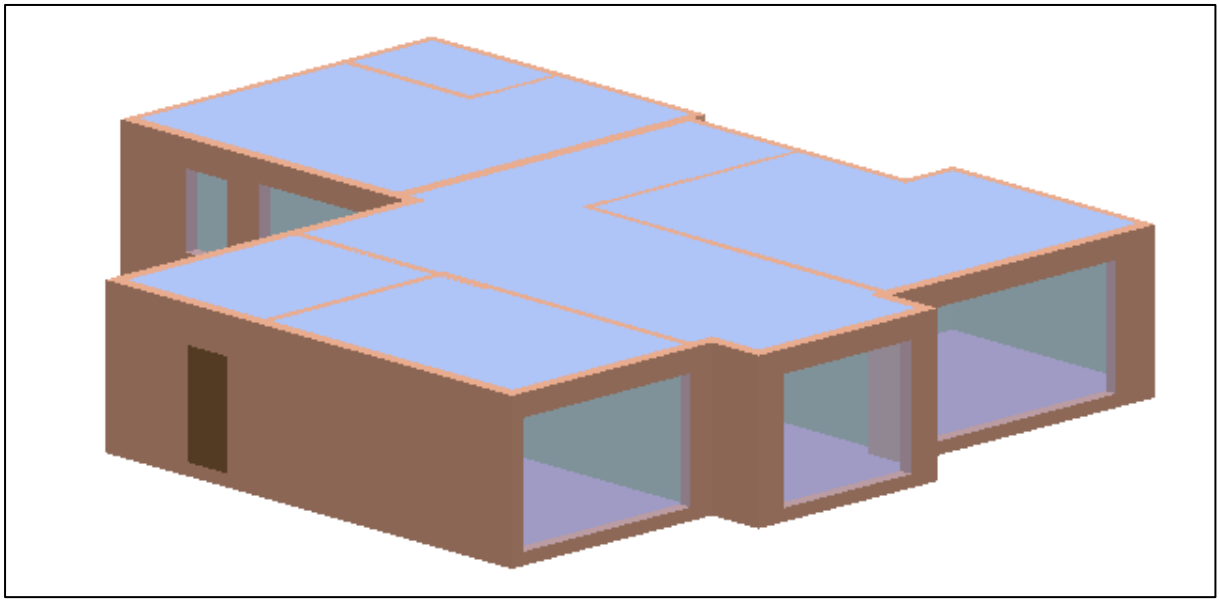
Energy Calculations

Typical Unit	Total Area	Quantity	Total Area	BaselineTotal kWh/annum	Baseline kgCO2/annum	PV kwh /annum	Total kwh/annum displaced	Total % kwh/annum displaced	kWp of PV Required
1 Bed Block 13	69.3	3	207.9	46,150	14,085	36577	9,574	20.74	9.625
1 Bed Block 27 & 29	62.5	2	125	36,331	7,328	31377	4,954	13.64	7.425
2 Bed Block 13	80	3	240	55,539	11,340	47719	7,820	14.08	11.825
2 Bed Block 27 & 29	92.75	4	371	86,221	20,802	72117	14,104	16.36	17.6
Total		12	944	224,241	53,555	187790	36,451	16.26	46.475

Unregulated Energy Demand									
Typical Unit	Area m^2	Quantity	Total Area	No of Occupants	Carbon from Appliances & Cooking per flat Tonnes Co2/Annum	Total Tonnes Co2 / Annum Cooking	Total kWH cooking	Total kWh Appliances	Total Tonnes Co2 / Annum Appliances
1 Bed Block 13	69.3	3	207.9	1.17	0.15	0.44	2251.22	4284.06	2.25
1 Bed Block 27 & 29	62.5	2	125	1.17	0.15	0.29	1500.82	2856.04	1.50
2 Bed Block 13	80	3	240	2.26	0.17	0.52	2651.63	4284.06	2.25
2 Bed Block 27 & 29	92.75	4	371	2.26	0.17	0.69	3535.51	5712.08	3.00
Total		12	944			2	9,939	17,136	9

Carbon Calculations									
Typical Unit	Total Area	Quantity	Total Area	BaselineTotal kWh/annum	Baseline kgCO2/annum	Improved Emissions after PV kgCO2/annum	Total kgCO2/annum displaced	Total TonsCO2/annum displaced	Total % TonsCO2/annum displaced
1 Bed Block 13	69.3	3	207.9	46,150	14,085	9,116	4968.81	4.97	35.28
1 Bed Block 27 & 29	62.5	2	125	36,331	7,328	4,756	2571.25	2.57	35.09
2 Bed Block 13	80	3	240	55,539	11,340	7,282	4058.40	4.06	35.79
2 Bed Block 27 & 29	92.75	4	371	86,221	20,802	13,482	7319.83	7.32	35.19
Total		12	944	224,241.05	53,554.70	34,636	18,918	18.92	35.33

Build – SBEM



Building Rating

	Heating	Cooling	Auxiliary	Lighting	Hot water	Total	
Actual	38.58	0.0	4.93	20.72	88.68	152.92	**kWh/m²**
Notional	42.77	0.0	3.5	20.7	89.52	156.48	**kWh/m²**

CO2 emissions mandatory requirement

BER	40.8	**kgCO2/m²**
Notional	40.8	**kgCO2/m²**
TER	40.8	**kgCO2/m²**
Pass CO2	**Yes**	

Orion House Commercial Baseline

Building Rating

	Heating	Cooling	Auxiliary	Lighting	Hot water	Total	
Actual	38.66	0.0	4.29	13.95	86.78	143.69	**kWh/m²**
Notional	42.77	0.0	3.5	20.7	89.52	156.48	**kWh/m²**

CO2 emissions mandatory requirement		
BER	36.6	**kgCO2/m²**
Notional	40.8	**kgCO2/m²**
TER	40.8	**kgCO2/m²**
Pass CO2	**Yes**	

Orion House Commercial Baseline + Passive Measures

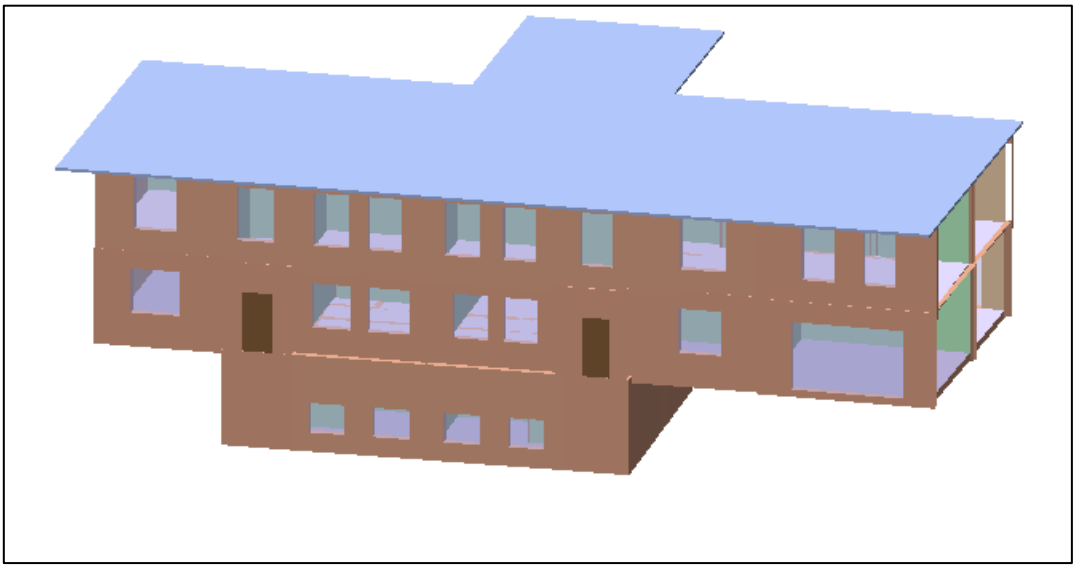
Building Rating

	Heating	Cooling	Auxiliary	Lighting	Hot water	Total	
Actual	38.66	0.0	4.29	13.95	86.78	143.69	**kWh/m²**
Notional	42.77	0.0	3.5	20.7	89.52	156.48	**kWh/m²**

CO2 emissions mandatory requirement		
BER	26.2	**kgCO2/m²**
Notional	40.8	**kgCO2/m²**
TER	40.8	**kgCO2/m²**
Pass CO2	**Yes**	

Orion House Commercial Baseline + Passive Measures + PV

Chapel – SBEM



Building Rating

	Heating	Cooling	Auxiliary	Lighting	Hot water	Total	
Actual	109.94	0.0	3.21	23.23	63.05	199.43	**kWh/m²**
Notional	31.77	0.0	2.23	21.11	62.72	117.83	**kWh/m²**

CO2 emissions mandatory requirement

BER	51.1	**kgCO2/m²**
Notional	32.2	**kgCO2/m²**
TER	32.2	**kgCO2/m²**
Pass CO2	**No**	

Chapel Baseline

Building Rating

	Heating	Cooling	Auxiliary	Lighting	Hot water	Total	
Actual	101.3	0.0	3.21	18.94	57.68	181.13	**kWh/m²**
Notional	31.77	0.0	2.23	21.11	62.72	117.83	**kWh/m²**

CO2 emissions mandatory requirement		
BER	45.8	**kgCO2/m²**
Notional	32.2	**kgCO2/m²**
TER	32.2	**kgCO2/m²**
Pass CO2	**No**	

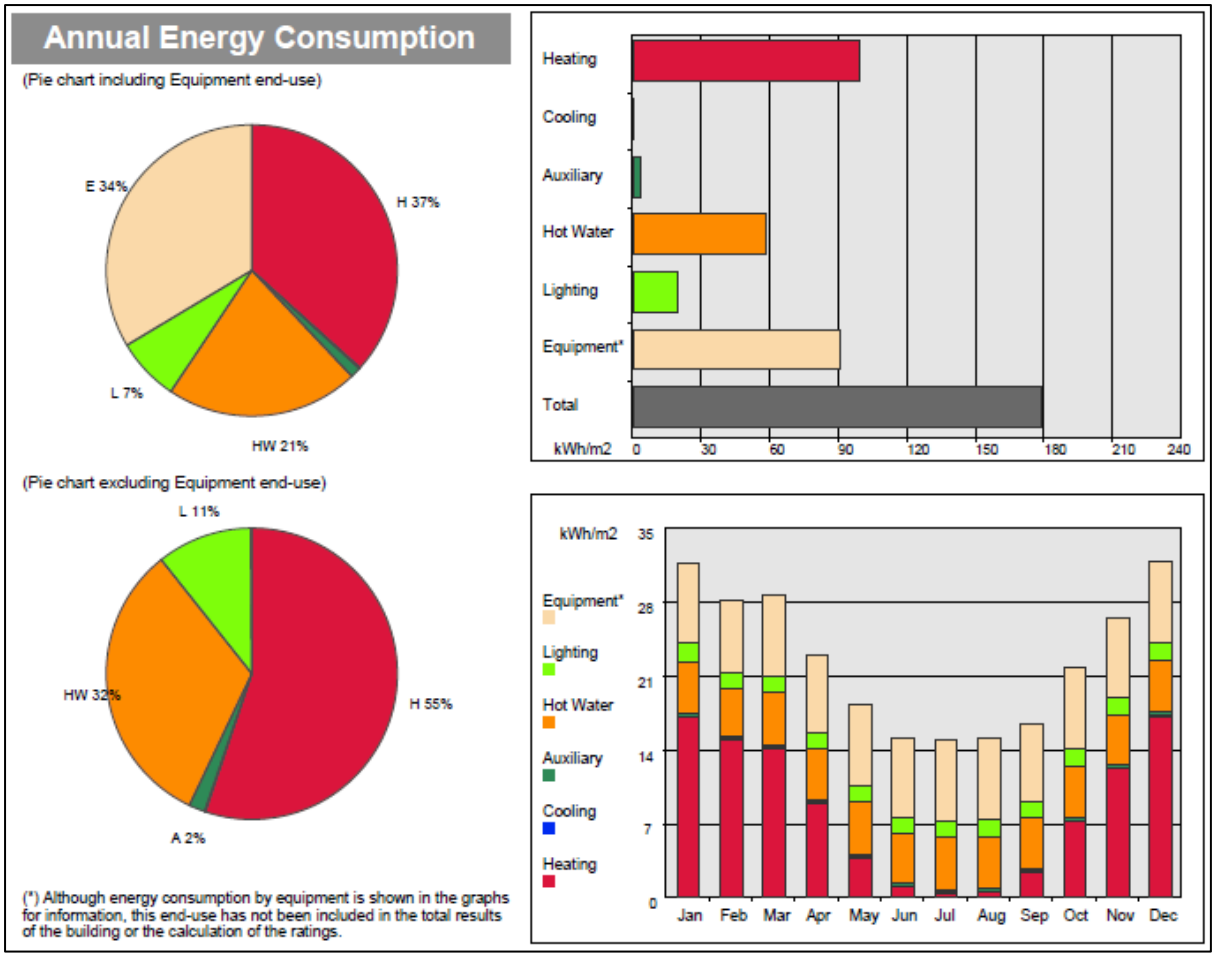
Chapel Baseline + Passive

Building Rating

	Heating	Cooling	Auxiliary	Lighting	Hot water	Total	
Actual	98.65	0.0	3.21	18.94	57.68	178.49	**kWh/m²**
Notional	31.77	0.0	2.23	21.11	62.72	117.83	**kWh/m²**

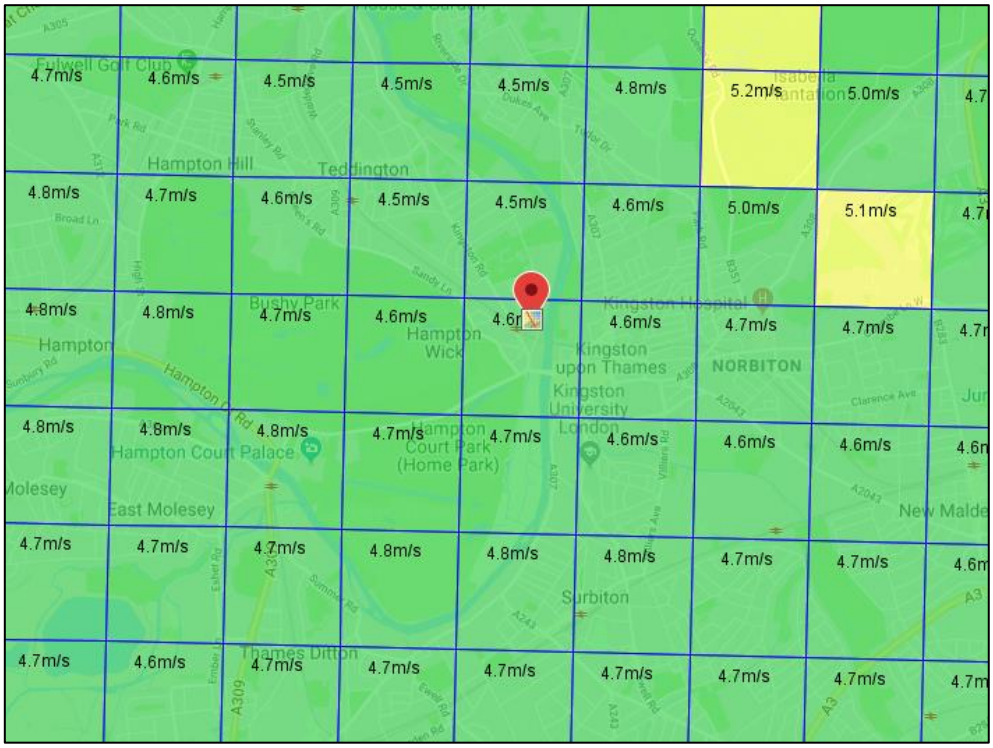
CO2 emissions mandatory requirement		
BER	33.2	**kgCO2/m²**
Notional	32.2	**kgCO2/m²**
TER	32.2	**kgCO2/m²**
Pass CO2	**No**	

Chapel Baseline + Passive + PV



Energy Consumption Chart

Appendix B – PV Location, Wind Data and FIT Rates

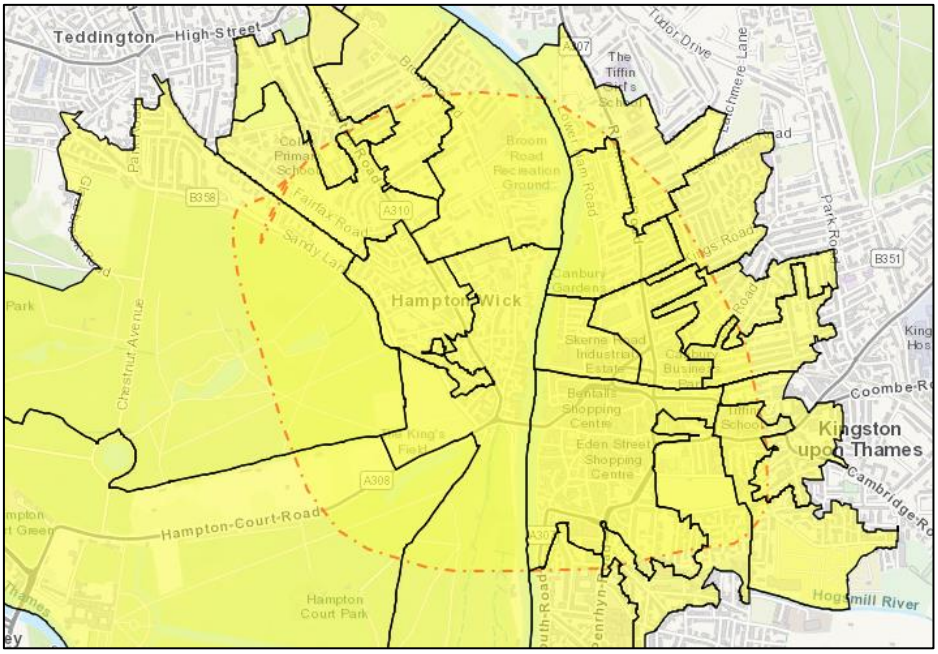


Wind Data Taken from RENSmart Wind Map

Description		2016/17				2017/18				2018/19			
		1 Apr to 30 Jun 2016	1 Jul to 30 Sep 2016	1 Oct to 31 Dec 2016	1 Jan to 31 Mar 2017	1 Apr to 30 Jun 2017	1 Jul to 30 Sep 2017	1 Oct to 31 Dec 2017	1 Jan to 31 Mar 2018	1 Apr to 30 Jun 2018	1 Jul to 30 Sep 2018	1 Oct to 31 Dec 2018	1 Jan to 31 Mar 2019
Hydro generating station with total installed capacity of less than 100kW		7.68	7.66	7.65	7.63	7.61	7.61	7.59	7.58	7.56	7.55	7.53	7.52
Hydro generating station with total installed capacity greater than 100kW but not exceeding 500kW		6.14	6.13	6.12	6.11	6.11	6.10	6.09	6.09	6.08	6.07	6.06	6.06
Hydro generating station with total installed capacity greater than 500kW but not exceeding 2 MW		6.14	6.13	6.12	6.11	6.11	6.10	6.09	6.09	6.08	6.07	6.06	6.06
Hydro generating station with total installed capacity greater than 2 MW		4.43	4.43	4.43	4.43	4.43	4.43	4.43	4.43	4.43	4.43	4.43	4.43
Solar photovoltaic (other than stand-alone) with total installed capacity of 10 kW or less	Higher	4.32	4.25	4.18	4.11	4.04	3.97	3.90	3.83	3.76	3.69	3.62	3.55
	Middle	3.89	3.83	3.76	3.70	3.64	3.57	3.51	3.45	3.38	3.32	3.26	3.20
	Lower	0.74	0.68	0.63	0.58	0.52	0.47	0.41	0.37	0.32	0.26	0.21	0.15
Solar photovoltaic (other than stand-alone) with total installed capacity greater than 10 kW but not exceeding 50kW	Higher	4.53	4.46	4.39	4.32	4.25	4.19	4.12	4.05	3.98	3.91	3.85	3.78
	Middle	4.08	4.01	3.95	3.89	3.83	3.77	3.71	3.65	3.58	3.52	3.47	3.40
	Lower	0.74	0.68	0.63	0.58	0.52	0.47	0.41	0.37	0.32	0.26	0.21	0.15
Solar photovoltaic (other than stand-alone) with total installed capacity greater than 50 kW but not exceeding 250kW	Higher	2.38	2.32	2.26	2.21	2.15	2.10	2.04	1.98	1.93	1.87	1.82	1.76
	Middle	2.14	2.09	2.03	1.99	1.94	1.89	1.84	1.78	1.74	1.68	1.64	1.58
	Lower	0.74	0.68	0.63	0.58	0.52	0.47	0.41	0.37	0.32	0.26	0.21	0.15
Solar photovoltaic (other than stand-alone) with total installed capacity greater than 250 kW but not exceeding 1 MW		1.99	1.94	1.88	1.83	1.77	1.72	1.67	1.60	1.55	1.49	1.44	1.39
Solar photovoltaic (other than stand-alone) with total installed capacity greater than 1 MW		0.74	0.68	0.63	0.58	0.52	0.47	0.41	0.37	0.32	0.26	0.21	0.15
Stand-alone solar photovoltaic		0.74	0.68	0.63	0.58	0.52	0.47	0.41	0.37	0.32	0.26	0.21	0.15

Solar Feed-In Tariffs

Appendix C – CHP Availability



Sector Name	Share	Total MWh
Communications and Transport	0.35%	1,229 MWh
Commercial Offices	1.58%	5,604 MWh
Domestic	78.18%	276,794 MWh
Education	9.83%	34,808 MWh
Government Buildings	1.05%	3,713 MWh
Hotels	0.64%	2,253 MWh
Large Industrial	0%	0 MWh
Health	1.33%	4,722 MWh
Other	0.16%	561 MWh
Small Industrial	4.17%	14,774 MWh
Prisons	0%	0 MWh
Retail	1.69%	5,988 MWh
Sport and Leisure	0.65%	2,299 MWh
Warehouses	0.37%	1,303 MWh
District Heating	0%	0 MWh
Total heat load in Area		**354,047 MWh**

Appendix D – Sample SAP Calculations

Project Information

Building type Ground-floor flat

Reference
Date 3 October 2018
Project 1 Bed Ground Floor
Baseline + Passive
KT1 4EZ

REGULATION COMPLIANCE REPORT - Approved Document L1A, 2012 Edition, England
assessed by program JPA Designer version 6.04a1, printed on 9/1/2019 at 10:52:25

New dwelling as designed

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1 TER and DER

Fuel for main heating system: Heat from boilers - mains gas (fuel factor = 1.00)

Target Carbon Dioxide Emission Rate	TER = 18.03	
Dwelling Carbon Dioxide Emission Rate	DER = 11.58	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	TFEE = 44.4	
Dwelling Fabric Energy Efficiency (DFEE)	DFEE = 38.3	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

---

2b Fabric U-values

Element	Average	Highest	
Wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.00 (max. 0.20)	0.00 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

---

3 Air permeability

Air permeability at 50 pascals:	3.00	OK
Maximum :	10.00	

---

4 Heating efficiency

Main heating system:
Community scheme
Source of efficiency: n/a
Secondary heating system:
None -

---

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

(Also refer to "Domestic Building Services Compliance Guide" by the DCLG)

Space heating controls	Charging system linked to use of community heating, programmer and at least two r	OK
	Cylinderstat - Yes	OK
	Independent timer for DHW - Yes	OK

7 Low energy lights

	Percentage of fixed lights with low-energy fittings: 100.0%	
	Minimum: 75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley):		OK
	Slight	OK

Based on:

Thermal mass parameter :	280.21
Overshading :	Average or unknown (20-60 % sky blocked)

Orientation : East

Ventilation rate :	4.00

Blinds/curtains :

None with blinds/shutters closed 0.00% of daylight hours

10 Key features

Design air permeability 3.0 $m^3/h.m^2$

Photovoltaic array

Project Information

Building type Ground-floor flat

Reference
Date 3 October 2018
Project 1 Bed Ground Floor
Baseline + Passive
KT1 4EZ

REGULATION COMPLIANCE REPORT - Approved Document L1A, 2012 Edition, England
assessed by program JPA Designer version 6.04a1, printed on 9/1/2019 at 10:49:38

New dwelling as designed

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1 TER and DER

Fuel for main heating system: Heat from boilers - mains gas (fuel factor = 1.00)

Target Carbon Dioxide Emission Rate	TER = 18.03	
Dwelling Carbon Dioxide Emission Rate	DER = 17.81	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	TFEE = 44.4	
Dwelling Fabric Energy Efficiency (DFEE)	DFEE = 38.3	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

---

2b Fabric U-values

Element	Average	Highest	
Wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.00 (max. 0.20)	0.00 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

---

3 Air permeability

Air permeability at 50 pascals:	3.00	OK
Maximum :	10.00	

---

4 Heating efficiency

Main heating system:
Community scheme
Source of efficiency: n/a
Secondary heating system:
None -

---

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

(Also refer to "Domestic Building Services Compliance Guide" by the DCLG)

Space heating controls	Charging system linked to use of community heating, programmer and at least two r	OK
	Cylinderstat - Yes	OK
	Independent timer for DHW - Yes	OK

7 Low energy lights

	Percentage of fixed lights with low-energy fittings: 100.0%	
	Minimum: 75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley):		OK
	Slight	OK

Based on:

Thermal mass parameter :	280.21
Overshading :	Average or unknown (20-60 % sky blocked)

Orientation : East

Ventilation rate :	4.00

Blinds/curtains :

None with blinds/shutters closed 0.00% of daylight hours

10 Key features

Design air permeability 3.0 $m^3/h.m^2$

Project Information

Building type Ground-floor flat

Reference
Date 3 October 2018
Project 1 Bed Ground Floor
Baseline
KT1 4EZ

REGULATION COMPLIANCE REPORT - Approved Document L1A, 2012 Edition, England
assessed by program JPA Designer version 6.04a1, printed on 9/1/2019 at 10:48:36

New dwelling as designed

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1 TER and DER

Fuel for main heating system: Heat from boilers - mains gas (fuel factor = 1.00)

Target Carbon Dioxide Emission Rate	TER = 18.03	
Dwelling Carbon Dioxide Emission Rate	DER = 18.03	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	TFEE = 44.4	
Dwelling Fabric Energy Efficiency (DFEE)	DFEE = 39.2	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

---

2b Fabric U-values

Element	Average	Highest	
Wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.00 (max. 0.20)	0.00 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

---

3 Air permeability

Air permeability at 50 pascals:	4.15	OK
Maximum :	10.00	

---

4 Heating efficiency

Main heating system:
Community scheme
Source of efficiency: n/a
Secondary heating system:
None -

---

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

(Also refer to "Domestic Building Services Compliance Guide" by the DCLG)

Space heating controls	Charging system linked to use of community heating, programmer and at least two roo	OK
	Cylinderstat - Yes	OK
	Independent timer for DHW - Yes	OK

7 Low energy lights

	Percentage of fixed lights with low-energy fittings: 100.0%	
	Minimum: 75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley):		OK
	Slight	OK

Based on:

Thermal mass parameter :	280.21
Overshading :	Average or unknown (20-60 % sky blocked)

Orientation : East

Ventilation rate :	4.00

Blinds/curtains :

None with blinds/shutters closed 0.00% of daylight hours

10 Key features

None

Project Information

Building type Mid-floor flat

Reference
Date 3 October 2018
Project 1 Bed Mid Floor
Baseline + Passive + PV
KT1 4EZ

REGULATION COMPLIANCE REPORT - Approved Document L1A, 2012 Edition, England
assessed by program JPA Designer version 6.04a1, printed on 9/1/2019 at 11:02:30

New dwelling as designed

---

1 TER and DER

Fuel for main heating system: Heat from boilers - mains gas (fuel factor = 1.00)

Target Carbon Dioxide Emission Rate	TER = 16.35	
Dwelling Carbon Dioxide Emission Rate	DER = 10.55	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	TFEE = 35.7	
Dwelling Fabric Energy Efficiency (DFEE)	DFEE = 30.2	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

---

2b Fabric U-values

Element	Average	Highest	
Wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	0.00 (max. 0.25)	0.00 (max. 0.70)	OK
Roof	0.00 (max. 0.20)	0.00 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

---

3 Air permeability

Air permeability at 50 pascals:	3.00	OK
Maximum :	10.00	

---

4 Heating efficiency

Main heating system:
Community scheme
Source of efficiency: n/a
Secondary heating system:
None -

---

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

(Also refer to "Domestic Building Services Compliance Guide" by the DCLG)

Space heating controls	Charging system linked to use of community heating, programmer and at least two r	OK
	Cylinderstat - Yes	OK
	Independent timer for DHW - Yes	OK

7 Low energy lights

	Percentage of fixed lights with low-energy fittings: 100.0%	
	Minimum: 75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley):		OK
	Slight	OK

Based on:

Thermal mass parameter :	210.21
Overshading :	Average or unknown (20-60 % sky blocked)

Orientation : East

Ventilation rate :	4.00

Blinds/curtains :

None with blinds/shutters closed 0.00% of daylight hours

10 Key features

Design air permeability 3.0 $m^3/h.m^2$

Photovoltaic array

Project Information

Building type Mid-floor flat

Reference
Date 3 October 2018
Project 1 Bed Mid Floor
Baseline + Passive
KT1 4EZ

REGULATION COMPLIANCE REPORT - Approved Document L1A, 2012 Edition, England
assessed by program JPA Designer version 6.04a1, printed on 9/1/2019 at 11:01:51

New dwelling as designed

---

1 TER and DER

Fuel for main heating system: Heat from boilers - mains gas (fuel factor = 1.00)

Target Carbon Dioxide Emission Rate	TER = 16.35	
Dwelling Carbon Dioxide Emission Rate	DER = 15.91	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	TFEE = 35.7	
Dwelling Fabric Energy Efficiency (DFEE)	DFEE = 30.2	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

---

2b Fabric U-values

Element	Average	Highest	
Wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	0.00 (max. 0.25)	0.00 (max. 0.70)	OK
Roof	0.00 (max. 0.20)	0.00 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

---

3 Air permeability

Air permeability at 50 pascals:	3.00	OK
Maximum :	10.00	

---

4 Heating efficiency

Main heating system:
Community scheme
Source of efficiency: n/a
Secondary heating system:
None -

---

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

(Also refer to "Domestic Building Services Compliance Guide" by the DCLG)

Space heating controls	Charging system linked to use of community heating, programmer and at least two r	OK
	Cylinderstat - Yes	OK
	Independent timer for DHW - Yes	OK

7 Low energy lights

	Percentage of fixed lights with low-energy fittings: 100.0%	
	Minimum: 75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley):		OK
	Slight	OK

Based on:

Thermal mass parameter :	210.21
Overshading :	Average or unknown (20-60 % sky blocked)

Orientation : East

Ventilation rate :	4.00

Blinds/curtains :

None with blinds/shutters closed 0.00% of daylight hours

10 Key features

Design air permeability 3.0 m³/h.m²

Project Information

Building type Mid-floor flat

Reference
Date 3 October 2018
Project 1 Bed Mid Floor
Baseline
KT1 4EZ

REGULATION COMPLIANCE REPORT - Approved Document L1A, 2012 Edition, England
assessed by program JPA Designer version 6.04a1, printed on 9/1/2019 at 10:53:14

New dwelling as designed

---

1 TER and DER

Fuel for main heating system: Heat from boilers - mains gas (fuel factor = 1.00)

Target Carbon Dioxide Emission Rate	TER = 16.35	
Dwelling Carbon Dioxide Emission Rate	DER = 16.35	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	TFEE = 35.7	
Dwelling Fabric Energy Efficiency (DFEE)	DFEE = 32.1	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

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2b Fabric U-values

Element	Average	Highest	
Wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	0.00 (max. 0.25)	0.00 (max. 0.70)	OK
Roof	0.00 (max. 0.20)	0.00 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

---

3 Air permeability

Air permeability at 50 pascals:	5.22	OK
Maximum :	10.00	

---

4 Heating efficiency

Main heating system:
Community scheme
Source of efficiency: n/a
Secondary heating system:
None -

---

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

(Also refer to "Domestic Building Services Compliance Guide" by the DCLG)

Space heating controls	Charging system linked to use of community heating, programmer and at least two r	OK
	Cylinderstat - Yes	OK
	Independent timer for DHW - Yes	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings: 100.0%

Minimum: 75.0% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): OK

Slight OK

Based on:

Thermal mass parameter : 210.21

Overshading : Average or unknown (20-60 % sky blocked)

Orientation : East

Ventilation rate : 4.00

Blinds/curtains :

None with blinds/shutters closed 0.00% of daylight hours

10 Key features

None

Project Information

Building type Ground-floor flat

Reference
Date 3 October 2018
Project 2 Bed Ground Floor
Baseline + Passive + PV
KT1 4EZ

REGULATION COMPLIANCE REPORT - Approved Document L1A, 2012 Edition, England
assessed by program JPA Designer version 6.04a1, printed on 9/1/2019 at 11:09:06

New dwelling as designed

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1 TER and DER

Fuel for main heating system: Heat from boilers - mains gas (fuel factor = 1.00)

Target Carbon Dioxide Emission Rate	TER = 15.18	
Dwelling Carbon Dioxide Emission Rate	DER = 9.72	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	TFEE = 35.8	
Dwelling Fabric Energy Efficiency (DFEE)	DFEE = 31.2	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

---

2b Fabric U-values

Element	Average	Highest	
Wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.00 (max. 0.20)	0.00 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

---

3 Air permeability

Air permeability at 50 pascals:	3.00	OK
Maximum :	10.00	

---

4 Heating efficiency

Main heating system:
Community scheme
Source of efficiency: n/a
Secondary heating system:
None -

---

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

(Also refer to "Domestic Building Services Compliance Guide" by the DCLG)

Space heating controls	Charging system linked to use of community heating, programmer and at least two r	OK
	Cylinderstat - Yes	OK
	Independent timer for DHW - Yes	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings: 100.0%

Minimum: 75.0% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): OK

Slight OK

Based on:

Thermal mass parameter : 239.95

Overshading : Average or unknown (20-60 % sky blocked)

Orientation : West

Ventilation rate : 4.00

Blinds/curtains :

None with blinds/shutters closed 0.00% of daylight hours

10 Key features

Design air permeability 3.0 $m^3/h.m^2$

Photovoltaic array

Project Information

Building type Ground-floor flat

Reference
Date 3 October 2018
Project 2 Bed Ground Floor
Baseline + Passive
KT1 4EZ

REGULATION COMPLIANCE REPORT - Approved Document L1A, 2012 Edition, England
assessed by program JPA Designer version 6.04a1, printed on 9/1/2019 at 11:05:10

New dwelling as designed

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1 TER and DER

Fuel for main heating system: Heat from boilers - mains gas (fuel factor = 1.00)

Target Carbon Dioxide Emission Rate	TER = 15.18	
Dwelling Carbon Dioxide Emission Rate	DER = 15.11	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	TFEE = 35.8	
Dwelling Fabric Energy Efficiency (DFEE)	DFEE = 31.2	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

---

2b Fabric U-values

Element	Average	Highest	
Wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.00 (max. 0.20)	0.00 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

---

3 Air permeability

Air permeability at 50 pascals:	3.00	OK
Maximum :	10.00	

---

4 Heating efficiency

Main heating system:
Community scheme
Source of efficiency: n/a
Secondary heating system:
None -

---

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

(Also refer to "Domestic Building Services Compliance Guide" by the DCLG)

Space heating controls	Charging system linked to use of community heating, programmer and at least two r	OK
	Cylinderstat - Yes	OK
	Independent timer for DHW - Yes	OK

7 Low energy lights

	Percentage of fixed lights with low-energy fittings: 100.0%	
	Minimum: 75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley):		OK
	Slight	OK

Based on:

Thermal mass parameter :	239.95
Overshading :	Average or unknown (20-60 % sky blocked)

Orientation : West

Ventilation rate :	4.00

Blinds/curtains :

None with blinds/shutters closed 0.00% of daylight hours

10 Key features

Design air permeability 3.0 m³/h.m²

Project Information

Building type Ground-floor flat

Reference
Date 3 October 2018
Project 2 Bed Ground Floor
Baseline
KT1 4EZ

REGULATION COMPLIANCE REPORT - Approved Document L1A, 2012 Edition, England
assessed by program JPA Designer version 6.04a1, printed on 9/1/2019 at 11:04:27

New dwelling as designed

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1 TER and DER

Fuel for main heating system: Heat from boilers - mains gas (fuel factor = 1.00)

Target Carbon Dioxide Emission Rate	TER = 15.18	
Dwelling Carbon Dioxide Emission Rate	DER = 15.18	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	TFEE = 35.8	
Dwelling Fabric Energy Efficiency (DFEE)	DFEE = 31.5	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

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2b Fabric U-values

Element	Average	Highest	
Wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.00 (max. 0.20)	0.00 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

---

3 Air permeability

Air permeability at 50 pascals:	3.45	OK
Maximum :	10.00	

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4 Heating efficiency

Main heating system:
Community scheme
Source of efficiency: n/a
Secondary heating system:
None -

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5 Cylinder insulation

Hot water storage No cylinder

6 Controls

(Also refer to "Domestic Building Services Compliance Guide" by the DCLG)

Space heating controls	Charging system linked to use of community heating, programmer and at least two r	OK
	Cylinderstat - Yes	OK
	Independent timer for DHW - Yes	OK

7 Low energy lights

	Percentage of fixed lights with low-energy fittings: 100.0%	
	Minimum: 75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley):		OK
	Slight	OK

Based on:

Thermal mass parameter :	239.95
Overshading :	Average or unknown (20-60 % sky blocked)

Orientation : West

Ventilation rate :	4.00

Blinds/curtains :

None with blinds/shutters closed 0.00% of daylight hours

10 Key features

Design air permeability 3.5 $m^3/h.m^2$