Land Off Taylor Close, Hampton TW12 1LE

Sustainability Statement

London Borough of Richmond Upon Thames

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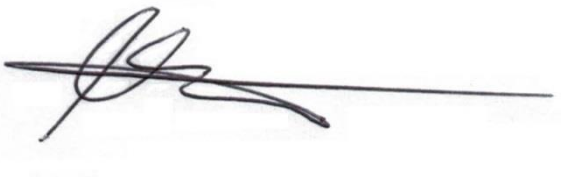	
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Contents

1.0 Executive Summary

This Sustainability and Energy Statement has been prepared in support of a planning application for the proposed new build dwelling to the Land off Taylor Close. The Statement includes an energy demand and carbon dioxide emission assessment showing how selected energy efficiency, low carbon and renewable energy measures have been considered and those, which are deemed appropriate for the scheme.

Design Stage SAP Calculations have been prepared for the dwellings based upon the construction specification set out within the report and using planning stage drawings. This provides an accurate assessment of the carbon dioxide emissions arising from the site and has allowed a number of different systems and technologies to be tested.

It is proposed to enhance the fabric insulation standards of the dwellings above the minimum required by the Building Regulations.

The development has been assessed as a minor development and in line with Richmond Upon Thames Local Development Framework Core Strategy (Adopted April 2019) where the dwellings needs to meet compliance with Building regulations Part L with an additional reduction in emissions of 20% from renewable and low or zero carbon technologies.

The conclusion of the energy strategy is that the development significantly reduces the buildings CO_2 emissions when compared to the baseline target, through a combination of passive measures, building fabric design improvements and the implementation of a 0.75kWp photovoltaic array.

A saving in CO_2 of **26.08%** is estimated to be achieved annually compared to the building regulations compliant baseline assessment across the site. This ensures compliance with the London Plan 2016 Policy 5.2 and Richmond Upon Thames Local Development Framework Core Strategy (Adopted April 2019) Policy CP2

The graph and tables on the following pages provides a summary of the regulated CO_2 savings at each stage of the London Plan Energy Hierarchy. The red line indicates the baseline condition which is equivalent to a notional building built to current Part L Building Regulations (2013) and green line indicates the London Plan Target.

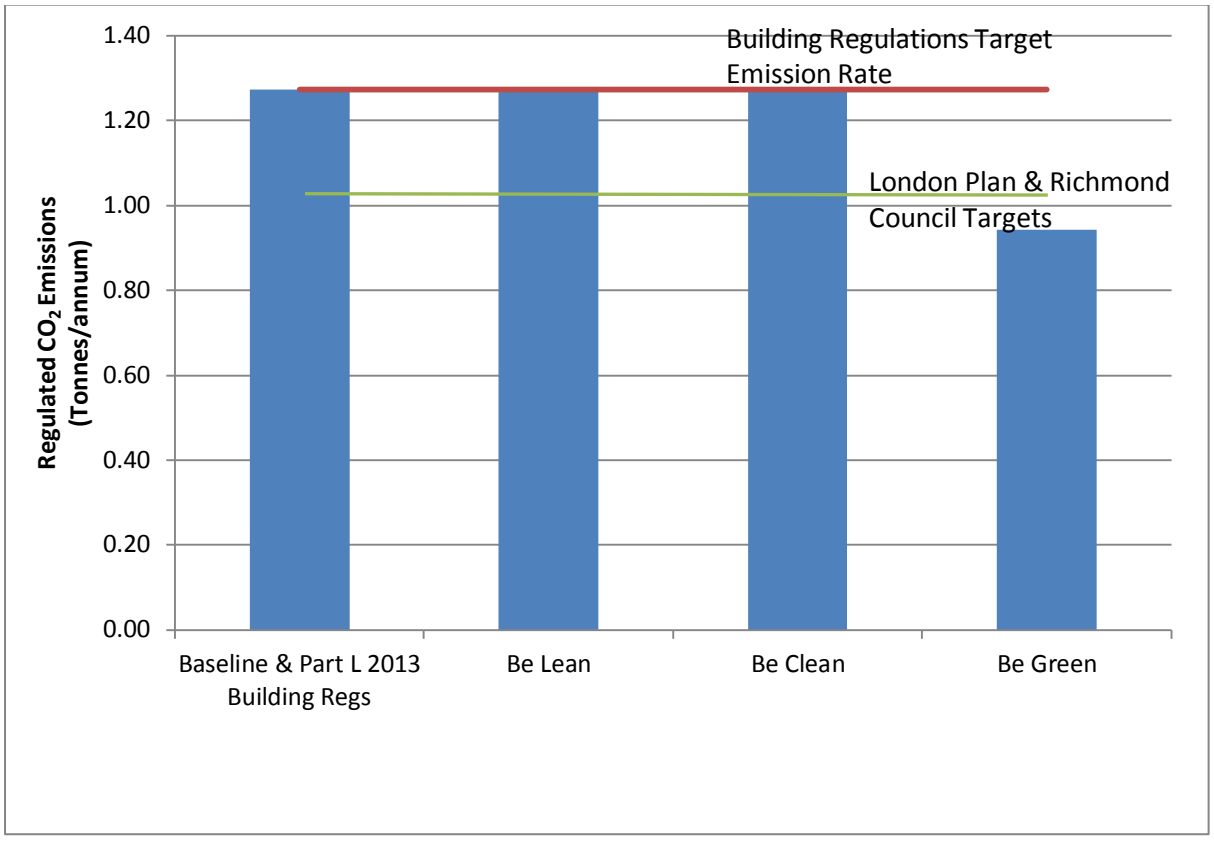
Carbon Dioxide Emissions after Each Stage of the Energy Hierarchy

	Carbon dioxide emissions (tonnes CO_2 per annum)
Baseline	1.27
Be Lean: After Energy Demand Reduction	1.27
Be Clean: After CHP/Community Heating	1.27
Be Green: Renewables	0.92

Regulated Carbon Dioxide Savings from Each Stage of the Energy Hierarchy

	Regulated domestic carbon dioxide savings	
	Tones CO_2 per Annum	%
Savings from energy demand reduction	0.00	0.00%
Savings from Community heating	0.00	0.00%
Savings from renewable energy	0.33	26.08%
Total Cumulative Savings	0.33	26.08%

The London Plan Energy Hierarchy



2.0 Introduction

Purpose of statement

This Sustainability Statement has been prepared by Darren Evans Assessments in support of a Planning Application by Aquinna homes for the new dwelling to the land off Taylor Close, Hampton TW12 1LE. The development consists of the following;

- One new build dwelling in an existing 4 space carpark

The following statement seeks to outline how the proposed development will comply with the National Planning Policy Framework which requires all developments to be sustainable, to mitigate and adapt to climate change, taking full account of flood risk, coastal change and water supply and demand considerations.

In particular the following documents have been referred to in this statement to demonstrate compliance:

- The National Planning Policy Framework (2012)
- The London Plan (2016)
- Richmond Upon Thames Local Development Framework Core Strategy (Adopted April 2019)
- Part L1A Conservation of Fuel and Power in New Dwellings (2013, 2016 Amendments)
- Development Management Document

It is the intention of the developer to deliver a highly sustainable development at Land off Taylor Close and therefore this Energy Statement has considered current policies within Richmond Upon Thames' most recent planning policies. Due consideration has been given to the current and future intentions of the Council for sustainable development.

This report will ensure the development incorporates sustainability by;

- Reducing carbon emissions associated with the development by following the Energy Hierarchy (Be Lean, Be Clean, Be Green)

- Carrying out a Renewable Energy Feasibility Assessment to determine the most viable low zero carbon technology for the development

- Identifying additional solutions outside the scope of renewable energy technologies which will assist in improving the energy efficiency of the proposed development

- Addressing how the development will meet wider sustainable development issues

3.0 Policy Review

Policy context

Anthropogenic climate change can be described as the production of greenhouse gases and associated change in global climate caused by human activity. In response to the increased scientific awareness of the effect of human activities there has been a push in developed economies towards more sustainable development.

In 1992, the UK signed the Kyoto protocol committing itself and other nations to cut emissions of various greenhouse gases, the most significant being carbon dioxide. Since then, different policies and targets have been set at national, regional and local levels to stimulate and regulate more sustainable development. The Climate Change Act 2008 set carbon budgets to ensure that by 2050 there would be at least an 80% reduction in UK carbon emissions from the 1990 baseline. Additionally, the Conference of the Parties COP21 Paris agreement limiting global warming to 1.5 - 2°C above pre-industrial levels came into force in November 2016.

National Policy

The UK ratified the above Paris Agreement in November 2016. Also, the National Planning Policy Framework 2019 aims to make the planning system less complex and easier to understand.

*"At the heart of the Framework is a **presumption in favour of sustainable development**."*[1]

The framework encourages applications to comply with local plans on decentralised energy supply where feasible and to take into account landform, layout, orientation, massing and landscaping design to minimise energy consumption. Paragraph 151 encourages the use of renewable and low carbon energy where suitable and for applications to have a positive strategy to promote the above.

New development should be planned for in ways that:

- *"avoid increasing 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*
- *Can help to reduce greenhouse 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."*[1]

This development is committed to meeting the regional and local requirements for carbon emissions and energy use from the development as a minimum.

[1] National Planning Policy Framework

Regional Policy – Greater London Authority

Chapter 5 of the London Plan 2016 sets out a comprehensive range of policies underpinning London's 'Response to Climate Change'. These policies cover climate change mitigation and adaptation, waste, aggregates, contaminated land and hazardous substances.

"The Mayor seeks to achieve an overall reduction in London's carbon dioxide emissions of 60 per cent (below 1990 levels) by 2025."[2] It is thought that whilst challenging, the target set by the mayor should be achievable with the full commitment and collaboration of all stakeholders.

London Plan Policies state that energy must be integral in the design of any new development (p.9). Indeed, energy assessments must:

- be submitted at the planning application stage, not submitted post planning in response to a condition
- commit to reducing regulated CO_2 emissions below those of a Part L 2013 of the Building Regulations compliant development through energy efficiency measures alone
- include information demonstrating that the risk of overheating has been mitigated through the incorporation of passive design measures
- demonstrate that connection to existing or planned district heating networks has been prioritised and provide correspondence to support this
- commit to a site wide heat network to allow connection to existing or planned district heating networks identified in the area
- commit to a single energy centre to supply the site wide heat network
- where CHP is applicable, select renewable technologies that are complementary with the optimal operation of the CHP

This document sets out to address the following London Plan Policies

Policy 5.2 - Minimising Carbon Dioxide Emissions - the development proposals will make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

Be lean: use less energy
Be clean: supply energy efficiently
Be green: use renewable energy

As outlined in the Mayor's Sustainable Design and Construction Supplementary Guidance (SPG) published in April 2014, from 6 April 2014 the Mayor will apply a 35 per cent carbon reduction target beyond Part L 2013 of the Building Regulations for major developments - this is deemed to be broadly equivalent to the 40 per cent target beyond Part L 2010 of the Building Regulations, as specified in Policy 5.2 of the London Plan for 2013-2016.

Policy 5.3 - Sustainable Design and Construction - requires that the highest standards of sustainable design and construction should be achieved to improve the environmental performance of new developments.

Policy 5.4 – Retrofitting – requires that programmes should be in place to bring existing buildings up to the Mayor's standards on sustainable design and construction.

[2] Chapter 5, London's Response to Climate Change, The London Plan 2015

Policy 5.5 - Decentralised Energy Networks - requires that 25% of the heat and power used in London to be generated through the use of localised decentralised energy systems by 2025.

Policy 5.6 - Decentralised Energy in Development Proposals – Development proposals should evaluate the feasibility of CHP systems

Policy 5.7 - Renewable Energy - requires that all major developments seek to reduce their CO_2 emissions through the use of onsite renewable energy generation wherever feasible. As this is a Major Development, the inclusion of renewable technologies is not mandatory but should be considered in line with the energy hierarchy where feasible

Policy 5.8 – Innovative Energy Technologies – encourages the use of innovative technologies for example the uptake of electric and hydrogen fuel cell vehicles, hydrogen supply and distribution, and advanced conversion technologies for the treatment of waste.

Policy 5.9 – Overheating and Cooling – encourages the design of 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.

Policy 5.15 – Water Use and Supplies – encourages the protection and conservation of water supplies and resources in order to secure London's needs in a sustainable manner

Housing Standards Policy 5.15 Water use and Supplies – Developments should minimise the use of mains water by incorporating water saving measures and designing to achieve a target of 105 litres or less per person per day.

Implementation of Zero Carbon Homes (from 1 October 2016)
Despite the government's announcement in July 2015 that it no longer intends to continue with the zero carbon allowable solutions carbon offsetting scheme 'Zero Carbon Homes', this remains in place within the London Plan for domestic buildings, with a view to preparing the city for 'Nearly Zero Energy Buildings' by 2020 (p.10)

'Zero carbon' homes are homes forming part of major development applications where the residential element of the application achieves at least a 35 per cent reduction in regulated carbon dioxide emissions (beyond Part L 2013 of the Building Regulations) on-site. The remaining regulated carbon dioxide emissions, to 100 per cent, are to be off-set through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere (in line with policy 5.2E)

Local Policy

Local Policy – London Borough of Richmond Upon Thames

Energy use in new development can be reduced by appropriate siting, design, landscaping and energy efficiencies within the building, and these can be retro-fitted to existing buildings. New developments, including conversions and refurbishments, will be expected achieve high environmental standards, and all new buildings to include the use of renewable energy sources, in accordance with The London Plan consolidated with Alterations since 2004. The production of energy close to where it is to be consumed (combined heat and power or CHP) is more efficient than centralised electricity generation where both heat and energy are wasted in production and transmission, and the potential for CCHP/CHP in new developments should be evaluated in accordance with The London Plan consolidated with Alterations since 2004. Where the principle of decentralised energy generation has been accepted on a specific site, developments on nearby sites should be designed to connect to the network when it is established. The Council will require an assessment of energy demand and carbon dioxide emissions from the proposed development, which should demonstrate the expected energy and carbon dioxide emissions savings from energy efficiency and renewable energy measures incorporated into the development.

Policy CP2 Reducing Carbon Emissions

2.A The Borough will reduce its carbon dioxide emissions by requiring measures that minimise energy consumption in new development and promoting these measures in existing development, particularly in its own buildings.

2.B The Council will require the evaluation, development and use of decentralised energy in appropriate development.

2.C The Council will increase the use of renewable energy by requiring all new development to achieve a reduction in carbon dioxide emissions of 20% from on-site renewable energy generation unless it can be demonstrated that such provision is not feasible, and by promoting its use in existing development.

4.0 Assessment Type

This development is assessed as a minor development following the guidance from the London Plan (2016), GLA guidance on producing energy statements (March 2016) and The Department for Communities and Local Government's 'Planning Applications Decisions – Major and Minor Developments'.

This is detailed in Table 1 which has been adapted from the GLA Annex Six Glossary and guidance from the DCLG.

Scale	Description
Householder	Extensions to houses (including roof extensions)
Minor	Residential development of 1 to 9 units in scale including conversions. Non-residential development of up to 999 m2.
Major	Residential development over 10 units. Non-residential development over 1,000 m2
Large Scale Major	Residential development over 200 units or a site of 4 hectares or more. Non-residential development over 10,000 m2

Table 1: The GLA Annex Six Glossary, Major or Minor Development

As the development is a single dwelling it has been assessed as a minor development. This development therefore will refer to minor development policies. This includes the energy targets which are outlined in the London Plan 2016 as well as within the Richmond Upon Thames Core Strategy (Adopted April 2019).

5.0 Proposal

This proposal seeks the proposal of the erection of a new dwelling in an existing car park on the land off Taylor Close, Hampton TW12 1LE

Figure 1: Site Location of Land off Taylor Close, Hampton Courtesy of Google Maps

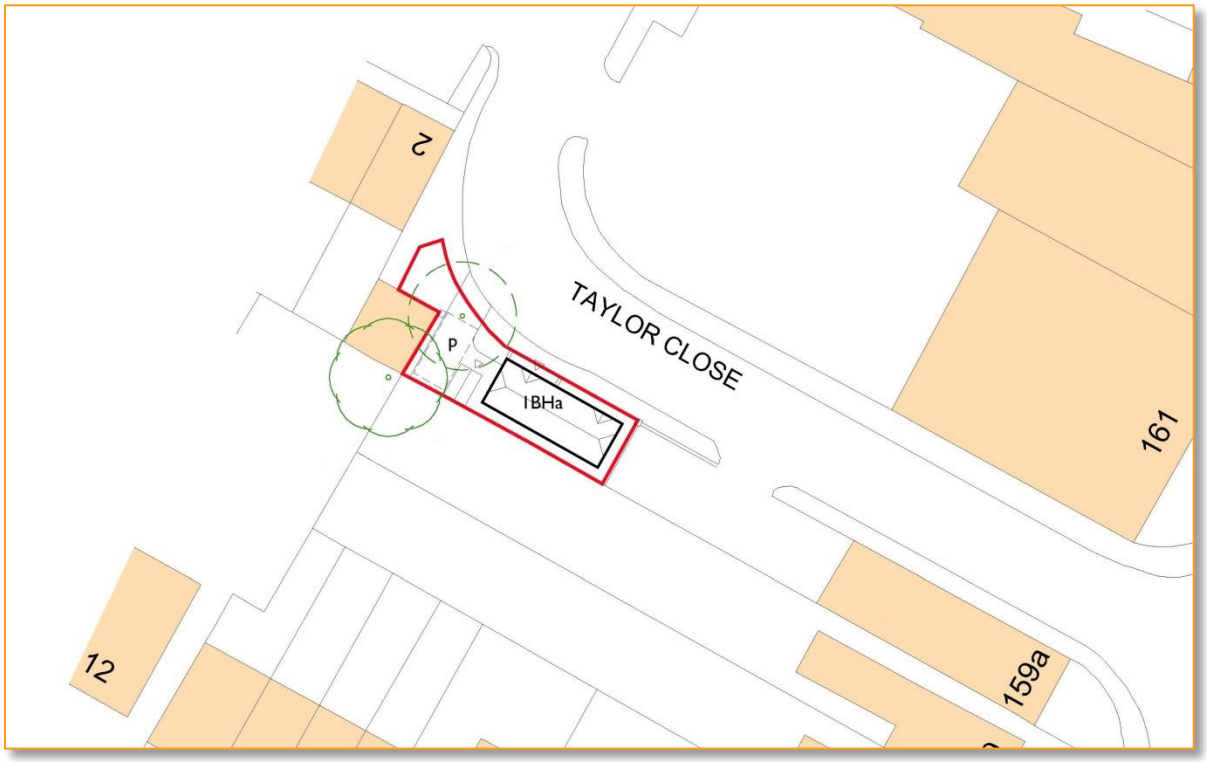


Figure 2: Proposed Block Plan of Land off Taylor Close Courtesy of Aquinna homes.

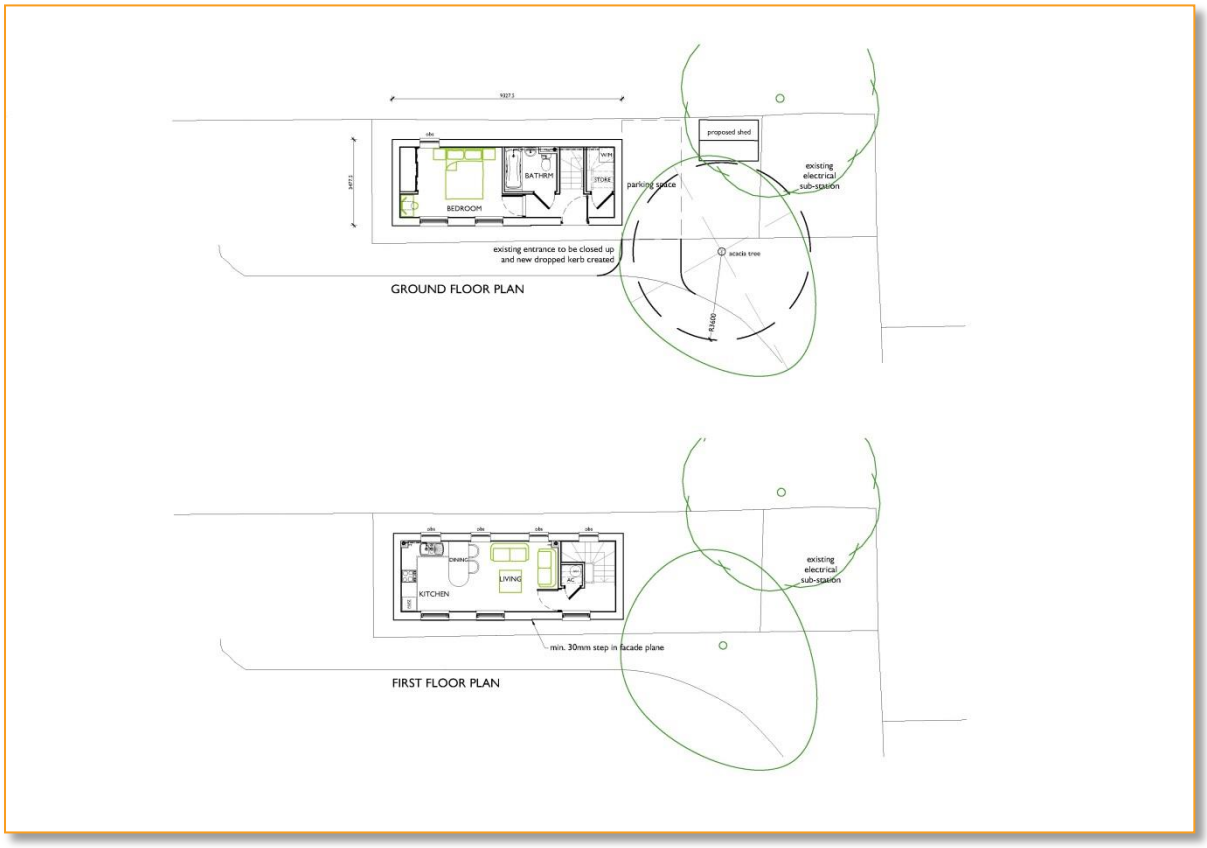
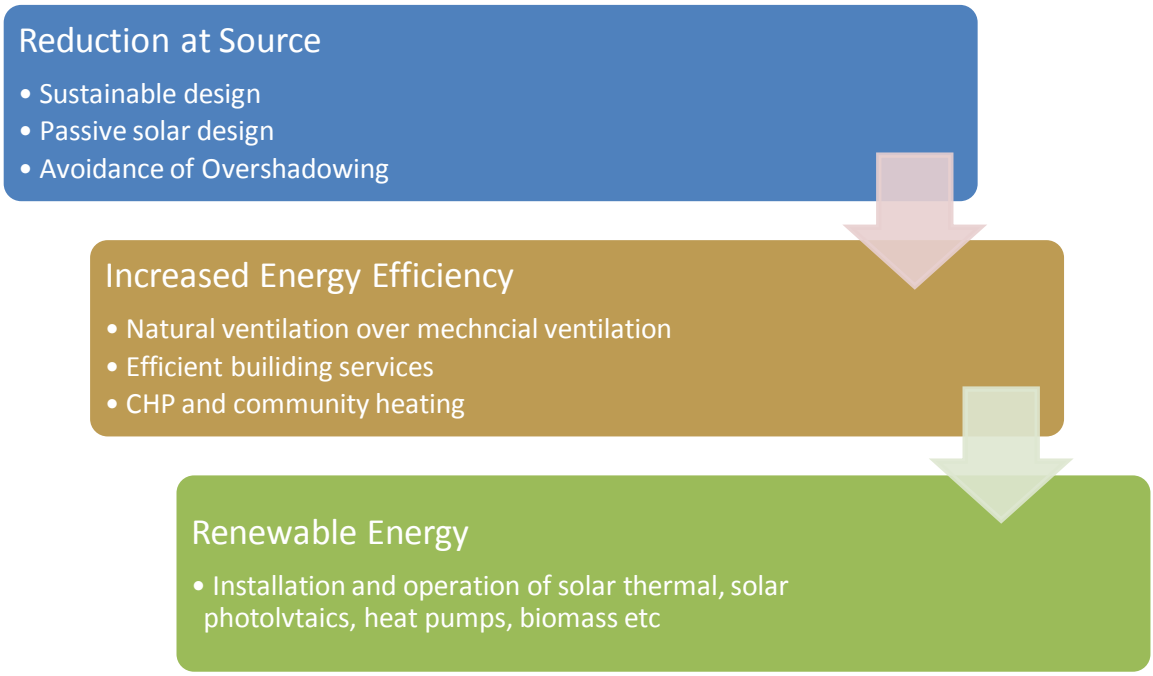


Figure 3: Proposed Ground and First Floor Plans of New Dwelling to the Land off Taylor Close Courtesy of Aquinna homes.

Figure 4: Proposed Front and Side Elevations of New Build Dwelling to the Land off Taylor Close Courtesy of Aquinna homes.

6.0 The Energy Hierarchy

The Energy Hierarchy is a widely adopted and recognised set of principles to guide design, planning and development decisions to optimise energy provision. The Hierarchy prioritises minimising the need for energy consumption through firstly design and energy efficiency and then through generating the reduced energy demand via renewables. The Hierarchy can also help to balance the economic and environmental dimensions of sustainability, supporting choices which are both environmentally and economically sustainable.



It is considered that the above principles for carbon reduction forms the most appropriate approach from both the practical and financial perspective. The industry is broadly in agreement that the energy efficiency and low carbon technologies have the greatest impact offsetting CO_2 emissions. Therefore, it is logical to encourage enhanced mitigation through energy efficiency and low carbon technologies in the first instance, as opposed to applying renewables as the first option at a significantly greater cost.

7.0 Assessment Methodology

This sustainability and energy assessment includes the following details:

Calculation of baseline energy demand and carbon dioxide emissions on a residual energy basis, showing the contribution of emissions from uses covered by building regulations (regulated emissions);

Proposals to reduce carbon dioxide emissions through the energy efficient design of the site, buildings and services;

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 onsite renewable energy technologies.

A baseline assessment has been carried out for the proposed development. In this assessment a gas boiler has been used to obtain a Dwelling Emission Rate which emission rate will form the baseline of which the heat pump is compared. This is in line with the GLA guidance on producing energy statements (March 2016).

8.0 Be Lean – Energy Efficiency

The energy performance of a building is affected by its design, construction and use and whilst occupant behaviour is beyond the remit of this statement, better design and construction methods can significantly reduce the life cycle emissions of a building and assist the occupant to reduce consumption.

Sustainable design is not just about incorporating renewable technologies; buildings should be designed at the outset to provide suitable environmental conditions for the occupants whilst also consuming as little energy as practical. It is possible to exceed Building Regulations requirements (Part L 2013) through demand reduction measures alone, which typically include a combination of passive design measures (e.g. building design and efficient building fabric) and active design measures (e.g. Building services).

Passive Design

Passive design is a key principle of sustainable design, and can be used to reduce the building's energy demand. Passive design responds to local climate and site conditions to maximise the building users' comfort and health while minimising energy use.

At the earliest stage the buildings have been designed using a fabric first approach as to initially minimise energy and resulting CO_2 emissions. Particular attention will be paid to thermal envelope and a high level of insulation will be specified to all thermal elements to minimise heat losses.

Passive solar gain reduces the amount of energy required for space heating during the winter months. The building is designed to maximise passive solar gains where best possible.

The development has been designed to improve daylighting in all habitable spaces, as a way of improving the health and wellbeing of its occupants. The majority of the habitable rooms, such as living rooms, will benefit from large windows to increase the amount of daylight within the internal spaces. Blinds will be installed for minimizing glare and regulating solar gains during hottest summer months.

A portion of the buildings heat loss will occur due to air infiltration. Good construction detailing and the use of best practice construction techniques will minimise the amount of air infiltration. The dwellings are designed to achieve $5m^3/hm^2$ at 50Pa or better.

The SAP calculation contains an overheating analysis to ensure that the risk is appropriately mitigated in the dwellings. The analysis demonstrates that all dwellings achieve a compliant level of overheating risk. This is based upon the provision of fully operable windows on all floors. Calculations can be provided at a later date to ensure compliance with Overheating Policy 5.9 of The London Plan if required.

Natural ventilation will be used to provide fresh air to all units to minimise energy demand for mechanical ventilation plant. All units will be Decentralised extract ventilation and equipped with trickle vents and operable windows in order to prevent overheating during hottest summer months.

The following table provide a summary of the energy efficient and carbon reducing design characteristics incorporated within the proposed development.

Design SAP Data Input Table			
Element		**Details**	**Comments**
Floor U-Values	New Build Ground Floor	0.13 W/m²K	75mm Screed, 150mm Celotex XR4000, 150mm Medium Density Concrete Slab
Wall U-Values	New Build External Walls - Brick	0.18 W/m²K	15mm Plasterboard on Dabs, 100mm Low Density Concrete Block (λ = 0.19W/mK), 150mm Springvale Ecobead Platinum, 102.5mm Brick Outer Leaf
Roof U-Values	New Build Roof – Flat Roof	0.14 W/m^{2}K	15mm Plasterboard, 150mm Unventilated Cavity Between Joists, 22mm Plywood, 125mm Celotex XR4000 to Flat Roof Finish
Opening U-Values	Windows	1.40 W/m²K	Double Glazed, Low-E Coated G Value: 0.63
	Doors - Solid	1.40 W/m²K	Solid Composite Door or Similar
Thermal Bridging	Y-Value	0.0456	Concreted Product Association (APA) & Accredited Construction Details (ACDs) Used
Ventilation	Air Tightness	5m^3/m^2 at 50Pa	Target Air Test Score to be Achieved
	Ventilation	Natural	Mechanical Extract Fans in Wet Rooms Only
Heating an Hot Water System	Primary Heating System	Gas Fired Boilers	Worcester Greenstar 28CDi Compact ErP Combi Boiler - Efficiency 89.8%
		Boiler Information	Pump in Heated Space, Boiler Interlock, Fan Assisted Flue
	Heat Distribution	Underfloor Heating / Radiators	Underfloor Heating Installed in Screed on Ground Floor, Radiators Installed on First Floor
	Controls	Programmer	Time and Temperature Zonal Heating Controls by Suitable Arrangement of Plumbing and Electrical Services - Delayed Start Thermostats Required
	Hot Water	From Gas Boiler	Hot Water Supplied Directly from Combi Boiler
Lighting	Low Energy	100% LED Fittings - Minimum Efficiency 45 Lm/cW	

Table 2: Energy Efficient Measures of SAP Calculations

Site Wide Summary of Be Lean Measures

SAP calculations have been produced for the site as a means of determining the emissions and the energy demand of the dwelling. This has been completed using the approved modelling software STROMA FSAP 2012.

Incorporating the above energy saving measures into the design SAP Assessment will reduce the sites overall energy demand and subsequent CO2 emissions beyond the requirements of Part L Building Regulations by **0.00 %.**

Be Lean Building Summary:

Dwelling	Floor Area m^2	Target Emission Rate $kgCO_2/m^2/Yr$	Dwelling Emission Rate $kgCO_2/m^2/Yr$	Percentage Improvement	Total Emissions $kgCO_2$/Year
Land off Taylor Close	51.14	24.92	24.92	0.00%	**1,274.41**

Table 3: Summary of Emissions (Regulated) of Proposed and Baseline Assessment

Dwelling	Main Heating Demand kWh/Year	Hot Water Demand kWh/Year	Pumps & Fans kWh/Year	Lighting kWh/Year	Total Energy Demand kWh/Year
Land off Taylor Close	2,822.13	1,717.09	75.00	245.51	**4,859.73**

Table 4: Summary of Energy Demand (Regulated) of Proposed and Baseline Assessment

The 'be lean' emissions are predicted to **1,274.41 $kgCO_2$ per year.**

This specification improves upon the baseline building's emission targets by a margin of **0.0%**.

The baseline energy demand is calculated to be **4,859.73kWh/Year**

Total Target Emission Rate: **1,274.41 $KgCO_2$/Year**
Total Design Emission Rate: **1,274.41 $KgCO_2$/Year**

9.0 Be Clean – Decentralised Energy

Policy 5.5 and 5.6 of the London Plan encourage the move to decentralised generation of heat and power seeking to reduce the losses and inefficiencies of reliance upon a centralised system. The mayor has set a target of 25% to be generated through localised decentralised energy systems by 2025.

Richmond Upon Thames requires all development proposals to prioritise connection to existing or planned future district energy (DE) networks unless it can be demonstrated it is not technically feasible or financially viable to do so. This is line with Policy CP2 2.B – Reducing Carbon Emissions, Richmond Upon Thames Local Development Framework Core Strategy – Adopted April 2019.

In determining whether a development is suitable to connect to a decentralised energy network or to include combine cooling, heat and power, the Council will consider the heat demand of the development and its proximity to a decentralised energy network as well as the feasibility and viability of connecting or including plant equipment.

Connection to Existing Heat Distribution Networks

Following London Plan guidance the priority will be given to connection to any existing CCHP/CHP distribution networks.

The maps below detail the existing and proposed district heating networks in the London Borough of Richmond Upon Thames and beyond. At present there are no nearby heat networks and no plans to extend any existing district heat networks to the vicinity of this development. The red lines show the existing networks, the purple ellipses show potential DE Networks.

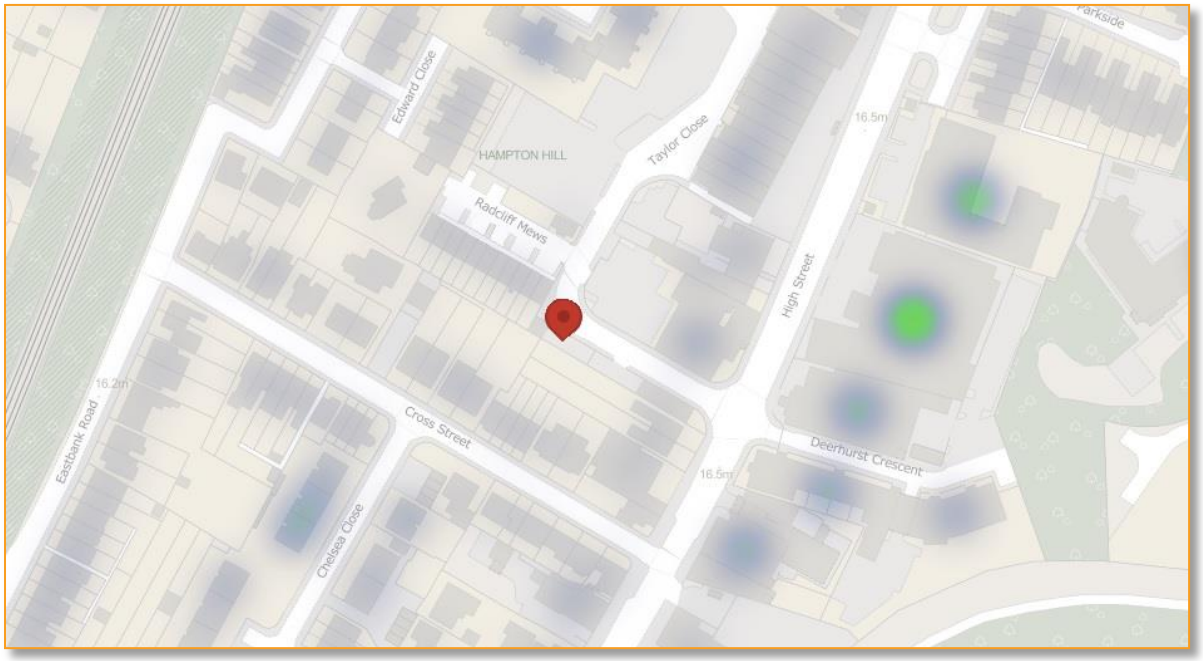


Figure 5: London Heat Density Map (http://www.londonheatmap.org.uk/Mapping/)

According to the interactive London Heat Map website, there are no current district heating networks in the area or imminent plans for a new network (See Figure 6). Therefore no provision to a supplement a network will be provided.

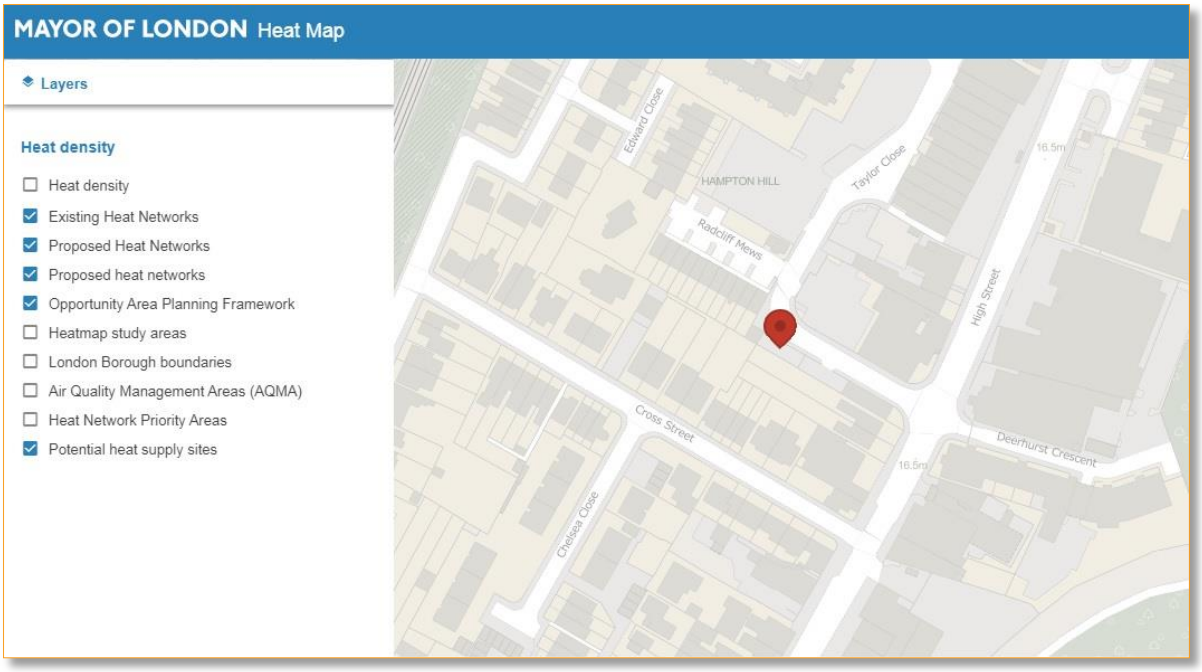


Figure 6: London's Existing and Proposed CHP Network (http://www.londonheatmap.org.uk/Mapping/)

Site Wide Summary of Be Clean Measures

After discussion with the client the decision has been made to stick with the intended heating system of gas boilers in the building. The current district heat network is not in a close proxcimity to the dwelling and would have to go through a significant distance of heavy developed area in order to connect the dwelling to the heat network. This would come at a great expense so would therefore not be a feasible option for Land off Taylor Close going forward at this time.

With regard to future connections the if there is evidience to suggest that the are planned heat networks being laid in the area the client is happy for a connection to be teed off for connection to a future heat network.

10.0 Be Green - Renewable Technologies

Policy 5.7 of the London plan states *"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."*

This section offers a technical analysis of various renewable energy technologies for consideration on the development.

Photovoltaics

Solar photovoltaics (PVs) convert energy from daylight into electricity using a semiconductor material such as silicon. When light hits the semiconductor, the energy in the light is absorbed, 'exciting' the electrons in the semiconductor so that they break free from their atoms. The resultant flow of electrons through the semiconductor material produces electricity.

Feasibility	Further Consideration
The development has a significant area of flat roof where it could be feasible to install a photovoltaic array in a southerly orientation. A Photovoltaic system is an ideal solution for reducing a building's emissions as the energy that is generated from the array would be used to offset the energy used in the running of the dwelling. As PV systems have no moving parts, generate no noise or pollution, this is an attractive option. If designed and properly installed require minimal maintenance and have long service lifetimes.	Yes

Solar Thermal (Hot Water)

Solar water heating systems convert solar radiation to heat carried by water for use in space heating or the provision of domestic hot water. Solar water heating systems normally operate with a back-up source of heat, such as gas condensing boilers. The solar water heating preheats the incoming water, which is topped up by the back-up heat source when there is insufficient solar energy to reach the target water temperature.

Feasibility	Further Consideration
This solution could be utilised to generate hot water using the energy from the sun. There is adequate south orientated roof to support a solar thermal installation. The use of solar thermal panels would require a hot water storage option such as a hot cylinder which at present is not within the scope of work. The water storage would need to be compatible with a solar thermal installation. Most cylinder and thermal store manufacturers make solar rated water storage so it is feasible to connect these to the solar thermal panel(s).	Yes

Wind Turbines

Wind turbines are modern, high-technology descendants of the windmills that have been around for centuries. In modern windmills the kinetic energy of the wind is used to turn a turbine to generate electricity as opposed to moving water or turning a grist mill wheel. There are two types of wind turbine, the horizontal-axis type which faces up or downstream of the wind and where the rotational movement of the blade is connected to a generator to create electricity. The other is the vertical-axis design, which is by far the most flexible type of wind turbine being best suited to more urban sites as it is more cost effective and operates with wind coming from any direction.

Feasibility	Further Consideration
Owing to site-constraints, micro-wind turbines have not been considered as part of this feasibility study. The primary constraints include the character of the building, the urban surroundings (and associated potential planning restrictions) and relatively low wind speeds in this area, averaging ~ 4.6 m/s-1 at 10m. (http://www.rensmart.com/Weather/BERR) Wind turbines are also likely to have a significant visual impact on local environment, as well as health and safety implications for occupiers or users on-site and on adjacent areas as a result of noise and light flicker associated with the wind turbines.	No

Ground Source Heat Pumps

Ground source heating takes advantage of the stable ground temperature of 12ºC to heat either air or water to provide energy efficient heating (and optional comfort cooling) to a building. The energy flow is driven by the temperature difference between the ground and the circulating fluid which can then be used to deliver heating (and optional cooling) to the building.

The direct bore hole type of installation requires a number of boreholes with a depth of up to 100m and a minimum centreline distance of 6m separating each bore hole.
Alternatively, closed loops can be installed along with the piles and or pad foundations of the building to take advantage of the foundation excavations to maximise the earth-connectivity of the system

Feasibility	Further Consideration
The dwelling is in a fairly built up area making it difficult to put ground collectors in without impacting the ground works or the surrounding areas. It is feasible but has a large outlying cost. As the development has a low heating demand it wouldn't be feasible as the cost for the ground works and the ground source unit itself would be very costly for a small dwelling with a low heating and hot water demand. Heat pumps do have their benefits as they are incredibly efficient if appropriately designed. This is mainly due to the ground having a more constant temperature throughput the year when compared to heating with an air source heat pump. It is possible to have ground source run at 400% efficient, meaning for every 1kW of electricity supplied to the system it will provide 4kW in heat.	No

Air Source Heat Pumps

An air source heat pump (ASHP) is a system which transfers heat from outside to inside a building. Under the principles of vapour compression refrigeration, an ASHP uses a refrigerant system involving a compressor and a condenser to absorb heat at one place and release it at another.

In domestic heating use, an ASHP absorbs heat from outside air and releases it inside the building, as hot air, hot water-filled radiators, under floor heating and/or domestic hot water supply.

Feasibility	Further Consideration
As the development is in a built up area residential area careful consideration would need to be taken as to the location of a proposed air source heat pump. Air source heat pumps have a higher capital cost than a conventional gas heating and domestic hot water system. For a start they require a cylinder that is not required with a combi gas boiler. However heat pumps are becoming more prevalent as there is better understanding from installers and the general public as to their operation. Heat pumps when installed correctly with an appropriate emitter system can be incredibly efficient. Heat pumps can run at over 300% efficient over the course of a year meaning for every 1kW of electricity used to run the compressor it will produce 3kW of heat. This means that running cost can be lower when compared to conventional systems. Maintenance costs at present are higher than conventional heating system but this will change as the energy market diversifies away from conventional heating. There are potential risks in relation to noise and neighbouring dwelling but most installers need to provide evidence that noise of a heat pump doesn't exceed a certain limit when sited near a habitable room. There are also risks with pressure losses in the system and loss of refrigerant gas. Refrigerant gases have a much higher environmental impact than carbon emissions in relation to global warming and ozone layer depletion. As these gases are contained within heat pump unit and the regulations with heat pumps have been significantly tightened since they entered the market this has become less of an issue but still one worth consideration.	Yes

Biomass

Biomass boilers are an alternative to conventional fossil fuel heating. They burn woodchip, wood pellets, cereal waste or a combination of organic fuels, and are a carbon neutral option. Using biomass as an energy source creates a 'closed carbon cycle' – i.e. as a biomass energy source grows it absorbs CO_2 from the atmosphere, when it is burnt the CO_2 stored by the biomass is released, making it carbon neutral.

Feasibility	Further Consideration
Consideration needs to be given to the size of the boiler and the frequency of fuel deliveries. The dwelling has a low heating and hot water demand which would make it unsuitable for a biomass installation unless the option of using a biomass stove was an option. These have capacities of 3-20kW so potentially this could be implemented. As with the other renewable technologies discussed this type of heating system would need a hot water cylinder installed. As well as this a pellet stove would have to be regularly cleaned to ensure that the stove works at it optimum. Fuel is often delivered in bulk to reduce cost to end user deliveries start 0.5 -30tonnes dependent on fuel type and boiler size. Suitable storage would need to be addressed as well as access for a large vehicle to access the site which would be problematic. There are also potential noise, dust and odor problems associated with the deliveries as well as Air Quality issues from the burning of the fuel. The higher NOx emissions are also of concern in this borough and as a result of this and the aforementioned items; Biomass is not considered a viable option.	No

Renewables Summary

Based on the above, the most feasible option for this development to secure at least a 20% saving in CO_2 emissions is installing solar photovoltaic panels. Other renewable energy schemes do hold merit, such as solar thermal and air source heat pump. However, from a practical and cost effective perspective reducing energy demand through lifestyle choices and fabric first solutions and then generating power with solar photovoltaic panels is the strongest candidate to achieve the most significant emission reductions. With both solar thermal and air source heat pumps they would require a hot water cylinder and this would take away from any storage space in the dwelling. Heat pumps are a possible option for future applications if it were proven economically viable.

There is adequate roof area to install 0.75kWp PV panel array. This gives a total number of 3 panels being installed on the flat roof of the dwelling and orientated south. Based on a standard 250W PV Panel being 1m x 1.6m, this gives a total approximate panel area of 4.8m^2.

11.0 Incorporation of Renewables

After consultation with the client, Aquinna homes, an agreement has been reached to proceed based on the use solar photovoltaic panels. Calculations have been completed incorporating 0.75 kWp of PV panels onto the flat roof pf the dwelling and orientate the panels in a southerly direction as best practicably possible.

The installation of PV panels would account for a **26.08%** improvement on carbon emissions against the Be Lean, therefore satisfying the requirements of Richmond Upon Thames Local Development Framework Core Strategy (Adopted April 2019) Policy CP2

Be Green Emission Summary:

Dwelling	Floor Area m^2	Target Emission Rate $kgCO_2/m^2/Yr$	Dwelling Emission Rate $kgCO_2/m^2/Yr$	Percentage Improvement	Total Emissions $kgCO_2/Year$
Land off Taylor Close	51.14	24.92	18.42	52.21	**942.00**

Table 5: Summary of Emissions (Regulated) of Proposed Assessment with Photovoltaics

Dwelling	Main Heating Demand kWh/Year	Hot Water Demand kWh/Year	Pumps & Fans kWh/Year	Lighting kWh/Year	PV Energy Produced kWh/Year	Total Energy Demand kWh/Year
Land off Taylor Close	2,822.13	1,717.09	75.00	245.51	-640.84	**4,218.89**

Table 6: Summary of Energy Demand (Regulated) of Proposed Assessment with Photovoltaics

The 'be green' emissions are predicted to **942.00 $kgCO_2$ per year.**

This specification improves upon the Residual Dwelling Emission Rate and the Baseline Target Emission Rate by **26.08%**

Total Target Emission Rate: **1,274.41 $KgCO_2$/Year**
Total Design Emission Rate: **942.00 $KgCO_2$/Year**

$$\frac{(Residual\ Emissions - Proposed\ Emissions)}{Residual\ Emissions}\ X\ 100 = \%\ Improvement$$

$$\frac{(1{,}274.41 - 942.00)}{1{,}274.41}\ X\ 100 = \mathbf{26.08}\%$$

12.0 Water conservation

As part of The London Plan Policy 5.15 there is a requirement to reduce internal potable water consumption.

The incorporation of water saving measures and equipment in all new developments are required in order to meet the London Plan water consumption targets of 105litres/per person/per day.

Reduced water usage through the use of low flow water outlets and appliances can also lead to a reduction in the energy required to heat domestic hot water. SAP 2012 methodology recognises a 5% reduction in domestic hot water heating energy if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day total water consumption.

The residential units will be designed to achieve water consumption of 105 litres per person per day, in line with Approved Document Part G 2015 with 2016 amendments, by the appropriate distribution system design and provision of low water use fixtures and fittings. An example of potential flow rates and fixtures is outlined in Table 7 below;

Internal Potable Water Fixing	Flow Rate / Capacity
Toilet	Dual Flush 4 and 2.6 litres
Basin Taps	5 litres / minute
Bath	150 litre capacity to overflow
Shower	8 litres / minute
Kitchen Taps	6 litres / minute

Table 7: Flow Rates and Capacities to Achieve Part G Enhanced Target of 105litres/person/day

13.0 Conclusions

This statement has reviewed the sustainability performance of proposed new dwelling at Land off Taylor Close against national and local policies. The material specification for the dwellings and the building (carbon dioxide) emission rates throughout the development have also been reviewed.

The developer has considered all sustainable solutions and has reduced the energy demand and resultant carbon dioxide emissions of the development above and beyond the requirements of the Building Regulations Part L1A. The proposed energy strategy has been proven to meet the key regulatory and local planning policy targets established by the London Borough of Richmond Upon Thames Policy CP2 – Reducing Carbon Emissions as well as the London Plan Policy 5.2.

This report has shown how the proposed development has been designed using the principles of the Energy Hierarchy in order to deliver significant carbon dioxide savings. In particular, the design team have sought to minimise emissions at source by the incorporation of the "Fabric First" approach utilising the principles of passive design. Furthermore the implementation of sustainable design features as well as high efficiency lighting throughout.

The feasibility study showed that no existing district heating networks are currently within close proximity of the site. Also, it is not considered economically or technically feasible to incorporate a communal heat system with a CHP for a small scale such as that at Land off Taylor Close. Space heating and hot water for the dwellings will be provided by high gas combi boiler.

A review of the possible low carbon or renewable energy strategies for the development has been carried out and it is has concluded that photovoltaic panels are the most appropriate in this instance. The client proposes to introduce an estimated 0.75kWp of photovoltaic panels to the south elevation, following the renewables feasibility. This equates to three panels which takes approximately 4.8m² in area (Based on a standard 250W panel being approximately 1.6m²).

These improvements to the specification will ensure the development achieves a reduction in emissions of **26.08%** through the use of onsite renewable technologies against the baseline Dwelling Emission Rate, as well as reducing CO_2 by **26.08%** against L1A Regulations

Therefore, the overall energy strategy through a fabric first approach will ensure the proposed new build at Land off Taylor Close, Hampton Hill achieves the required reduction in CO_2 against the developments baseline case and complies with National Planning Policy Frame Work, The London Plan and The London Borough of Richmond Upon Thames Local Development Framework Core Strategy (Adopted April 2019) Policy CP2.

14.0 Summary Tables

Carbon Dioxide Emissions after Each Stage of the Energy Hierarchy

	Carbon dioxide emissions (tonnes CO_2 per annum)
	Regulated
Baseline	1.27
Be Lean: After Energy Demand Reduction	1.27
Be Clean: After CHP/Community Heating	1.27
Be Green: Renewables	0.94

Table 8: Carbon Dioxide Emissions After Each Stage of the Energy Hierarchy

Regulated Carbon Dioxide Savings from Each Stage of the Energy Hierarchy

	Regulated domestic carbon dioxide savings	
	Tones CO_2 per Annum	%
Savings from energy demand reduction	0.00	0.00%
Savings from Community heating	0.00	0.00%
Savings from renewable energy	0.33	26.08%
Total Cumulative Savings	0.33	26.08%

Table 9: Regulated Carbon Dioxide Savings from Each Stage of the Energy Hierarchy

The London Plan Energy Hierarchy

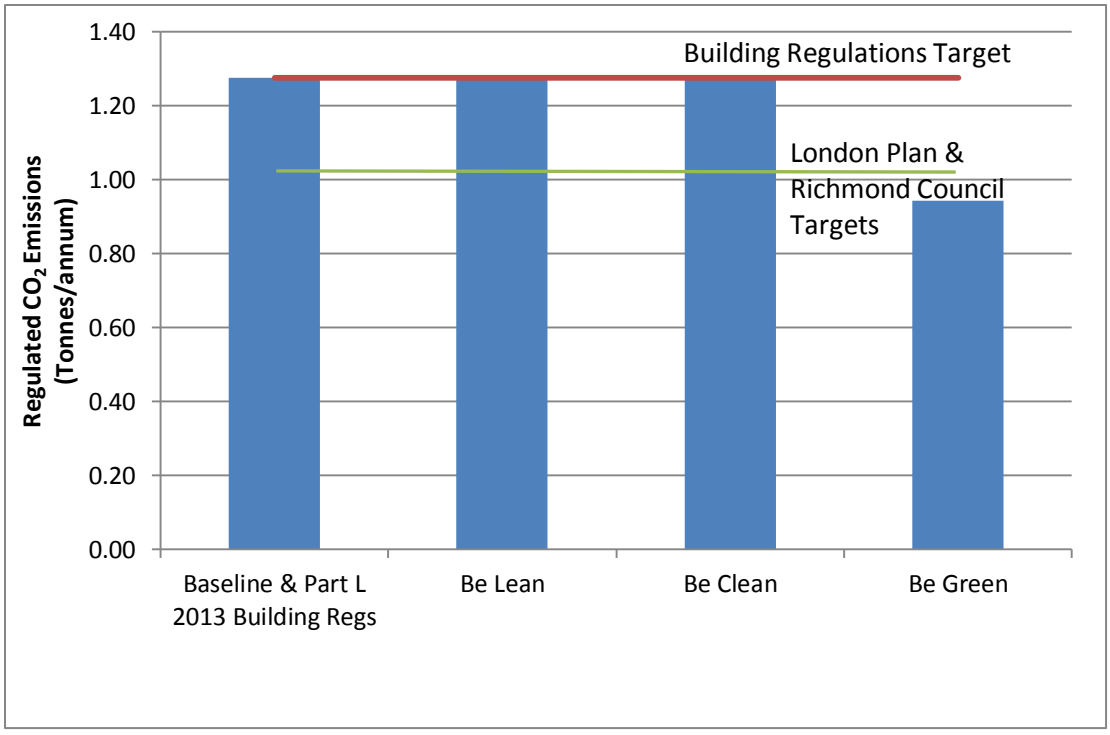


Figure 7: Regulated London Plan Hierarchy Summary Chart

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