Former Royal Mail Sorting Office, Twickenham

Sustainability Statement

November 2012

WHITECODE DESIGN ASSOCIATES
BUILDING SERVICES DESIGN CONSULTANTS

St James
Designed for life

CONTENTS

1. INTRODUCTION

1.1 This sustainability statement has been prepared in support of a planning application submitted to the London Borough of Richmond upon Thames (LBRuT) by St James Group for the redevelopment of the Former Royal Mail Sorting Office, Twickenham (the Site) to provide a residential led, mixed use development.

1.2 The proposed development will comply with the relevant sustainability policy and guidance as set out at national, regional and local level. This statement therefore responds specifically to guidance as set out in;

- The National Planning Policy Framework (March 2012)
- London Plan (July 2011) & SPG on Sustainable Design and Construction (May 2006)
- LBRuT Core Strategy (April 2009)
- LBRuT Development Plan (Nov 2011)
- LBRuT Sustainable Construction Checklist SPD (Aug 2011)

1.3 The proposals summarised within this statement promote a development which will incorporate an energy efficient, sustainable design with environmental performance and climate change in mind.

1.4 London Plan Policy 5.2 'Minimising Carbon Dioxide Emissions' confirms that development proposals should make the fullest contribution to minimising CO_2 emissions in accordance with the energy hierarchy of Be Lean (use less energy), Be Clean (supply energy efficiently) and Be Green (use renewable energy). The London Plan requires all new development from 2010 to achieve Code for Sustainable Homes Level 4 based on a 25% reduction in CO_2 emissions over the 2010 Building Regulations.

1.5 This requirement is also reflected in the LBRuT Development Management Plan Policy DM SD1 which confirms that development should meet or exceed the requirements for Code for Sustainable Homes Level 3 based on achieving a 25% reduction in carbon emissions over 2010 Building Regulations. All commercial developments should seek to achieve BREEAM Excellent.

1.6 The Energy Strategy prepared by Whitecode Design Associates and submitted as an appendix to this statement demonstrates that this development will achieve Code Level 4 and concludes that a 35.53% reduction in carbon emissions will be achieved across the site. The commercial units will achieve BREEAM 'Very Good' however the design will enable the operator/end user to achieve BREEAM 'Excellent'.

2. PROPOSED DEVELOPMENT

2.1 The proposals for the Site comprise a residential-led mixed use development which includes 110 residential units (82 apartments and 28 houses), 2 restaurants, a new community building and open space.

2.2 A mixed use building accommodating the apartments and restaurants will be provided in the north eastern part of the Site, fronting both the River Crane and London Road. The new community building will be provided in the south eastern corner of the Site and also front London Road. The new houses will be delivered in terraces set out across the western part of the Site towards the Metropolitan Open Land (MOL) beyond.

2.3 The main access to the development is provided at the front of the Site from London Road and will serve the mixed use building and community building. A second access is provided via the existing the Network Rail owned ramp (also served from London Road) which lies between part of the eastern boundary the Site and the London Road. This ramp connects to Brewery Lane which will form the southern boundary of the development and provides access for Network Rail and the occupiers of the existing four railway cottages (nos.1 – 4 Brewery Lane). It will also provide access to the proposed houses on the western part of the Site.

2.4 The mixed use building which forms a 'horseshoe' shape wrapped around a private courtyard area, ranges from 3 – 5 storeys in height. It will front a newly created public piazza which will be formed between the London Road and the River Crane. This space will lead into a new riverside area along the edge of the River Crane connecting to LBRuT owned land to the west.

2.5 The apartments are provided with private balconies and terraces but also have access to a ground floor courtyard. The 2 restaurant units provide active frontages to the piazza and the opportunity for outdoor dining. A new basement car park will be created under this building to provide car and cycle parking for the apartments.

2.6 The proposed community building will be 5 storey's in height and will front onto London Road, albeit that the building will sit lower than London Road. The new building will provide a 350 – 400 seat community hall under part of which there will be a small basement accommodating dressing rooms and storage space. A bar/café and reception area will also be provided on the ground floor. Flexible floor space will be provided on the first, second, third and fourth floors which can be used for a range of purposes including art and music studios, rehearsal space, teaching and meeting rooms and conference space. Ground floor outdoor space in addition to a communal roof terrace on the second floor of the building will also be provided.

2.7 The 28 houses are set out in 5 separate terraces which are located on the western section of the Site. The terraces run north to south with parking courtyards to the front and private gardens to the rear. The houses will 3-storeys in height with some units having rooms in the roof.

2.8 In summary the proposals comprise;

Residential Use

- 110 residential units (including 10% affordable housing provision)

Commercial Uses

- 2 restaurant units providing 592sqm of Class A3 (restaurant) floorspace

Community Facilities

- New community building delivering 1,265sqm of flexible community floorspace

Car Parking

- 68 spaces provided for the apartments (in basement car park)
- 2 parking spaces provided for each of the houses (56 spaces)
- 3 visitor spaces

Cycle Parking

- 142 secure cycle spaces provided for the apartments (in basement car park)
- 2 secure cycle spaces provided for each of the houses

Motorcycle Parking

- 4 secure motorcycle spaces (in basement car park)

Public Open Space

- New public piazza
- New riverside area
- Open space associated with community building

3. POLICY REQUIREMENTS

3.1 The proposed development will comply with national, regional and local planning policy. It will also comply with the Berkeley Group's own sustainability commitments as documented within Vision 2020, the Group's ten year sustainability strategy.

3.2 The NPPF published by the Department of Communities and Local Government confirms that the purpose of the planning system is to contribute to the achievement of sustainable development.

3.3 The NPPF sets out a definition for sustainable development, based on a three stranded approach which includes economic, environmental and social criteria. It confirms that these roles should be mutually dependant on one another and therefore to achieve sustainable development economic, social and environmental gains should be sought jointly and simultaneously. It confirms that this approach should be encouraged through the planning system in order to achieve sustainable solutions within development.

3.4 The London Plan establishes the objective of securing climate change mitigation through new development. Paragraph 5.15 states;

'In the planning context, the Mayor expects that all new development will fully contribute towards the reduction in carbon dioxide emissions and this will be principally achieved through the application of Policy 5.2 and the Mayor's energy strategy.'

3.5 London Plan Policy 5.2 'Minimising Carbon Dioxide Emissions' sets out the Be Lean, Be Clean and Be Green criteria against which new development will be assessed. It states:

- ***Be Lean:*** *minimise energy use by implementing passive design measures.*
- ***Be Clean:*** *all systems which use fossil fuels i.e. gas, oil, coal or electricity must utilise these fuels at optimum efficiency.*
- ***Be Green:*** *any remaining energy demand should be produced with as much renewable technology as practically/financially possible.*

3.6 Policy CP2 of the Core Strategy 'Reducing Carbon Emissions' adopted prior to the London Plan requires all new development to achieve a reduction in CO_2 emissions by 20% from on – site renewable energy generation unless it can be demonstrated that such provision is not feasible.

3.7 Policy DM SD1 of the Development Management Plan requires new development to meet or exceed the requirements of Code for Sustainable Homes Level 3 based on achieving a 25% reduction in CO_2 emissions over the 2010 Building Regulations. It requires commercial development to seek to achieve BREEAM 'Excellent'. Policy DM SD2 seeks to maximise opportunities for securing some form of renewable/low carbon decentralised energy network in new development.

3.8 The Sustainable Construction Checklist SPD outlines the sustainability issues LBRuT expects applicants to follow in order to make an increased contribution to sustainability and help create a townscape which will adapt to and mitigate climate change. A Sustainability Checklist for this development has been submitted in support of this application and is appended to this report.

3.9 In addition to the statutory planning policy requirements the Berkeley Group has set its own sustainability commitments which are documented in Vision 2020, the group's 10 year sustainability strategy which aims to establish the Berkeley Group as one of the most successful and sustainable businesses in Britain. Launched in May 2010 Vision 2020 is structured around four key actions areas that reflect where the Group's performance needs to be outstanding in order to achieve this;

- **The Customer Experience** – providing exceptional customer service throughout the purchasing process and after completion
- **Building Greener Homes** – creating high quality, well designed comfortable homes with low environmental impact
- **Delivering Sustainable Communities –** developing sustainable places where people choose to live, work and spend leisure time
- **Running a Sustainable Business** – managing the environmental, social and economic impacts of our business whilst delivering strong financial performance

3.10 In addition to the Vision 2020 commitments the Berkeley Group has, since the beginning of 2012 commissioned research into the definition of social sustainability, a concept which seeks to create places which support people's well being and quality of life;

'Social sustainability describes the way a neighbourhood supports individuals and collective – well being. It is about people's quality of life. Social sustainability combines design of the physical environment with a focus on how the people who live in and use a space relate to each other and function as a community. It is enhanced by development which provides the right infrastructure to support strong social and cultural life, opportunities for people to get involved, and scope for the place and the community to evolve.'

3.11 St James has, as part of the design and consultation process, carefully considered how the proposals will deliver a place which will support both the existing community and the future community within the development itself. The provision of the new community building will act as a focal point within the town centre.

3.12 As detailed within Section 4 of this statement the proposed development will achieve Code for Sustainable Homes Level 4 which coincides with the minimum requirements as set out in London Plan Policy 5.2 and LBRuT Development Management Plan Policy DM SD1. The commercial units will achieve BREEAM 'Very Good' however the design will allow the operator to achieve BREEAM 'Excellent'. The pre – assessment scores can be found in the Code for Sustainable Homes Pre-Assessment document and BREEAM Pre-Assessment Estimator submitted as appendices to this report.

4. SUSTAINABILITY STRATEGY

4.1 Introduction

4.1.1 The following summarises the key sustainability points derived from the Energy Strategy, Code for Sustainable Homes Pre – Assessment and BREEAM Pre – Assessment submitted as part of this planning application. It also provides details of additional measures which have been incorporated into the design to reduce the environmental impact of the scheme proposed.

4.2 Energy Strategy

4.2.1 The proposed development seeks to substantially reduce energy demand and carbon dioxide emissions.

4.2.2 The Energy Strategy submitted with this application has been developed in line with the energy hierarchy of 'Be Lean,' 'Be Clean' and 'Be Green' to reduce the energy consumption of the proposed development.

4.2.3 An assessment of the sites potential energy use has been conducted in compliance with the minimum requirements of the current Part L of the Building Regulations. The Energy Strategy demonstrates that the proposed development will reduce site wide carbon emissions by 35.35%. The development has been designed to meet Code Level 4 with the commercial units designed to achieve BREEAM 'Very Good.'

4.2.4 The development has been benchmarked against the Target Emissions Ratings (TER) for Building Regulations Part L 2010.

4.2.5 'Be Lean' energy efficiency measures are detailed within the Energy Strategy. Energy efficiency measures include improvements in the building fabric in addition to improvements in detailing to reduce thermal bridging. It is proposed that 100% of all lighting will be energy efficient with an effort made to reduce un-regulated energy use.

4.2.6 Various 'Be Clean' energy efficient technologies have been considered. 'Be Clean' measures include the provision of a Combined Heat & Power (CHP) unit to serve the proposed apartment units. Due to the extensive amount of pipework required to connect the houses to a CHP unit only the apartment units have been considered. The community building will have the option to connect to the unit however, this will be dependant on operator preference. The thermal demand calculations undertaken by Whitecode suggest a 70kWe CHP unit would be most appropriate for this site, this would generate the most carbon savings without excessive heat dumping. The CHP unit is based on a running time of 17 hours per day which is considered to be an appropriate time to maximise carbon savings and to include necessary maintenance.

4.2.7 'Be Green' renewable technologies have been considered to achieve the additional CO_2 savings required to meet Code Level 4. Photovoltaics (PV) is considered a suitable solution for the houses. PV positioned at a tilt of 30 degrees is proposed for each dwelling.

4.2.8 Comfort cooling will be achieved passively through a reasonable combination of glazing, external shading, solar control glazing and natural ventilation.

4.3 Code for Sustainable Homes Pre – Assessment

4.3.1 The Code for Sustainable Homes is used as a benchmarking tool in the design of new residential developments, it aims to set new standards in sustainability and energy efficiency which are not mandatory under the current Building Regulations.

4.3.2 A Code for Sustainable Homes pre – assessment has been undertaken for the Site. The target score for both the houses and apartments proposed is 68.33 which achieves Code for Sustainable Homes Level 4 rating (a margin of 0.33 above the minimum required score of 68). For a full overview of the pre – assessment undertaken please refer to Appendix B.

4.4 BREEAM Pre – Assessment

4.4.1 BREEAM is the benchmarking tool used in the design of non – residential dwellings and sets the standard for best practice in sustainable building design, construction and operation.

4.4.2 A BREEAM pre – assessment has been undertaken for the Site. The target score for the commercial units is 66.58 which achieves a BREEAM 'Very Good' rating (a margin of 11.58 above the minimum required score of 55). The design of the development will allow end users/operators to achieve BREEAM 'Excellent' rating. For a full overview of the pre – assessment undertaken please refer to Appendix C.

4.5 Summary of Additional Sustainability Measures

4.5.1 Resource Efficiency

Water consumption will be minimised through the installation of highly efficient appliances which will include water efficient taps and dual flush WC's, a water meter will also be fitted to each dwelling. Each dwelling will have to meet the Code for Sustainable Homes mandatory water requirement of 105 litres per person per day.

4.5.2 Transport

The Site has a good level of transport accessibility and can be accessed via a number of different transport nodes. It is located opposite Twickenham Rail Station and can be accessed easily via bus routes which stop at various points on London Road. The Site has a PTAL rating of 5 at the front reducing to a PTAL rating of 4 at its western edge. A Travel Plan has been drafted for the scheme and will be implemented prior to occupation of the development. This aims to reduce private vehicular trips, encourage walking, cycling and the use of public transport.

4.5.3 Materials

Where feasible materials will be sourced which have low environmental impacts. These will (where possible) be recycled and sustainably sourced from local areas. This will be investigated further throughout the detailed design stage.

4.5.4 Surface Water Run Off

The proposed development is situated in Flood Zone 1 and therefore has a low probability of flooding. The proposals incorporate sustainable urban drainage systems (SUDS) and include mitigation strategies to deal with contamination and waste. These are set out in the ES.

5. WASTE

5.1 Peter Brett Associates were commissioned to produce a Waste Strategy for the scheme, this can be found in Appendix A.4 of the Environment Statement submitted with this application.

5.2 The Waste Strategy is based on the Berkeley Group's commitment to a 10 year sustainability strategy 'Vision 2020.' This Vision 2020 aims to raise the standard of sustainable development in relation to new homes. To do so the Group has set specific commitments which apply to waste issues. These include;

- Producing recycling bins for every home
- Design all new homes to achieve at least Code for Sustainable Homes Level 3; and
- Reuse over 80% of construction, demolition and excavation waste

5.3 In line with the above, the Waste Strategy adopted demonstrates how the proposed development will; minimise, re – use and recycle waste; minimise the use of raw materials; minimise the pollution potential of unavoidable waste and; dispose of unavoidable waste in an environmentally acceptable manner.

5.4 Against this background the document sets out the strategy for managing waste deriving from demolition, construction and occupation phases. The Waste Strategy provides details of each stage, the expected waste arisings and how they will be managed. This is in line with the relevant national, regional and local planning policy context in addition to commitments contained within the Berkeley Group's Vision 2020 document.

5.5 Demolition

It is estimated that demolition will result in 7,710 tonnes of waste of which 90% will be concrete and tarmac. Recycling of such arisings could take place on site with processing of concrete and tarmac to produce a coarse aggregate that can be used in construction.

5.6 Construction

Construction waste is estimated at 2,150m^3, with a further 4,330m^3 created from excavation of the basements. As with demolition waste construction waste will be re-used on site where practicable. A Site Waste Management Plan will be prepared detailing how construction and demolition wastes will be managed on-site.

5.7 Operational

Operational waste volumes are estimated to be approximately 100 tonnes per annum for the residential units with 43 tonnes of that being recycled and the remainder sent for disposal. For the commercial units (the restaurants and the community building) it is estimated there will be 240 tonnes of waste per annum.

5.8 In terms of residential waste, this will be managed through LBRuT's existing waste management contracts. Development has been designed to allow space for waste and recyclable storage in and out of homes. Implementation of Borough-wide schemes to reduce waste sent to landfill, including improving community awareness, will improve recycling rates. The commercial waste management arrangements will require specific consultation by the

future operators with appropriate waste management companies, depending upon the waste to be generated.

6. SUMMARY

6.1 The proposals summarised within this statement promote an energy efficient, sustainable development which has been designed in accordance with the relevant sustainability policy and guidance as set out at national, regional and local level.

6.2 An Energy Strategy has been undertaken which demonstrates how the proposed development complies with the relevant requirements of the Development Plan policy and confirms that the overall development will achieve a 35.53% CO_2 emission reduction against 2010 Building Regulations. This will be achieved through an energy efficient design (be lean), the use of a district heating system (gas fired CHP) for the apartments, restaurants and community building (be clean) and the use of photo-voltaic panels on the roofs of the houses (be green).

6.3 The residential part of the development has been designed to achieve Code for Sustainable Homes Level 4 rating and the commercial and community uses will achieve BREEAM 'Very Good'. However, the design of the development will allow end users/operators of the commercial and community uses to achieve BREEAM 'Excellent'.

6.4 As detailed within this statement additional sustainability measures have also been incorporated into the design such as; the installation of highly efficient appliances and the incorporation of sustainable urban drainage systems.

6.5 The Waste Strategy submitted as part of the Environment Statement demonstrates how the development will sustainably manage waste arising's from demolition, construction and operational stages.

APPENDIX A

Former Royal Mail Sorting Office Twickenham

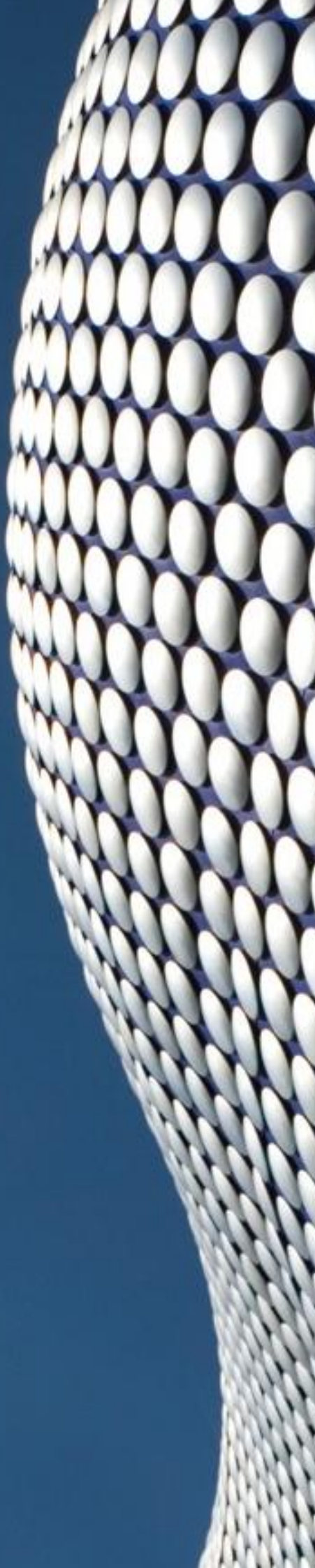
Energy Strategy Overview

Revision: P4

Date: 13 November 2012

Prepared for: St James

Job Number: 9698



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Executive Summary

The following report presents the preferred Energy Strategy for the proposed redevelopment of the Former Royal Mail Sorting Office, Twickenham (the 'Site'). The scheme is for a new-build development and carbon dioxide emissions have been calculated accordingly.

All residential units have been analysed using the Standard Assessment Procedure (SAP) and averaged accordingly. The Greater London Authority's '*Integrating renewable energy into new developments: Toolkit for planners, developers and consultants*' strategy has been applied.

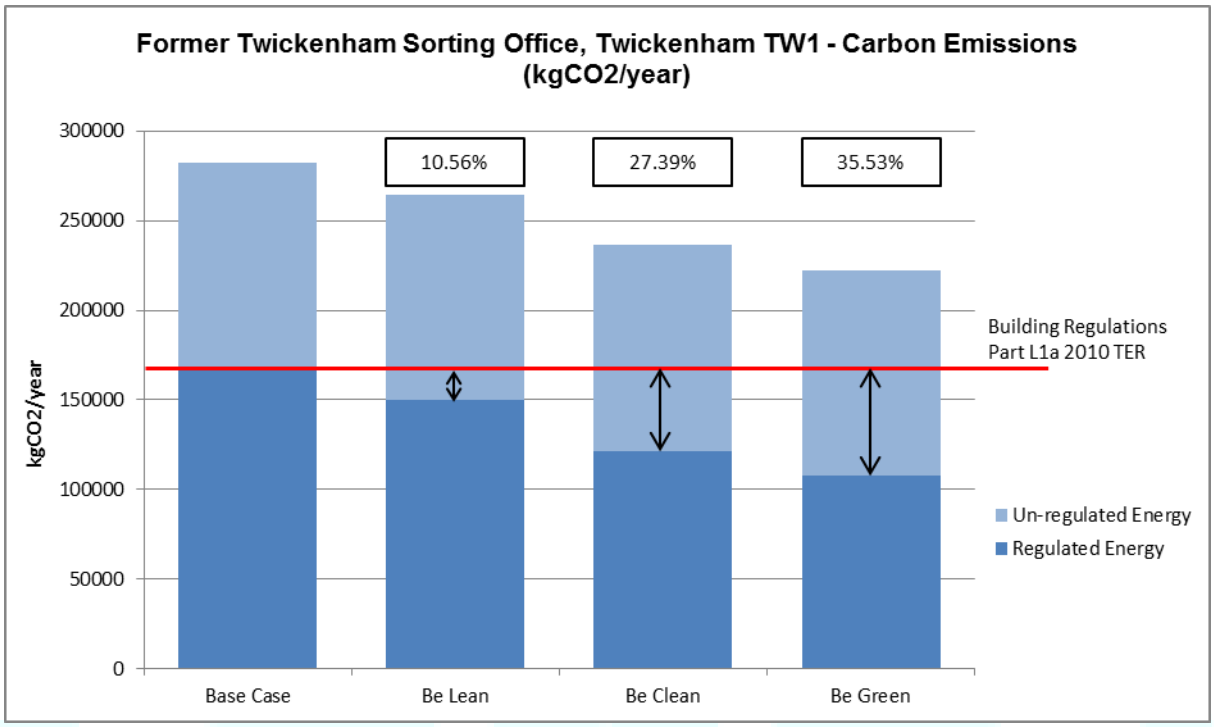
The Mayor of London expects all new developments to fully contribute towards the reduction of carbon dioxide emissions. The targets are highlighted in Planning Policy 5.2 of the London Plan 2011. The target for this development is to achieve Code for Sustainable Homes Level 4 and improve carbon emissions reduction by at least 25% over the Target Emissions Rate (TER) outlined in the 2010 Building Regulations. This is also reflected in the LB Richmond Development Management Plan Policy DM SD1 which confirms that new development should meet or exceed the requirements of Code for Sustainable Homes Level 3, but this will be based on achieving 25% reduction in CO2 emissions over 2010 Building Regulations. This report concludes that the proposed scheme would achieve a **35.53%** carbon saving of fixed services above 2010 Building Regulations thereby achieving Code for Sustainable Homes Level 4. This will be achieved by using:

- District heating scheme with a 70kWe CHP serving the apartments
- 34.8kWp of Photovoltaic panels serving the houses

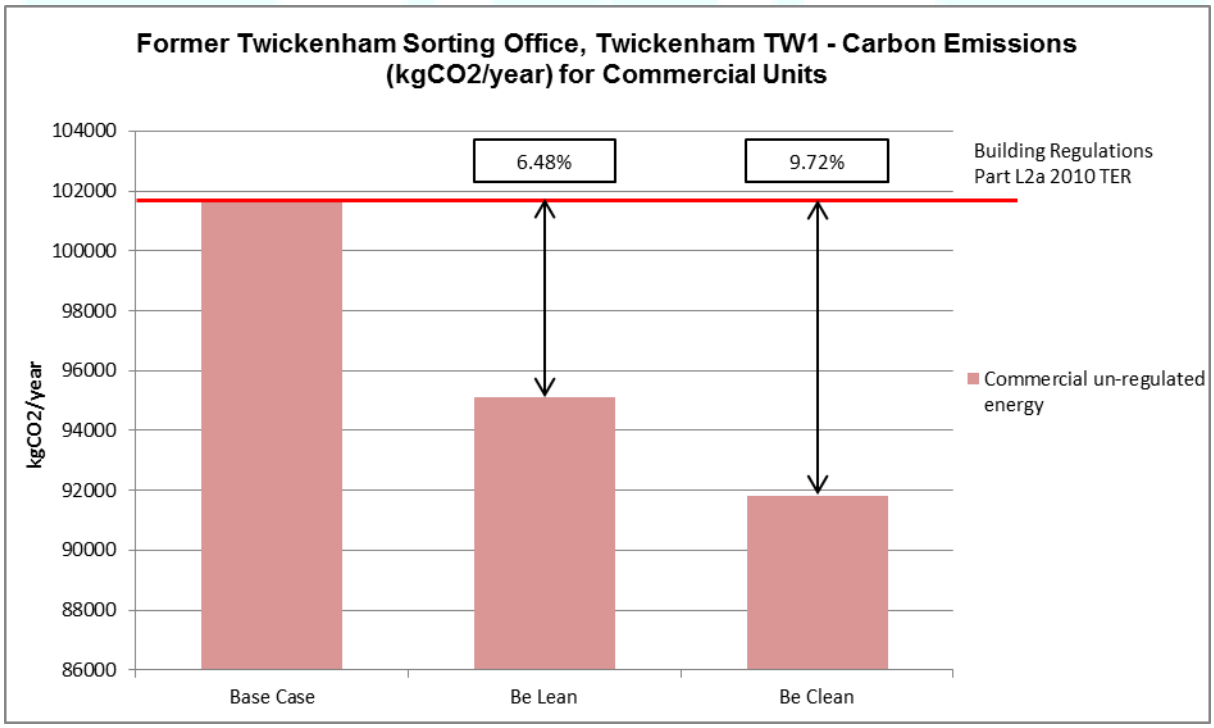
As the Site is to be assessed under current Building Regulations, particularly Part L1a:2010, the current SAP calculation 2009 and Code for Sustainable Homes Guidance November 2010 has been applied. All documents focus on low carbon buildings assisted by renewable technologies and do not focus on a fixed renewable percentage.

The commercial element of the scheme has been assessed under current Building Regulations, Part L2a:2010, using IES iSBEM modelling software. The model concludes that the proposed commercial units would achieve a **9.72%** carbon saving with improved building fabric and the connection to the CHP to the Community building. Greater savings are likely to be made once the final design is known. The commercial units will be delivered to BREEAM 'Very Good' rating.

The Energy Strategy has focused on securing the greatest reduction in carbon dioxide emissions primarily from passive measures. This approach complies with the relevant policies from the Development Plan.



Former Royal Mail Sorting Office residential units site-wide carbon emissions



Former Royal Mail Sorting Office commercial units site-wide carbon emissions

Please note the improvement of the commercial units is an indication of savings that can be made when improving the building fabric to the same specification as the residential unit, and connecting the Community Building to the district heating scheme.

Contents

Revision History

Rev	Date	Purpose / Status	Created by	Issued by
P1	03.07.12	Issued for discussion/comment.	Jason Tramontano	Jason Tramontano
P2	10.08.12	Results revised to current layouts & report amended to Client's comments. Issued for discussion/comment.	Jason Tramontano	Jason Tramontano
P3	31.08.12	Results revised to current Accommodation Schedule and Client's comments. Issued for discussion/comment.	Jason Tramontano	Jason Tramontano
P4	13.11.12	Community areas amended. Issued for discussion/comment.	Jason Tramontano	Jason Tramontano

1.0 Introduction

1.0 Introduction

This report demonstrates how the Energy Strategy for the proposed development at the Former Royal Mail Sorting Office (the 'Site') will address the relevant Development Plan policies relating to energy and climate change.

The London Plan 2011 establishes the overarching objective of securing climate change mitigation through new development. Paragraph 5.15 states:

'In the planning context, the Mayor expects that all new development will fully contribute towards the reduction of carbon dioxide emissions, and this will be principally achieved through the application of Policy 5.2 and the Mayor's energy hierarchy.'

The key policy from the London Plan is Policy 5.2 'Minimising Carbon Dioxide Emissions' which sets out the criteria against which new development will be assessed. A full extract of this policy is attached as Appendix I.

The LB Richmond Core Strategy (which was adopted prior to the London Plan) confirms in Policy CP2 (Reducing Carbon Emissions) that:

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

The LB Richmond Development Management Plan adopted in November 2011 includes Policy DM SD1 which confirms that new development should meet or exceed the requirements of the Code for Sustainable Homes Level 3 (based on achieving 25% reduction in CO2 emissions over 2010 Building Regulations) and Policy DM SD2 which seeks to maximise the opportunities for securing some form of renewable/low carbon decentralised energy network in new development.

All residential units have been analysed using the Standard Assessment Procedure (SAP) and averaged accordingly. As the site is to be assessed under current Building Regulations, particularly Part L1a:2010, the current SAP calculation 2009 and Code for Sustainable Homes Guidance November 2010 has been applied.

The Energy Strategy seeks to deliver the mandatory percentage emission improvements for Code for Sustainable Homes Level 4 in ENE 1 of the Code guidance November 2010, whilst implementing as much renewable energy as feasibly possible.

The achievement of Code for Sustainable Homes Level 4 also coincides with the minimum requirements set out in Policy 5.2 of the London Plan 2011 and LB Richmond Development Management Plan Policy DM SD1. Not only are the minimum improvements over the Target Emission Rate (TER) stated in the Policy 5.2, but also the strategy to achieve the improvements.

The strategy set out in Policy 5.2 of the London Plan to achieve the fullest contribution to minimising carbon dioxide emissions is as follows:

BE LEAN – minimise energy use by implementing passive design measures, e.g. improve fabric U-values and minimise air permeability.
BE CLEAN – all systems which use fossil fuels, i.e. gas, oil, coal or electricity, must utilise these fuels at optimum efficiency.
BE GREEN – any remaining energy demand should be produced with as much renewable technology as practically/financially possible.

The Development

The scheme comprises of 82 apartments, 28 houses and 1,859m^2 of commercial/community floor space. All of the apartments and houses are self-contained. The accommodation mix is broken down as follows;

- 22 x 1 Bedroom apartments
- 60 x 2 Bedroom apartments
- 28 x 3 & 4 Bedroom houses
- Restaurant 1 – 303m²
- Restaurant 2 – 291m²
- Community Building – 1,265m²

A selection of 48 NHER SAP calculations for the dwellings have been carried out to produce an accurate representation of the site. Averages have been taken where applicable.

The baseline scheme will be based on an individual gas boiler heating system with radiators and u-values to 2010 Building Regulations.

All documents set targets for and require evaluations of regulated energy use. This is the energy use associated to building services, such as heating, ventilation, cooling and lighting. Other energy use is classed as un-regulated and covers energy use in building occupants, which cannot be influenced by the developer.

The commercial aspect of the development is classed as un-regulated energy; however, this report will highlight the potential energy and carbon savings that could be achieved when using the same building fabric and air tightness as the residential scheme. The Community Building will assume a connection to the district heating network.

2.0 Baseline Energy Demands

2.0 Baseline Energy Demands

An assessment of the sites potential energy use was conducted in compliance with the minimum requirements of the current Part L of the Building Regulations. The Part L compliance results were calculated using the notional building from the NHER SAP software.

A number of SAP calculations were carried out for the residential part of the scheme, using the Part L 2010 notional building.

The SAP result sheets are summarised below:

Base Case		
Part L 2010 Notional Building		
Application	Annual Energy Consumption (kWh/year)	Annual Carbon Emissions (kgCO2/year)
Heating	699,819	144,265
Lighting	40,028	18,267
Appliances	123,481	63,839
Cooking	59,476	30,749
Fans & Pumps	11,550	4,874
Common Areas	38,715	20,016
Total	**973,069**	**282,010**

Table 2.1: Baseline SAP results – TER

When adding the commercial units to the calculation the site is summarised below:

	Total Annual Energy Demand (kWh/yr)	**Total Annual Carbon Emissions ($kgCO_2$/yr)**
Residential	973,069	282,010
Commercial (1,859m^2)	268,942	86,072
Total	**1,242,011**	**368,082**

Table 2.2: Baseline site-wide results – TER

The following pie chart indicates the breakdown of carbon emissions (kgCO2/year) for the development.

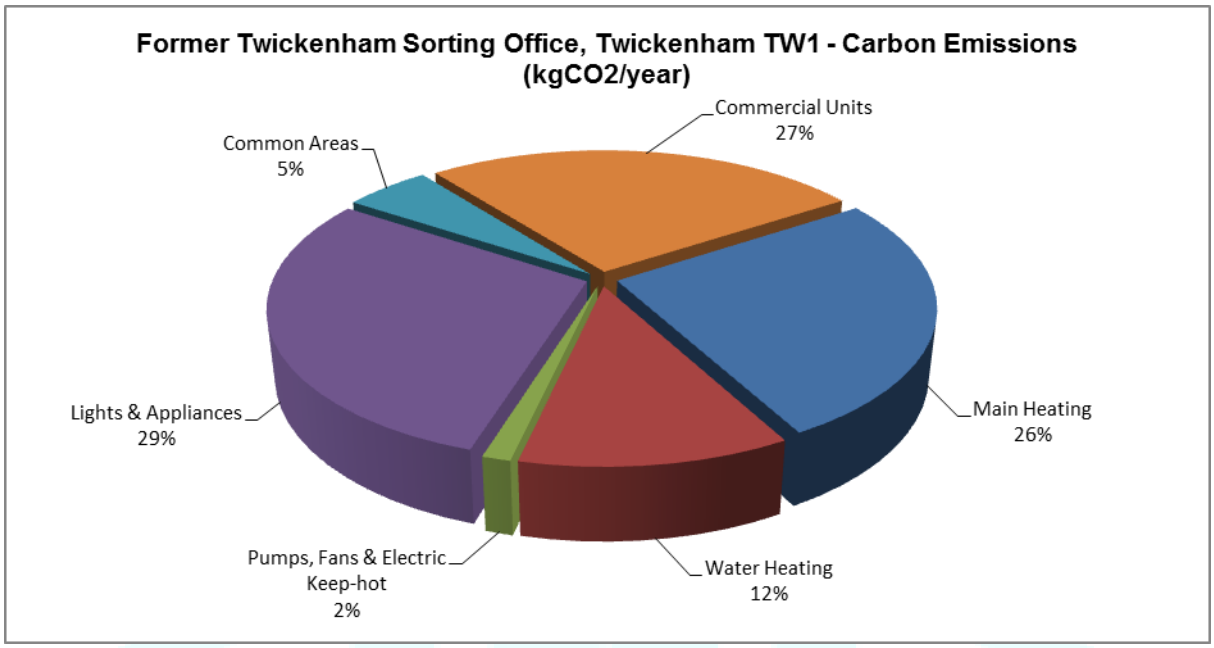
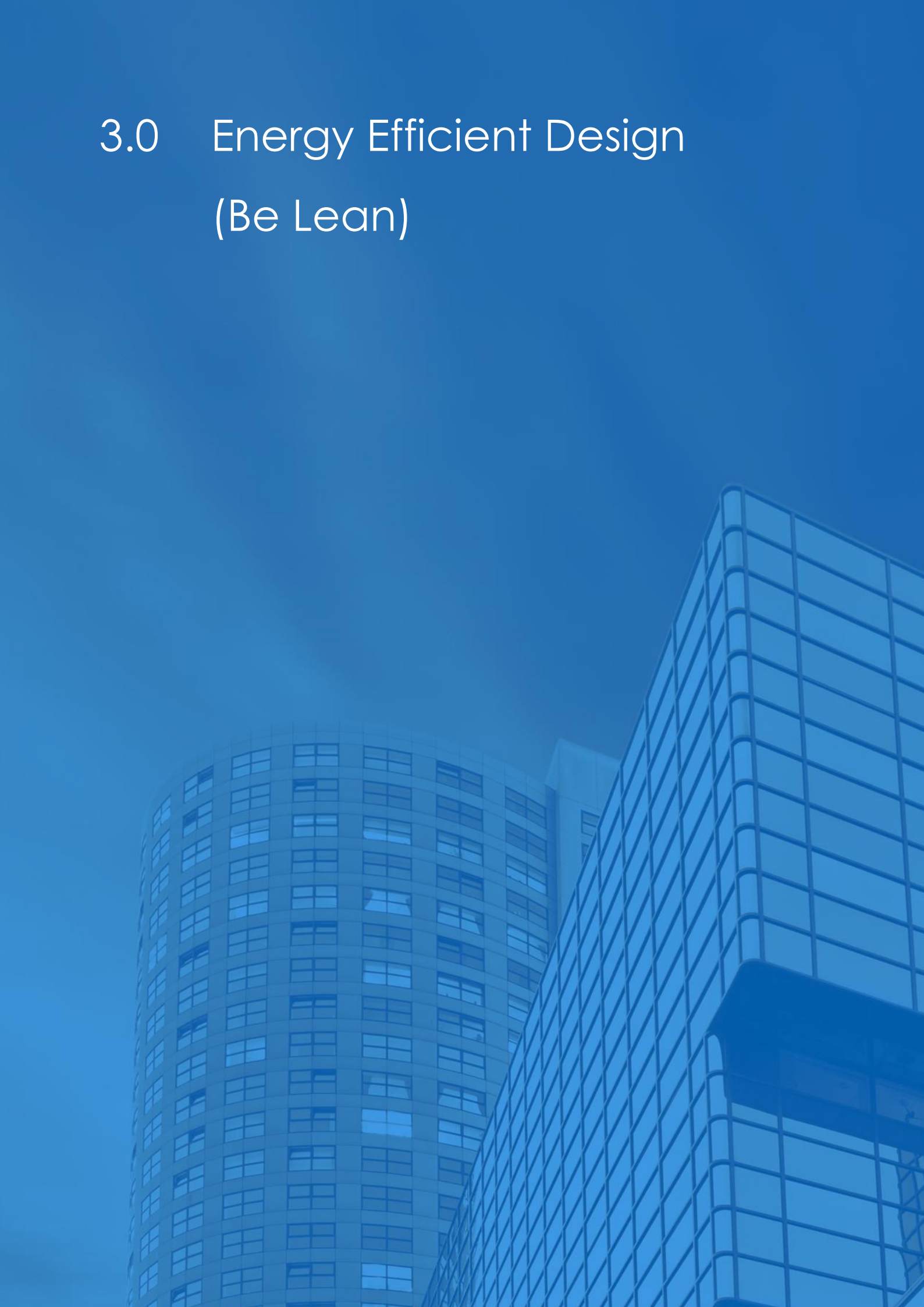


Table 2.3: Baseline Carbon Emissions Breakdown

3.0 Energy Efficient Design (Be Lean)



3.0 Energy Efficient Design (Be Lean)

Development Plan Policy requires a reduction in the carbon emissions of the proposed scheme by energy-efficient measures. A number of energy-efficient measures are considered below:

3.1 Improvements to Building Fabric and Air Permeability

Approximately 50% of heat is lost through the fabric of a building. This includes walls, floors, windows, roofs and the thermal bridging connecting them. The remaining 50% is lost through uncontrolled ventilation through gaps around doors, windows and any service penetrations.

3.2 Thermal Bridging

Around 30% of the total heat loss through a building's fabric can be caused by thermal bridging. Indications are that better detailing and improved air tightness can reduce a dwelling's annual carbon dioxide (CO_2) emissions by up to 10%.

Simple design principles can improve the thermal performance of key details such as lintels, wall to floor junctions and ceiling to gable wall junctions by over 85%. Furthermore, improving fabric thermal performance with better detailing and improved air tightness can increase opportunities for design flexibility. Site construction activities are key to realising design improvements in thermal bridging performance and improved air tightness.

Detailed design of the scheme proposed will include such measures to reduce overall space heating and energy demands for years to come. It is a design philosophy which is prompted by the Government and should be encouraged. For further construction details, please refer to the website below:

http://www.energysavingtrust.org.uk/business/Business/Housing-professionals/Interactive-tools/Enhanced-Construction-Details

The thermal bridging y-value has been calculated in the SAPs using Accredited Construction Details for all junctions.

3.3 Appendix Q Ventilation for Houses – Part F 2010, System 3 Central Extract

The design difficulties associated with System 1 of the current ventilation regulations means that System 3 is an obvious option for houses. The team have chosen an Appendix Q registered central extract fan, which has considerable running cost savings against the counterpart. The Vortice Vort Penta ES unit has been suggested as the central extract unit as it has vast improvements over the SAP defaults, and therefore carbon savings. This extract unit is located at high level in every dwelling, in the storage cupboard. Ventilation within each commercial unit will have limiting specific fan powers to the new Non Dwelling Building Services Design Guide 2010.

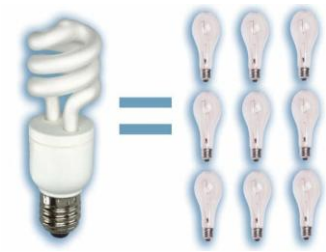
3.4 Appendix Q Ventilation for Apartments – Part F 2010, System 4 Balanced Heat Recovery

The design difficulties associated with System 1 of the current ventilation regulations means that System 4 is an obvious option for apartments. Intermittent extract fans require a great deal more trickle vents under the new regulations (Part F:2010). They are also required at the top and bottom of single aspect dwellings which is generally undesirable. The team have therefore chosen an Appendix Q registered heat recovery unit. The Vortice Vort HR200 unit removes stale air from wet areas creating a permanent air path through the property through habitable rooms. The air drawn into the dwelling is routed through a high efficiency heat exchanger where warmth from the extracted air is transferred to the incoming fresh air before being supplied to habitable rooms. This therefore lowers the heating requirements of the dwelling.

3.5 Improved Heating Efficiency

The *baseline* heating system design modelled consists of a modern SEDBUK A gas boiler and typical indirect hot water cylinder. 40% of all energy used within dwellings is for heating, and so minor improvements of boiler efficiency, cylinder insulation and controls can have a huge impact on carbon savings and overall energy use.

3.6 Energy Efficient Dwelling Lighting



It is proposed that 100% of all internal lighting will consist of low-energy lamps in order to reduce carbon emissions and overall energy use (typical tungsten bulbs can use up to 300% more energy). In SAP 2009, low energy lighting has an impact on Dwelling Emission Rates and therefore 100% of all internal light fittings will be low energy.

3.7 Un-regulated Energy

There is limited design control over the un-regulated energy use at the development. An effort will be made to reduce the un-regulated energy use through the following measures:

- Energy efficient white goods – Where white goods and kitchen equipment is provided, they will be energy efficient.

- External lighting – The external lighting will be 100% energy efficient and will incorporate the relevant controls in order to ensure that the lights are not switched on when they are not required.

3.8 Commercial and Community Uses

It is assumed that the commercial and community uses units will adopt the same energy efficient design as the residential units with regards to building fabric and air tightness. Further measures can be designed in by the end user/operator to reduce energy demand.

3.9 Be Lean Results

A number of SAP calculations have been carried out for the scheme, using an assumed 'be lean' specification (see Appendix A).

The SAP results sheets are summarised below:

Be Lean		
Please See Assumed Specification Table 1 (Appendix A)		
Application	Annual Energy Consumption (kWh/year)	Annual Carbon Emissions (kgCO2/year)
Heating	539,637	106,849
Lighting	39,740	20,546
Appliances	123,481	63,839
Cooking	59,476	30,749
Fans & Pumps	38,766	22,334
Common Areas	38,715	20,016
Total	**839,815**	**264,333**

Figure 3.1: Be Lean SAP results

Through passive and active design, there has been a **6.27%** reduction in carbon emissions and a **13.69%** reduction in energy used (regulated and un-regulated energy). This is a significant saving when considering no additional technologies have been implemented into the design. Without passive and active design measures, a significantly higher amount of renewable energy would be required to achieve the carbon savings required. The SAP results show how the scheme has exceeded requirements for Part L1a 2010 compliance through passive measures (Appendix E).

When adding the commercial units to the calculation the site is summarised below:

	Total Annual Energy Demand (kWh/yr)	**Total Annual Carbon Emissions ($kgCO_2$/yr)**
Residential	839,815	264,333
Commercial (1,859m^2)	248,437	80,495
Total	**1,088,252**	**344,828**

Table 3.2: Be Lean site-wide results

Through passive and active design for both the residential and commercial units a reduction of **6.32%** in carbon emissions and a reduction of **12.38%** in energy use (regulated and un-regulated energy) has been achieved.

4.0 Efficient Services Design (Be Clean)

4.0 Efficient Services Design (Be Clean)

Following the inclusion of energy-efficient design, consideration can then be given to the use of technologies such as district heating CHP systems. This is to ensure the highly efficient use of any non-renewable fuels that the scheme is likely to expend.

4.1 District Heating

4.1.1 On-Site Central Plant

The main considerations of district heating are the fuel running costs and on-going management. Central boiler plant rooms, as their name suggests, allows servicing to be carried out in one location; therefore reducing future maintenance costs. There are also small discounts to be had on the unit cost of fuel per kWh, as the gas supply serving the site is considered commercial. However, the initial installation cost for materials and labour is considerably more than the installation cost for serving each unit with its own boiler. However, despite cost, one significant advantage of this technology is that the primary energy plant can be changed at a later date (according to technological advances) much more easily than if individual boilers are used. For example, fuel cells and advanced CHP technology could be installed in 15-20 years, once the old plant is decommissioned.

Maintenance is still required on a heat interface unit (HIU) within each dwelling and commercial unit; however, this is not mandatory like the annual gas checks. The HIU is simply the device which separates the main heating circuit from the dwelling LPHW circuit. It is typically a similar size to a boiler and houses a heat meter, plate heat exchanger and LPHW component valves.

4.1.2 Connection to an Existing Scheme

In accordance with the London Plan, the development has been assessed against its suitability for centralised CHP communal heating. As can be seen from the map below, there are currently no available district heating networks in the vicinity to connect to (proposed and current networks shown in red and yellow).

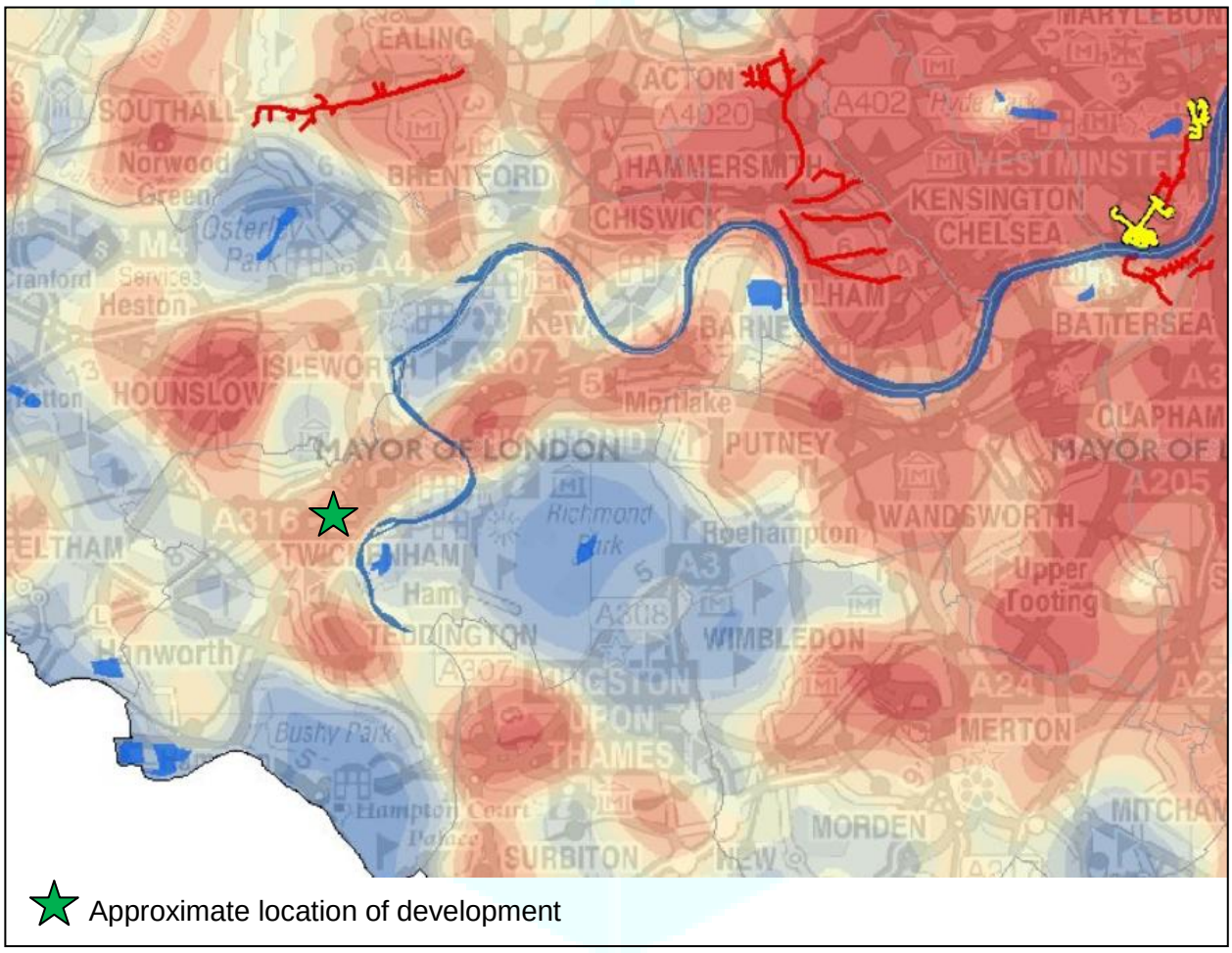


Table 4.1: London Heat Map

4.2 Combined Heat and Power

Combined Heat & Power (CHP) requires a thermal load present throughout the year. This thermal load acts as a heat dump to cool the engine. To maximise efficiency of the engine it needs to run for at least 17 hours a day; therefore, the heat needs to be present for this period. In a residential scheme, summer time hot water is the only constant load present throughout the year and during daylight hours this load is very small, with peaks in the morning and evening. Thus, the engine supplies a proportion of the annual thermal demand. The key benefit from running a CHP engine is that it produces electricity, which can displace grid-supplied electricity, which has significant carbon savings. It is for this reason that CHP is designed to run for as many hours of the year as possible.

The proposed development is primarily a residential scheme and therefore its base hot water load is in the summer months. The following feasibility study demonstrates whether or not this demand is high enough to ensure little to no 'down time' for the CHP. Our calculations are based on a running time of 17 hours per day, which we feel is appropriate to maximise carbon savings and to include necessary maintenance. As demonstrated in the calculations below there is a significant base thermal load to warrant the use of CHP (Appendix F). Below is the thermal load graph:

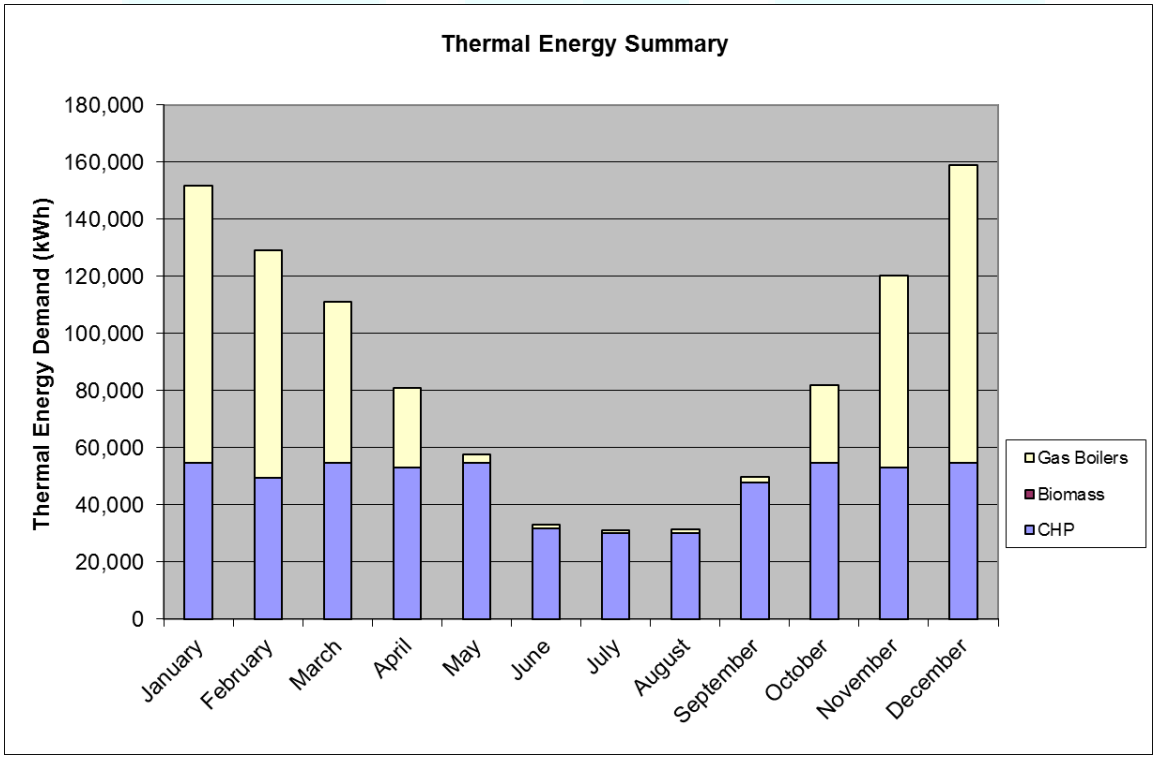


Table 4.2: Thermal Load Graph

Only the apartments and Community Building have been considered for connection to the district heating system with CHP due to the amount of pipework and high costs required to connect the houses to the system. If the houses were connected to the district heating system they would not get the full benefit, due to heat loss from the pipes running from the energy centre to each individual dwelling.

The thermal demand calculations suggest that a **70kWe CHP** would be the most appropriate for the site. This would generate the most carbon savings without excessive heat dumping. Calculations also show that the scheme would be acceptable under CHPQA standards and be classified as ‘good quality’. This allows the operator to secure a capital grant and levy on current gas and electricity prices.

Although CHP is considered feasible for the scheme, it is a low carbon technology and not a renewable energy source. Therefore, where feasible, 20% of the sites energy demand must still be met with the use of renewable technologies. Should CHP not be able to work in conjunction with the renewable technology, the renewable technology will take preference and the use of CHP will be dismissed.

4.3 Be Clean Results

A number of SAP calculations have been carried out for the scheme, using an assumed 'be clean' specification (see Appendix B).

The SAP results sheets are summarised below:

Be Clean		
Please See Assumed Specification Table 1 (Appendix B)		
Application	Annual Energy Consumption (kWh/year)	Annual Carbon Emissions (kgCO2/year)
Heating	511,404	88,426
Lighting	39,740	20,546
Appliances	123,481	63,839
Cooking	59,476	30,749
Fans & Pumps	24,329	12,578
Common Areas	38,715	20,016
Total	**797,145**	**236,154**

Figure 4.3: Be Clean SAP results

The SAPs have been calculated using the u-values as per the assumed 'be lean' specification (see Appendix A). When a district heating system with CHP is implemented into the scheme, there is a **16.26%** reduction in carbon emissions and an **18.08%** reduction in energy use (regulated and un-regulated energy) against the 'base case' results.

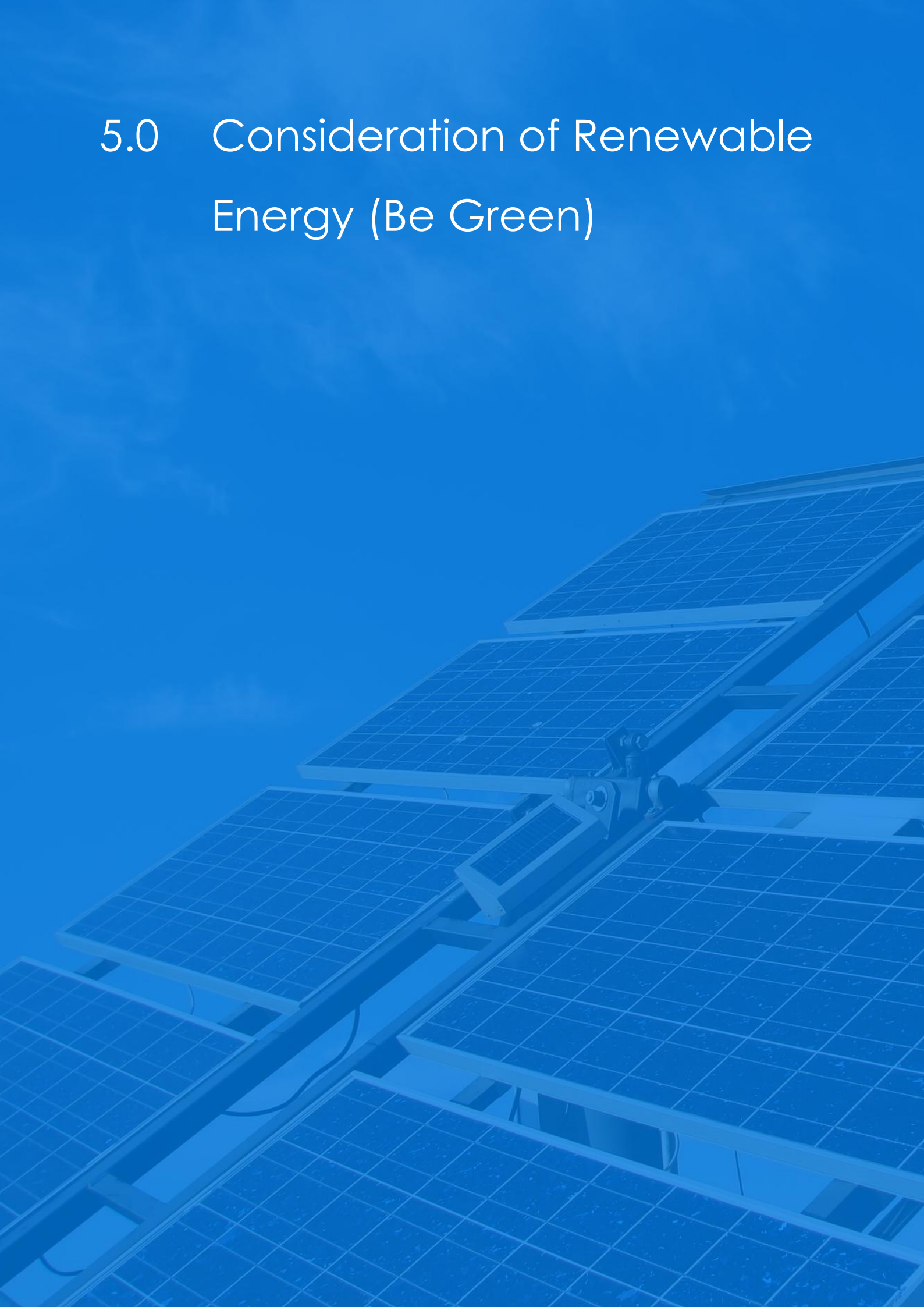
The site summary when adding the commercial units to the calculation is summarised below:

	Total Annual Energy Demand (kWh/yr)	**Total Annual Carbon Emissions ($kgCO_2/yr$)**
Residential	797,145	236,154
Commercial (1,859m^2)	238,268	77,706
Total	**1,035,413**	**313,860**

Table 4.4: Be Clean site-wide results

When considering connection to the district heating system with CHP for both the residential and the Community Building, there is a **14.73%** reduction in carbon emissions and a **16.63%** reduction in energy use (regulated and un-regulated energy) against the 'base case' results. CHP could therefore be used to serve the commercial units.

5.0 Consideration of Renewable Energy (Be Green)



5.0 Consideration of Renewable Energy (Be Green)

After energy efficiency measures have been considered, the next step is to consider renewable technology. Although CHP is considered feasible on a scheme of this size, it is not considered a renewable source, so the following technologies will be assessed to ascertain whether they can achieve the required carbon savings.

Technical information regarding each of the following technologies is shown in Appendix H.

5.1 Photovoltaics

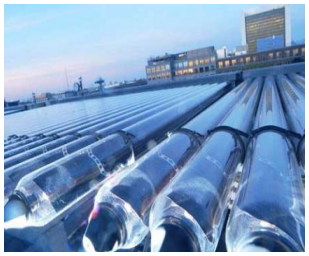
The installation of Photovoltaics (PV) is a suitable solution for the development. PV can be installed on the roofs of houses and apartments. There are no significant areas of shading on the site, such as other buildings or trees; therefore a shading factor of low/negligible has been used, i.e. less than 20%, and this has been accounted for in the SAP calculations.

In order to meet the target set out in Section 8.1.2 of the LB Richmond Core Strategy, carbon emissions will need to be reduced by 51,978kgCO2/year against the 'be lean' results. To meet this target using PV alone, assuming the PV can be positioned at a 30° tilt, facing South with low/negligible shading factor, 61.15kWp of PV would be required. This means there is a requirement for a roof space of approximately 489.2m^2.

As this scheme consists of both houses and apartments there is not sufficient South facing roof space to install this amount of PV array. Therefore, PV has been specified to the houses only as they have not been connected to the district heating system. With this in mind, to meet the Code for Sustainable Homes ENE1 mandatory criteria for Level 4, a minimum amount of PV is required for each dwelling. An array of **34.8kWp** is required to meet the targets.

FEASIBLE

5.2 Solar Water Heating



For blocks of apartments there are a number of complications which derive from solar water heating. If solar water systems are required to serve the apartments other than those on the top floor there is the requirement for long runs of pipework to serve the apartment units. This results in access issues, adds to the long-term maintenance of the system and reduces efficiencies due to pipe losses. Additionally if a communal system is to be implemented, then a buffer vessel, expansion vessels and commercial pumps will be required, all of which require a large amount of plant space and maintenance. Within the apartments themselves, a large solar hot water cylinder will be required, but due to spatial requirements, this may not be practical to implement.

A South facing $1m^2$ highly efficient evacuated tube solar array will provide approximately 520kWh/year of hot water, reducing carbon emissions by 275.08kgCO2/year. Therefore, to meet the 20% renewable target a total of $100m^2$ of solar water heating array will be required over the development.

Solar water heating is suitable to use on houses and was incorporated into the SAP calculations, however they did not meet the mandatory requirements set within Code for Sustainable Homes ENE1 and therefore are not considered feasible for this development.

NOT FEASIBLE

5.3 Wind Turbines

The installation of a large wind turbine is practically impossible, as there is nowhere to position or mount such a large piece of equipment. Opting for smaller roof-mounted turbines, such as those manufactured by Quiet Revolution (which are more aesthetically pleasing) could be an option. A typical 6kW turbine in a suburban environment could generate 6765kWh and hence save 3843kgCO_2. 8 turbines are required, and each turbine requires a minimum of 10m between each turbine and this would account for a significant alteration to the development. We would suggest that this technology is not suitable for this site as the space required to install the turbines is not available.

NOT FEASIBLE

5.4 Ground Source Heat Pumps

The use of horizontal ground source heat pumps is not possible due to the area required for the horizontal ground loop – 39,600kWh/year can be produced per 50x1.5m trench, saving 7,680kgCO_2/year. This would require 2 trenches which the site cannot cater for in terms of free surface area. Vertical GSHPs have therefore been investigated, but installation would be difficult on this site. One borehole needs to be 165m deep in order to produce 327,164kWh/year; therefore saving 63,470kgCO_2/year, which would cost approximately £229,170. In addition, the lack of available open space and safe working area to install the boreholes excludes this technology; therefore, it is not appropriate to include this technology within the scheme.

Individual GSHPs were investigated for each house type. This method of carbon reduction is controversial because using a method based on the difference between the input energy and the output energy overlooks the fact that the input, being electricity, has a much higher emissions factor than the common alternative, natural gas. For this reason, we have evaluated the emissions using the heat pump to the emissions using a gas boiler. This approach uses the method within ENE 7 of the Code for Sustainable Homes, when inputting this data into the SAP calculations, there is an average carbon saving of 15.78%, compared to the 18.97% when using condensing boilers. This means that using GSHPs used more carbon than condensing boilers due to the higher fuel factor for electricity (see Appendix J for results).

NOT FEASIBLE

5.5 Exhaust Air Heat Pumps

Exhaust air heat pumps extract warm, stale air from the dwelling and use it to heat hot water and heat fresh air entering the property. They do not require an externally-mounted condenser; however, they do have one of the lowest coefficients of performances for heat pumps and are therefore not applicable for an enhanced capital grant from the government. The units themselves can be very heavy and need to be craned into position. From completing SAP calculations, the reduction in DER from using this technology alone is not achieving 20% target.

As calculated for GSHPs, we calculated the exhaust air heat pumps for individual houses. When inputting this into the SAP software we found that the use of exhaust air heat pumps had an 18.3% improvement in carbon savings, 0.67% lower than that of condensing boilers, again because of electricity higher fuel factor.

NOT FEASIBLE

5.6 Biomass

As a centralised plant and CHP is being considered at this stage, employing the technology would be fairly easy to implement and therefore there is potential to include this in the future. However, a separate storage facility would be required to hold the pellets for the biomass boiler in addition to space required for the delivery of the pellets. Due to the limited space available within the scheme proposed this is not the preferred option.

The inclusion of biomass with CHP would be excessive as the uplift in carbon savings required is relatively small. For this reason, and the issues with delivery, delivery cost and air pollution, it makes PV a more attractive source of renewable energy.

NOT FEASIBLE

5.7 Be Green Results

A number of SAP calculations have been carried out for the scheme, using an assumed 'be green' specification (see Appendix C).

The SAP results sheets are summarised below:

Be Green		
Please See Assumed Specification Table 1 (Appendix C)		
Application	Annual Energy Consumption (kWh/year)	Annual Carbon Emissions (kgCO2/year)
Total	**771,388**	**222,528**

Figure 5.1: Be Green SAP results

These results incorporate all 3 stages of carbon savings, 'be lean', 'be clean' and 'be green'. This gives a total carbon saving of **21.09%** and energy saving of **20.73%** for un-regulated and regulated energy use (residential only).

When adding the commercial units to the calculation the site is summarised below:

	Total Annual Energy Demand (kWh/yr)	**Total Annual Carbon Emissions ($kgCO_2/yr$)**
Residential	771,388	222,528
Commercial (1,859m^2)	238,268	77,706
Total	**1,009,656**	**300,234**

Table 5.2: Be Green site-wide results

When combining the commercial units with the residential units, there is an **18.43%** reduction in carbon emissions and an **18.71%** reduction in energy use (regulated and un-regulated energy) against the 'base case' results.

6.0 Cooling Due To Potential Overheating

6.0 Cooling due to potential overheating

As a result of increasing thermal efficiency and air tightness, the possibility of overheating and poor air quality within buildings has become an issue.

Comfort cooling will be achieved passively through a combination of reasonable proportions of glazing, external shading, solar control glazing and natural ventilation.

The possibility of summertime overheating is initially addressed by providing opening windows to provide natural ventilation and night time cooling, to comply with Part F of the Building Regulations. Low temperature air from external is allowed into the buildings during the night, and circulates throughout the building cooling the building fabric. This allows the building fabric to dissipate the cool air throughout the building at a later stage, for example throughout the next day, in order to offset heat gains. This night time cooling is achieved by occupants opening windows throughout the night where possible. This not only cools the building, but also improves the indoor air quality.

Solar gain through glazing is a main factor in the potential for overheating, unprotected glass is often the greatest source of unwanted heat gain within. Radiant heat from the sun passes through glass and is absorbed by building elements and furnishings which the re-radiate heat back into the internal space. Re-radiated heat has a different wavelength and cannot pass back out through the glass as easily. This therefore traps the radiant heat within the room causing heat gains within the room and elevated temperatures.

Overhangs and balconies provide shading, which reduces solar gain within apartments. An overheating report shall be provided to ascertain measures to reduce to cooling load, therefore reducing energy use within the dwellings. The overheating report will also confirm compliance with recommendations made with CIBSE Guide A.

7.0 Conclusion

7.0 Conclusion

The use of CHP for the apartments and PV for the houses has the greatest benefits to the residents and scheme as a whole. Biomass and CHP both utilise the base heat demand of the scheme. The CHP creates the greatest carbon savings through the generation of on-site electricity and therefore if the biomass was considered it would be quite small and demand a great deal of maintenance and design to assist operation. Whilst biomass can achieve the quoted 20% renewable target, the CHP and PV option actually saves more carbon, which is the overriding policy consideration.

We suggest that 70kWe CHP and 34.8kWp PV be given highest priority. The uplift in carbon savings required to achieve Code level 4 cannot be met by CHP alone. The photovoltaic array is ideal to achieve Code Level 4 as it requires little maintenance. The benefit of using both CHP and PV is that it delivers a design that is simple, and easy to monitor and maintain.

	Total Annual Energy Demand (kWh/yr)	Total Annual Carbon Emissions ($kgCO_2/yr$)
Base Case	973,069	282,010
Be Lean	839,815	264,333
Reduction against Base Case	**13.69%**	**6.27%**
Be Clean	797,145	236,154
Reduction against Base Case	**18.08%**	**16.26%**
Be Green	771,388	222,528
Reduction against Base Case	**20.73%**	**21.09%**
Reduction against Be Lean	**8.15%**	**15.82%**

Figure 7.1: Overall site-wide results summary (un-regulated and regulated energy)

	Total Annual Energy Demand (kWh/yr)	Total Annual Carbon Emissions ($kgCO_2/yr$)
Base Case	751,397	167,406
Be Lean	618,143	149,729
Reduction against Base Case	**17.73%**	**10.56%**
Be Clean	575,473	121,550
Reduction against Base Case	**23.41%**	**27.39%**
Be Green	549,716	107,924
Reduction against Base Case	**26.84%**	**35.53%**
Reduction against Be Lean	**11.07%**	**27.92%**

Figure 7.2: Overall site-wide results summary (regulated energy only)

We can clearly see that the passive design measures ('be lean') make a significant impact on the carbon emissions. However, a large reduction can also be achieved from the employment of the CHP engine.

When analysing regulated energy use only, we can see that the use of CHP and PV reduces carbon emissions by **41,805kgCO2/year**, a reduction of **27.92%** compared to the 'be lean' results.

When implementing the energy hierarchy to regulated energy use, a total of **35.53%** of carbon emissions has been saved compared to the 'base case' results.

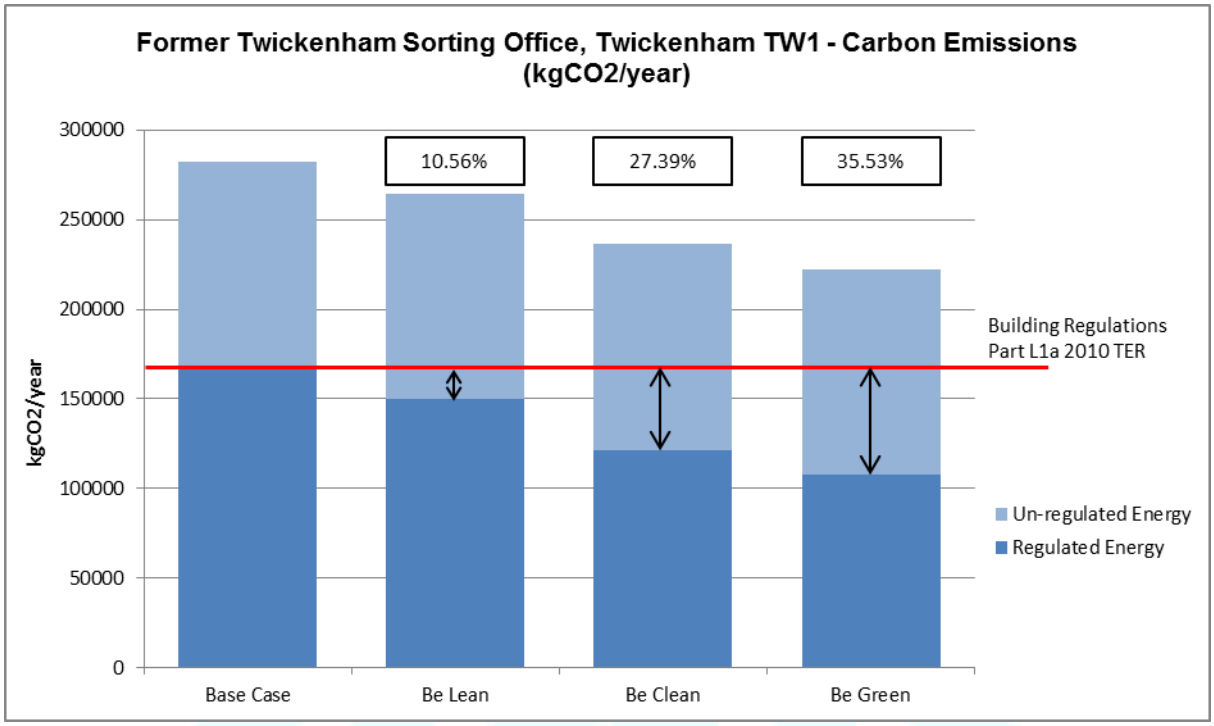


Figure 7.3: Summary of site-wide carbon emissions savings for residential element

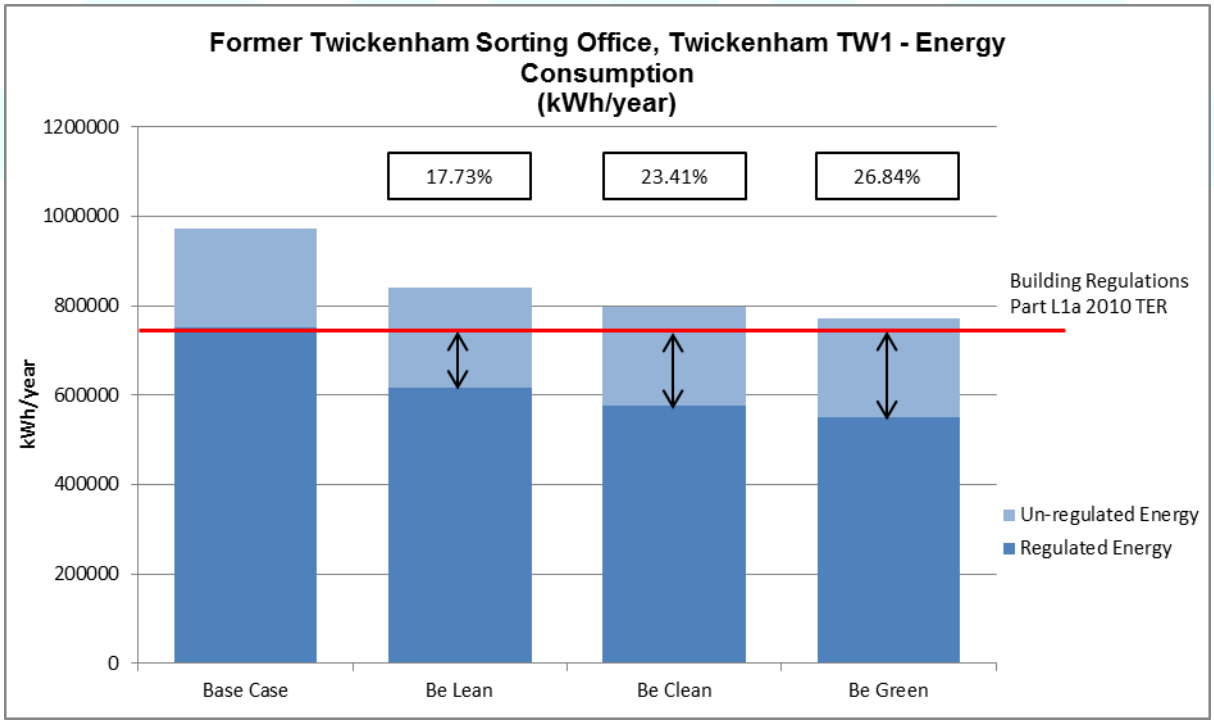


Figure 7.4: Summary of site-wide energy consumption savings for residential element

Below is a summary of results for the commercial element of the scheme. As the commercial units are currently shell and core only it is not possible to calculate the energy consumption and carbon emissions accurately. However, the below results show how connecting the commercial units to the CHP will improve their performance:

	Total Annual Energy Demand (kWh/yr)	Total Annual Carbon Emissions ($kgCO_2/yr$)
Base Case	268,942	86,072
Be Lean	248,437	80,495
Reduction against Base Case	**7.62%**	**6.48%**
Be Clean	238,268	77,706
Reduction against Base Case	**11.41%**	**9.72%**
Reduction against Be Lean	**4.09%**	**3.46%**

Figure 7.5: Overall site-wide results summary (regulated energy only)

When using passive design measures and connecting the Community Building to the district heating system with CHP carbon emissions are reduced by **8,366kgCO2/year**, a reduction of **9.72%** compared to the 'base case' results.

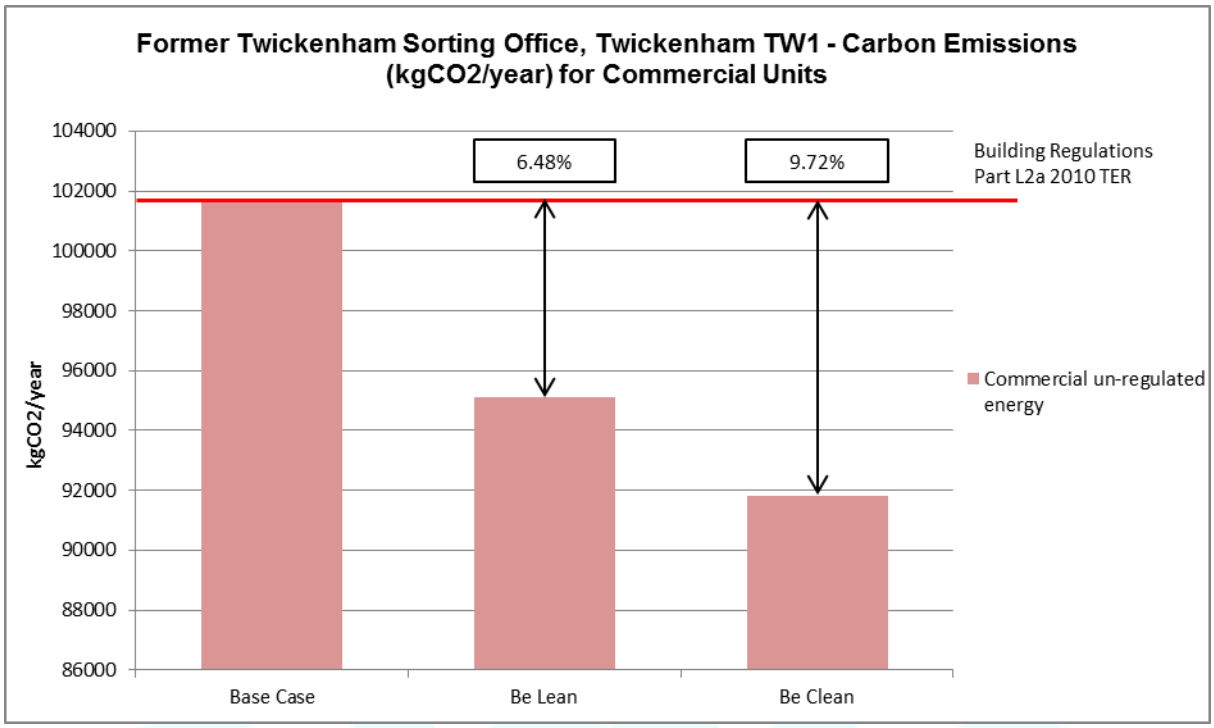


Figure 7.6: Summary of site-wide carbon emissions savings for commercial element

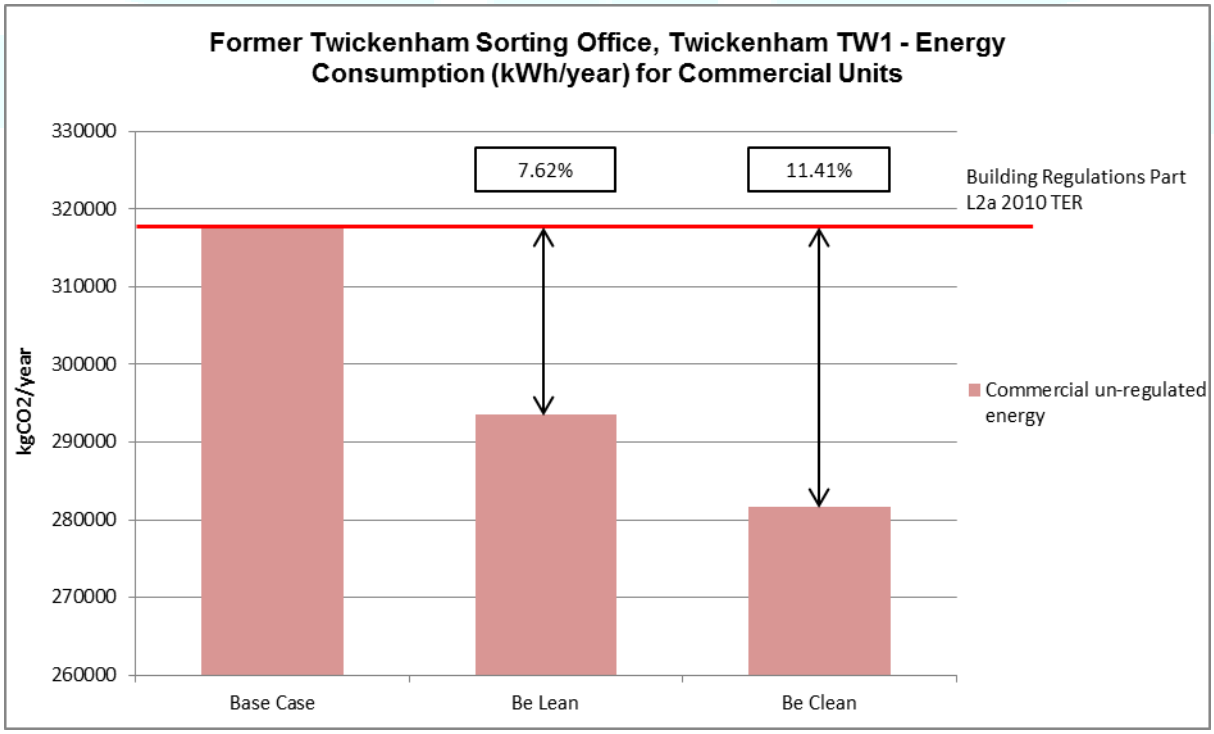
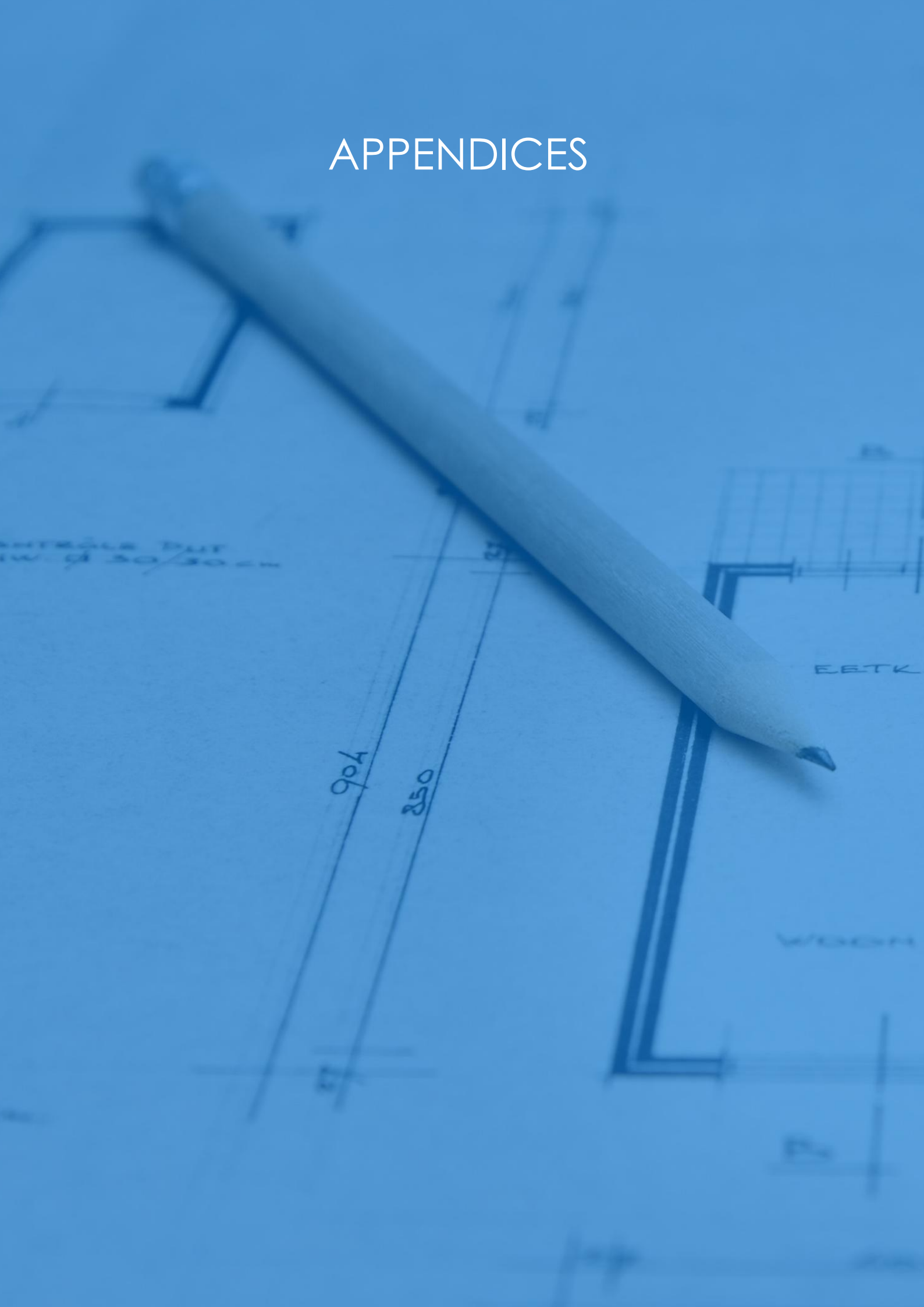


Figure 7.7: Summary of site-wide energy consumption savings for commercial element

APPENDICES



APPENDIX A – BE LEAN ASSUMED SPECIFICATION

Heat loss floor u-values – Apartments 0.16 W/m2K (0.08 W/m2K above restaurant) / House Types A-end terrace, B, C-end terrace, D-end terrace and E-end terrace 0.16 W/m2K / House Type A-mid terrace 0.13 W/m2K / House Type C-mid terrace 0.14 W/m2K / House Types D-mid terrace and E-mid terrace 0.15 W/m2K

External wall u-values – Apartments 0.17 W/m2K / Houses 0.14 W/m2K

Common area wall u-value – 0.25 W/m2K

Party wall between dwellings u-value – 0 W/m2K (fully filled with effective edge sealing)

Roof u-values – Apartments, terraces and pitched roof where insulated at joists 0.11 W/m2K / Pitched roof where insulated at rafters 0.14 W/m2K

Front door – Solid with u-PVC frame u-value of 2 W/m2K

Windows – Double glazed with hard low-E coating and u-PVC frame; emissivity of 0.2; argon filled gap of 16mm or more; draught proofing; g-value of 0.64; frame factor of 0.7; u-value of 1.4 W/m2K

Ventilation to Apartments – Balanced heat recovery using the Vortice Vort HR200 unit

Ventilation to Houses – Central extract using the Vortice Vort Penta ES unit

Space heating – Houses to have Logic + System individual boilers with efficiency of 89.6%; Apartments to have Keston Qudos 28h individual boilers with efficiency of 90.3%; controlled by time and temperature zone control, interlock, delayed start thermostat and weather compensator; heat emitted by radiators

Water heating – 1Bath units to have 120 litre cylinder with declared loss factor of 1.05 kWh/day; 2Bath units to have 150 litre cylinder with declared loss factor of 1.31 kWh/day; 3Bath units to have 180 litre cylinder with declared loss factor of 1.6 kWh/day

Renewables – None

Thermal bridging – All junctions calculated using Accredited Construction Details for the psi value

Lighting – 100% low energy

APPENDIX B – BE CLEAN ASSUMED SPECIFICATION

Heat loss floor u-values – Apartments 0.16 W/m2K (0.08 W/m2K above restaurant) / House Types A-end terrace, B, C-end terrace, D-end terrace and E-end terrace 0.16 W/m2K / House Type A-mid terrace 0.13 W/m2K / House Type C-mid terrace 0.14 W/m2K / House Types D-mid terrace and E-mid terrace 0.15 W/m2K

External wall u-values – Apartments 0.17 W/m2K / Houses 0.14 W/m2K

Common area wall u-value – 0.25 W/m2K

Party wall between dwellings u-value – 0 W/m2K (fully filled with effective edge sealing)

Roof u-values – Apartments, terraces and pitched roof where insulated at joists 0.11 W/m2K / Pitched roof where insulated at rafters 0.14 W/m2K

Front door – Solid with u-PVC frame u-value of 2 W/m2K

Windows – Double glazed with hard low-E coating and u-PVC frame; emissivity of 0.2; argon filled gap of 16mm or more; draught proofing; g-value of 0.64; frame factor of 0.7; u-value of 1.4 W/m2K

Ventilation to Apartments – Balanced heat recovery using the Vortice Vort HR200 unit

Ventilation to Houses – Central extract using the Vortice Vort Penta ES unit

Space heating to Apartments – Community heating with CHP & boilers; CHP serving 55% of heat demand with efficiency of 76.99%; boilers serving 45% of heat demand with efficiency of 88%; controlled by charging system linked to use, programmer and TRVs; heat emitted by radiators

Space heating to Houses – Houses to have Logic + System individual boilers with efficiency of 89.6%; controlled by time and temperature zone control, interlock, delayed start thermostat and weather compensator; heat emitted by radiators

Water heating – 1Bath units to have 120 litre cylinder with declared loss factor of 1.05 kWh/day; 2Bath units to have 150 litre cylinder with declared loss factor of 1.31 kWh/day; 3Bath units to have 180 litre cylinder with declared loss factor of 1.6 kWh/day

Renewables – None

Thermal bridging – All junctions calculated using Accredited Construction Details for the psi value

Lighting – 100% low energy

APPENDIX C – BE GREEN ASSUMED SPECIFICATION

Heat loss floor u-values – Apartments 0.16 W/m2K (0.08 W/m2K above restaurant) / House Types A-end terrace, B, C-end terrace, D-end terrace and E-end terrace 0.16 W/m2K / House Type A-mid terrace 0.13 W/m2K / House Type C-mid terrace 0.14 W/m2K / House Types D-mid terrace and E-mid terrace 0.15 W/m2K

External wall u-values – Apartments 0.17 W/m2K / Houses 0.14 W/m2K

Common area wall u-value – 0.25 W/m2K

Party wall between dwellings u-value – 0 W/m2K (fully filled with effective edge sealing)

Roof u-values – Apartments, terraces and pitched roof where insulated at joists 0.11 W/m2K / Pitched roof where insulated at rafters 0.14 W/m2K

Front door – Solid with u-PVC frame u-value of 2 W/m2K

Windows – Double glazed with hard low-E coating and u-PVC frame; emissivity of 0.2; argon filled gap of 16mm or more; draught proofing; g-value of 0.64; frame factor of 0.7; u-value of 1.4 W/m2K

Ventilation to Apartments – Balanced heat recovery using the Vortice Vort HR200 unit

Ventilation to Houses – Central extract using the Vortice Vort Penta ES unit

Space heating to Apartments – Community heating with CHP & boilers; CHP serving 55% of heat demand with efficiency of 76.99%; boilers serving 45% of heat demand with efficiency of 88%; controlled by charging system linked to use, programmer and TRVs; heat emitted by radiators

Space heating to Houses – Houses to have Logic + System individual boilers with efficiency of 89.6%; controlled by time and temperature zone control, interlock, delayed start thermostat and weather compensator; heat emitted by radiators

Water heating – 1Bath units to have 120 litre cylinder with declared loss factor of 1.05 kWh/day; 2Bath units to have 150 litre cylinder with declared loss factor of 1.31 kWh/day; 3Bath units to have 180 litre cylinder with declared loss factor of 1.6 kWh/day

Renewables – Houses to have PV located on roof, amounts required shown below; none to very little overshading assumed

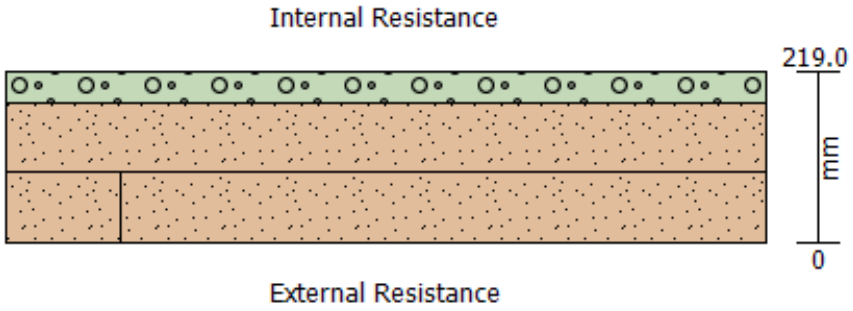
Thermal bridging – All junctions calculated using Accredited Construction Details for the psi value

Lighting – 100% low energy

APPENDIX D – U-VALUE CALCULATIONS

D.1 Apartments

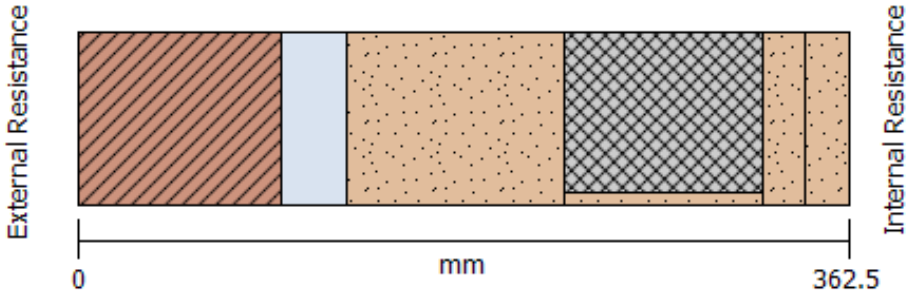
D.1.1 Heat Loss Floor U-Value



Chipboard (19mm), Kingspan Thermafloor TF70 insulation (100m), concrete beam and block (100mm)

U-value – 0.16 W/m^{2}K (0.08 W/m^{2}K above restaurant)

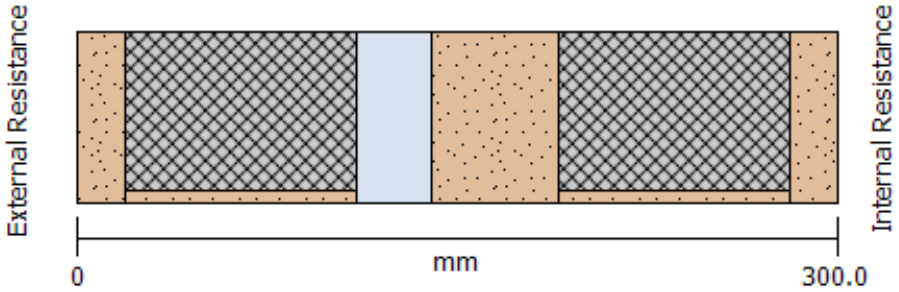
D.1.2 External Wall U-Value



Brickwork (102.5mm), cavity (25mm), Kingspan Thermawall TW50 insulation (110mm), blockwork (100mm), Gypsum plasterboard (12.5mm), Gypsum plasterboard (12.5mm)

U-value – 0.17 W/m^{2}K

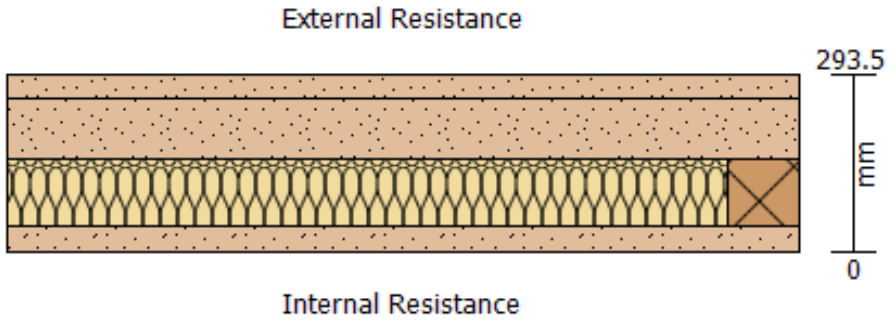
D.1.3 Common Area Wall U-Value (wall between apartments and common area)



Gypsum plasterboard (12.5mm), blockwork (100mm), cavity (25mm), Kingspan Thermawall TW50 insulation (50mm), blockwork (100mm), Gypsum plasterboard (12.5mm)

U-value – 0.25 W/m^{2}K

D.1.4 Flat Roof U-Value

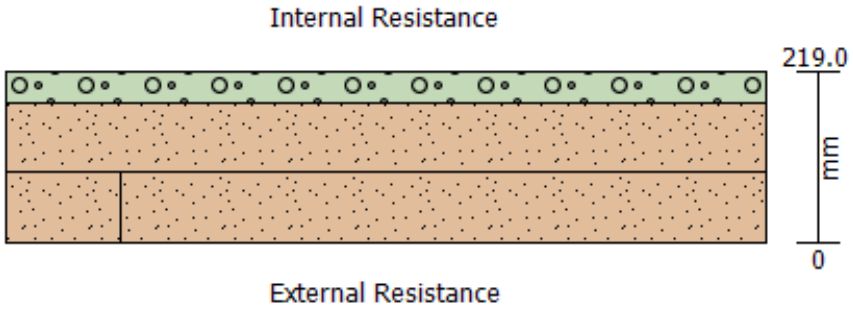


Bitumen – felt/sheet (6mm), Kingspan Thermaroof TR31 insulation (125mm), mineral wool batt insulation between timber joists (150mm), plasterboard (12.5mm)

U-value – 0.11 W/m^{2}K

D.2 Houses

D.2.1 Heat Loss Floor U-Value



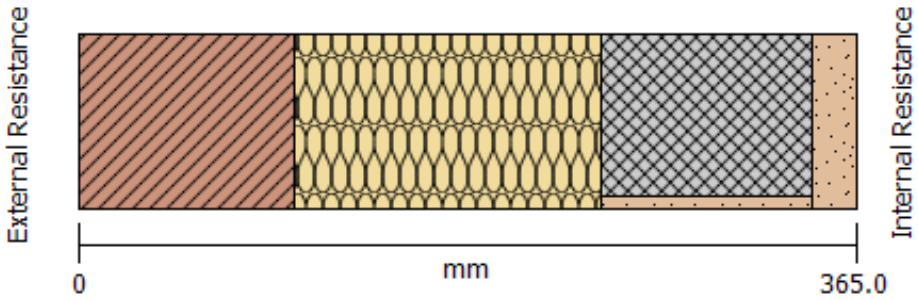
Chipboard (19mm), Kingspan Thermafloor TF70 insulation (100m), concrete beam and block (100mm)

End terrace u-values (House Types A, B, C, D and E) – 0.16 W/m^{2}K

Mid terrace u-values:

- House Type A – 0.13 W/m^{2}K
- House Type C – 0.14 W/m^{2}K
- House Type D – 0.15 W/m^{2}K
- House Type E – 0.15 W/m^{2}K

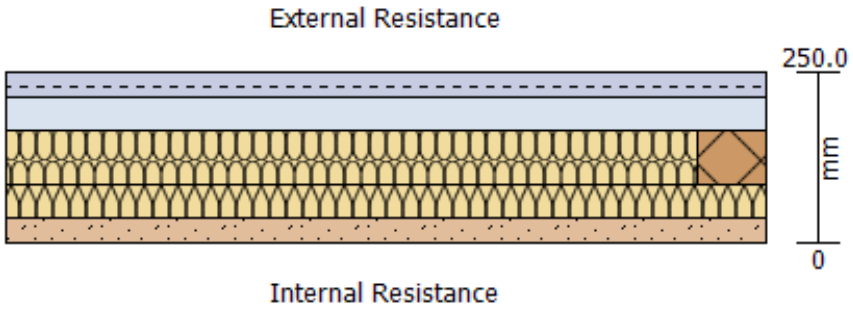
D.2.2 External Wall U-Value



Brickwork (102.5mm), Xtratherm CavityTherm insulation (150mm), blockwork (100mm), plasterboard (12.5mm)

U-value – 0.14 W/m^{2}K

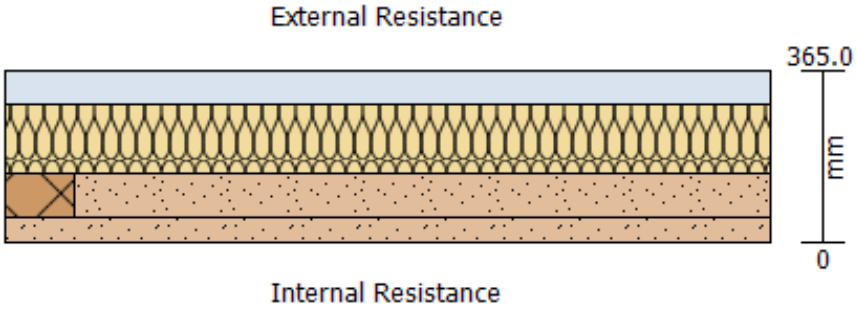
D.2.3 Pitched Roof Insulated at Rafters U-Value



Tiles (15mm), cavity (50mm), Kingspan Kooltherm K7 insulation between timber joists (120mm), PU foam board (50mm), plasterboard (15mm)

U-value – 0.14 W/m^{2}K

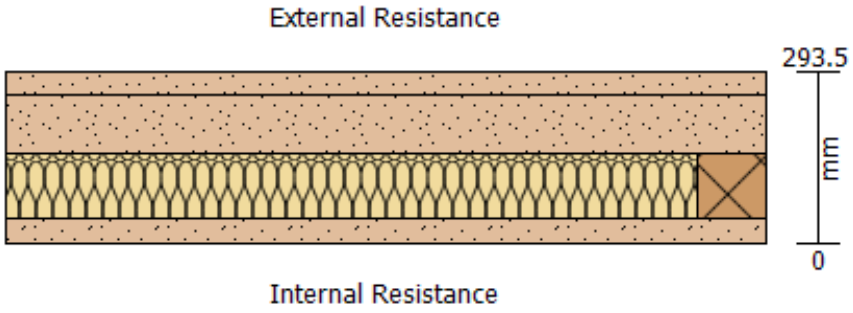
D.2.4 Pitched Roof Insulated at Joists U-Value



Roof space, Earthwool Loft Roll 40 Knauf insulation (200mm), Kingspan Kooltherm K7 Roof insulation (100mm), Kingspan Kooltherm K18 insulated plasterboard (15mm)

U-value – 0.11 W/m^{2}K

D.2.5 Terrace Roof U-Value



Bitumen – Felt/Sheet (6mm), Kingspan Thermaroof TR31 insulation (125mm), mineral wool batt insulation between timer joists (150mm), plasterboard (12.5mm)

U-value – 0.11 W/m^{2}K

APPENDIX E – SAP EVALUATION

Former Twickenham Sorting Office, Twickenham TW1
SAP Evaluation

Job No.: 9698
Date: Rev 1 - 2012.08.10

WHITECODE DESIGN ASSOCIATES
BUILDING SERVICES DESIGN CONSULTANTS

	Base Case	Be Lean	Be Clean	Be Green
	The following results are for the notional dwelling of the dwelling being calculated.	Heat loss floor u-values – Apartments 0.16 W/m2K (0.08 W/m2K above resturant) / House Types A-end terrace, B, C-end terrace, D-end terrace and E-end terrace 0.16 W/m2K / House Type A-mid terrace 0.13 W/m2K / House Type C-mid terrace 0.14 W/m2K / House Types D-mid terrace and E-mid terrace 0.15 W/m2K External wall u-values – Apartments 0.17 W/m2K / Houses 0.14 W/m2K Common area wall u-value – 0.25 W/m2K Party wall between dwellings u-value – 0 W/m2K (fully filled with effective edge sealing) Roof u-values – Apartmentss, terraces and pitched roof where insulated at joists 0.11 W/m2K / Pitched roof where insulated at rafters 0.14 W/m2K Front door – Solid with u-PVC frame u-value of 2 W/m2K Windows – Double glazed with hard low-E coating and u-PVC frame; emissivity of 0.2; argon filled gap of 16mm or more; draught proofing; g-value of 0.64; frame factor of 0.7; u-value of 1.4 W/m2K Ventilation to Apartments – Balanced heat recovery using the Vortice Vort HR200 unit Ventilation to Houses – Central extract using the Vortice Vort Penta ES unit Space heating – Houses to have Logic + System individual boilers with efficiency of 89.6%; Apartments to have Keston Qudos 28h individual boilers with efficiency of 90.3%; controlled by time and temperature zone control, interlock, delayed start thermostat and weather compensator; heat emitted by radiators Water heating – 1Bath units to have 120 litre cylinder with declared loss factor of 1.05 kWh/day; 2Bath units to have 150 litre cylinder with declared loss factor of 1.31 kWh/day; 3Bath units to have 180 litre cylinder with declared loss factor of 1.6 kWh/day Renewables – None Thermal bridging – All junctions calculated using Accredited Construction Details for the psi value Lighting – 100% low energy	Heat loss floor u-values – Apartments 0.16 W/m2K (0.08 W/m2K above resturant) / House Types A-end terrace, B, C-end terrace, D-end terrace and E-end terrace 0.16 W/m2K / House Type A-mid terrace 0.13 W/m2K / House Type C-mid terrace 0.14 W/m2K / House Types D-mid terrace and E-mid terrace 0.15 W/m2K External wall u-values – Apartments 0.17 W/m2K / Houses 0.14 W/m2K Common area wall u-value – 0.25 W/m2K Party wall between dwellings u-value – 0 W/m2K (fully filled with effective edge sealing) Roof u-values – Apartmentss, terraces and pitched roof where insulated at joists 0.11 W/m2K / Pitched roof where insulated at rafters 0.14 W/m2K Front door – Solid with u-PVC frame u-value of 2 W/m2K Windows – Double glazed with hard low-E coating and u-PVC frame; emissivity of 0.2; argon filled gap of 16mm or more; draught proofing; g-value of 0.64; frame factor of 0.7; u-value of 1.4 W/m2K Ventilation to Apartments – Balanced heat recovery using the Vortice Vort HR200 unit Ventilation to Houses – Central extract using the Vortice Vort Penta ES unit *Space heating to Apartments – Community heating with CHP & boilers; CHP serving 55% of heat demand with efficiency of 76.99%; boilers serving 45% of heat demand with efficiency of 88%; controlled by charging system linked to use, programmer and TRVs; heat emitted by radiators* Space heating to Houses – Houses to have Logic + System individual boilers with efficiency of 89.6%; controlled by time and temperature zone control, interlock, delayed start thermostat and weather compensator; heat emitted by radiators Water heating – 1Bath units to have 120 litre cylinder with declared loss factor of 1.05 kWh/day; 2Bath units to have 150 litre cylinder with declared loss factor of 1.31 kWh/day; 3Bath units to have 180 litre cylinder with declared loss factor of 1.6 kWh/day Renewables – None Thermal bridging – All junctions calculated using Accredited Construction Details for the psi value Lighting – 100% low energy	Heat loss floor u-values – Apartments 0.16 W/m2K (0.08 W/m2K above resturant) / House Types A-end terrace, B, C-end terrace, D-end terrace and E-end terrace 0.16 W/m2K / House Type A-mid terrace 0.13 W/m2K / House Type C-mid terrace 0.14 W/m2K / House Types D-mid terrace and E-mid terrace 0.15 W/m2K External wall u-values – Apartments 0.17 W/m2K / Houses 0.14 W/m2K Common area wall u-value – 0.25 W/m2K Party wall between dwellings u-value – 0 W/m2K (fully filled with effective edge sealing) Roof u-values – Apartmentss, terraces and pitched roof where insulated at joists 0.11 W/m2K / Pitched roof where insulated at rafters 0.14 W/m2K Front door – Solid with u-PVC frame u-value of 2 W/m2K Windows – Double glazed with hard low-E coating and u-PVC frame; 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none to very little overshading assumed* Thermal bridging – All junctions calculated using Accredited Construction Details for the psi value Lighting – 100% low energy

Plot No.:	Area (m2):	No. of Occupants:	Type:	Floor:	DER	TER	Improvement on TER:	DER	TER	Improvement on TER:	DER	TER	Improvement on TER:	DER	TER	Improvement on TER:	Renewable:
A01	70.76	4	2Bed	Ground	18.39	18.39	0.00%	16.51	18.39	10.22%	11.86	18.39	35.51%	11.86	18.39	35.51%	0
A02	62.59	4	2Bed	Ground	19.73	19.73	0.00%	17.96	19.73	8.97%	12.80	19.73	35.12%	12.80	19.73	35.12%	0
A3	71.15	4	2Bed	Ground	20.16	20.16	0.00%	19.73	20.16	2.13%	14.34	20.16	28.87%	14.34	20.16	28.87%	0
A4	64.77	4	2Bed	Ground	21.25	21.25	0.00%	20.17	21.25	5.08%	14.57	21.25	31.44%	14.57	21.25	31.44%	0
A8	71.15	4	2Bed	Mid	16.11	16.11	0.00%	16.71	16.11	-3.72%	12.02	16.11	25.39%	12.02	16.11	25.39%	0
A11	70.21	4	2Bed	Mid	19.26	19.26	0.00%	18.59	19.26	3.48%	13.45	19.26	30.17%	13.45	19.26	30.17%	0
A13	49.97	2	1Bed	Mid	21.41	21.41	0.00%	18.79	21.41	12.24%	13.07	21.41	38.95%	13.07	21.41	38.95%	0
A14	64.77	4	2Bed	Mid	17.61	17.61	0.00%	17.27	17.61	1.93%	12.33	17.61	29.98%	12.33	17.61	29.98%	0
A16	50.32	2	1Bed	Mid	17.30	17.30	0.00%	16.64	17.30	3.82%	11.40	17.30	34.10%	11.40	17.30	34.10%	0
A17	62.18	4	2Bed	Mid	16.11	16.11	0.00%	15.30	16.11	5.03%	10.75	16.11	33.27%	10.75	16.11	33.27%	0
A21	70.21	4	2Bed	Top	18.51	18.51	0.00%	18.55	18.51	-0.22%	13.42	18.51	27.50%	13.42	18.51	27.50%	0
A23	49.97	2	1Bed	Mid	18.83	18.83	0.00%	17.84	18.83	5.26%	12.32	18.83	34.57%	12.32	18.83	34.57%	0
A28	92.54	4	2Bed	Top	18.27	18.27	0.00%	17.14	18.27	6.19%	12.63	18.27	30.87%	12.63	18.27	30.87%	0
A29	74.31	4	2Bed	Top	16.38	16.38	0.00%	15.69	16.38	4.21%	11.27	16.38	31.20%	11.27	16.38	31.20%	0
A30	79.01	4	2Bed	Top	19.00	19.00	0.00%	16.48	19.00	13.26%	11.97	19.00	37.00%	11.97	19.00	37.00%	0
B4	64.69	4	2Bed	Ground	21.26	21.26	0.00%	20.95	21.26	1.46%	15.16	21.26	28.69%	15.16	21.26	28.69%	0
B5	51.49	2	1Bed	Ground	23.89	23.89	0.00%	23.21	23.89	2.85%	16.56	23.89	30.68%	16.56	23.89	30.68%	0
B6	78.25	4	2Bed	Ground	19.76	19.76	0.00%	18.49	19.76	6.43%	13.50	19.76	31.68%	13.50	19.76	31.68%	0
B7	71.23	4	2Bed	Ground	19.24	19.24	0.00%	17.32	19.24	9.98%	12.51	19.24	34.98%	12.51	19.24	34.98%	0
B8	61.14	4	2Bed	Ground	20.15	20.15	0.00%	18.11	20.15	10.12%	12.91	20.15	35.93%	12.91	20.15	35.93%	0
B9	71.39	4	2Bed	Ground	19.16	19.16	0.00%	17.37	19.16	9.34%	12.53	19.16	34.60%	12.53	19.16	34.60%	0
B13	64.69	4	2Bed	Mid	17.62	17.62	0.00%	17.98	17.62	-2.04%	12.88	17.62	26.90%	12.88	17.62	26.90%	0
B14	70.39	4	2Bed	Mid	16.64	16.64	0.00%	17.13	16.64	-2.94%	12.34	16.64	25.84%	12.34	16.64	25.84%	0
B16	71.23	4	2Bed	Mid	15.88	15.88	0.00%	15.00	15.88	5.54%	10.69	15.88	32.68%	10.69	15.88	32.68%	0
B17	61.14	4	2Bed	Mid	17.07	17.07	0.00%	15.96	17.07	6.50%	11.23	17.07	34.21%	11.23	17.07	34.21%	0
B18	71.39	4	2Bed	Mid	16.09	16.09	0.00%	15.43	16.09	4.10%	11.02	16.09	31.51%	11.02	16.09	31.51%	0
B31	84.06	4	2Bed	Top	18.55	18.55	0.00%	17.69	18.55	4.64%	12.95	18.55	30.19%	12.95	18.55	30.19%	0
B33	71.23	4	2Bed	Top	17.66	17.66	0.00%	15.86	17.66	10.19%	11.34	17.66	35.79%	11.34	17.66	35.79%	0
B35	73	4	2Bed	Top	19.20	19.20	0.00%	16.83	19.20	12.34%	12.13	19.20	36.82%	12.13	19.20	36.82%	0
C2	50.55	2	1Bed	Mid	21.07	21.07	0.00%	20.37	21.07	3.32%	14.31	21.07	32.08%	14.31	21.07	32.08%	0
C4	49.97	2	1Bed	Mid	20.75	20.75	0.00%	18.88	20.75	9.01%	13.16	20.75	36.58%	13.16	20.75	36.58%	0
C7	50.55	2	1Bed	Mid	18.41	18.41	0.00%	19.15	18.41	-4.02%	13.36	18.41	27.43%	13.36	18.41	27.43%	0
C9	49.97	2	1Bed	Mid	17.67	17.67	0.00%	17.53	17.67	0.79%	12.09	17.67	31.58%	12.09	17.67	31.58%	0
C15	94.72	4	2Bed	Top	18.92	18.92	0.00%	18.21	18.92	3.75%	13.46	18.92	28.86%	13.46	18.92	28.86%	0
C16	93.7	4	2Bed	Top	16.46	16.46	0.00%	15.00	16.46	8.87%	11.01	16.46	33.11%	11.01	16.46	33.11%	0
C17	79.98	4	2Bed	Top	17.46	17.46	0.00%	15.44	17.46	11.57%	11.16	17.46	36.08%	11.16	17.46	36.08%	0
H-1	199.9	9	4/5Bed	A-End	15.17	15.17	0.00%	13.55	15.17	10.68%	13.55	15.17	10.68%	11.20	15.17	26.17%	1.05
H-2	209.8	9	4/5Bed	A-Mid	12.69	12.69	0.00%	12.11	12.69	4.57%	12.11	12.69	4.57%	9.19	12.69	27.58%	1.41
H-5	211.02	7	3/4Bed	B-End	15.05	15.05	0.00%	13.10	15.05	12.96%	13.10	15.05	12.96%	10.94	15.05	27.31%	1.05
H-6	210.82	7	3/4Bed	B-End	15.41	15.41	0.00%	13.25	15.41	14.02%	13.25	15.41	14.02%	11.09	15.41	28.03%	1.05
H-9	204.44	9	4/5Bed	C-Mid	12.96	12.96	0.00%	12.33	12.96	4.86%	12.33	12.96	4.86%	9.33	12.96	28.01%	1.41
H-10	196.2	9	4/5Bed	C-End	15.03	15.03	0.00%	13.63	15.03	9.31%	13.63	15.03	9.31%	10.50	15.03	30.14%	1.41
H-22	117.81	6	3Bed	D-Mid	15.61	15.61	0.00%	14.97	15.61	4.10%	14.97	15.61	4.10%	11.09	15.61	28.96%	1.05
H-23	117.81	6	3Bed	D-End	17.76	17.76	0.00%	16.02	17.76	9.80%	16.02	17.76	9.80%	12.15	17.76	31.59%	1.05
H-24	117.81	6	3Bed	D-End	17.76	17.76	0.00%	15.72	17.76	11.49%	15.72	17.76	11.49%	11.85	17.76	33.28%	1.05
H-25	117.81	6	3Bed	D-Mid	15.61	15.61	0.00%	14.67	15.61	6.02%	14.67	15.61	6.02%	10.80	15.61	30.81%	1.05
H-27	146.13	8	4Bed	E-Mid	15.23	15.23	0.00%	14.07	15.23	7.62%	14.07	15.23	7.62%	10.94	15.23	28.17%	1.05
H-28	146.13	8	4Bed	E-End	16.76	16.76	0.00%	14.79	16.76	11.75%	14.79	16.76	11.75%	11.67	16.76	30.37%	1.05
					17.84	**17.84**	**0.00%**	**16.74**	**17.84**	**6.18%**	**12.97**	**17.84**	**26.40%**	**12.19**	**17.84**	**31.47%**	**34.8**

APPENDIX F – THERMAL LOADINGS FOR CHP

--

WDA Job Number: --
Prepared by: --
Date: --
Part 1 of 2

WHITECODE DESIGN ASSOCIATES
BUILDING SERVICES DESIGN CONSULTANTS

Month		Monthly Thermal	CHP Thermal	CHP Electric	CHP Fuel	Biomass	Boilers (with Bio)	Boilers (without Bio)
January	31	147,913	54,808	36,890	119,102	0	93,105	93,105
February	28	126,423	49,504	33,320	107,576	0	76,919	76,919
March	31	111,362	54,808	36,890	119,102	0	56,554	56,554
April	30	83,965	53,040	35,700	115,260	0	30,925	30,925
May	31	63,550	54,808	36,890	119,102	0	8,742	8,742
June	30	40,905	34,476	35,700	115,260	0	6,429	6,429
July	31	39,608	35,625	36,890	119,102	0	3,983	3,983
August	31	39,827	35,625	36,890	119,102	0	4,202	4,202
September	30	56,069	53,040	35,700	115,260	0	3,029	3,029
October	31	85,051	54,808	36,890	119,102	0	30,243	30,243
November	30	119,055	53,040	35,700	115,260	0	66,015	66,015
December	31	154,181	54,808	36,890	119,102	0	99,373	99,373
Totals		**1,067,909**	**588,390**	**434,350**	**1,402,330**	**0**	**479,519**	**479,519**
Carbon Used ($kgCO_2$)			n/a		277,661	0	110,401	110,401
Carbon Displaced ($kgCO_2$)			246,711		n/a	n/a	n/a	n/a

CHP, Boilers & Biomass	388,062	$kgCO_2$
CHP & Boilers Only	388,062	$kgCO_2$

CHP Thermal	104	kWth
CHP Electrical	70	kWe
CHP Fuel	226	kW
CHP Running Hours	17	hours
Biomass Size	0	kW
Biomass Running Hours	0	hours
% CHP	55.10%	
% Biomass	0.00%	
% Gas Boilers	44.90%	

APPENDIX G – COMBINED HEAT & POWER (CHP) ENGINE OVERVIEW

G.1 Combined Heat and Power Engines (CHP)

G.1.1 Overview

A CHP engine generates both heat and power, using gas (or biomass/biofuel) to drive a turbine that produces electricity and from which the heat is captured to produce hot water. Financial and environmental benefits are derived from the electricity production, but the use of a CHP is limited by the heat demand. A CHP requires a thermal load present throughout the year. To maximise efficiency of the engine it needs to run at least 17 hours a day; therefore, the heat needs to be present for this period. There are different scales of CHP from around 1kWe (micro-CHP) to 2MW+ giving a wider opportunity. The larger engines are ideal for use on buildings with high heat demands and are being increasingly used for District Energy Networks.

The key benefit from running a CHP engine is that it produces electricity, which can displace grid-supplied electricity, which has significant carbon savings. It is for this reason that CHP is designed to run for as many hours of the year as possible. The SAP calculation assumes 40% of the electricity generated is used directly within the dwelling and 60% is exported to the grid.

G.1.2 General Rules of Thumb

Energy Generated	Depends on size and use
CO_2 Savings	Approximately 430g of CO_2/kWh
Life Span	15-20 years
Payback	Approximately 10-20 years depending on engine size and development

G.1.3 Technical Considerations

- Limited modulation compared to gas boilers so needs to be sized to meet constant heat demand, i.e. hot water
- Need to aim for 4,500+ hours of operation each year, minimum of 13 hours per day
- Ideal for wet leisure centres, hotels, halls of residence, hospital, block of flats etc.
- Micro-CHP can be used for houses with a large heat demand
- Thermal store improves system performance can also consider part-loads, multiple units, heat dumping
- Absorption cooing also improves usage; however, need to consider relatively low CoP of absorption chillers
- Energy Centre (size, location, design) and Heat Network
- Flue height and air quality implications
- System set up for phasing

G.1.4 Pros & Cons

Pros

- Planning compliance
- High CO_2 savings from local electricity generation
- Potential to provide reduced operational costs
- Potential to reduce building electrical supply
- District energy networks

Cons

- Significant operational and maintenance implications
- High capital costs especially for district heating network infrastructure

APPENDIX H – RENEWABLE TECHNOLOGIES OVERVIEW

H.1 Photovoltaics

H.1.1 Overview

Photovoltaic (PV) systems convert energy from the sun into electricity via semi-conductor cells. There are a wide range of different panels available on the market, from less expensive amorphous silicon with low efficiencies (1kW installation requires approximately 20m^2 of roof area), to mono-crystalline silicon with much higher efficiencies (1kW installation requires approximately 7-8m^2 of roof area). Ideally, PV panels need to be positioned within 30^o of south and at an angle of 30^o to achieve optimum performance. It is essential that PV arrays are un-shaded, as even a small amount of shading dramatically reduces the output of the panel.

If the electricity generated is greater than the demand, any additional electricity can be exported to the grid. The SAP calculation assumes 50% of the electricity generated is used directly within the dwelling and 50% is exported to the grid.

H.1.2 General Rules of Thumb

Energy Generated	SAP assumes 850kWh per kWp (South @ 30^o) but will vary depending on various features
CO_2 Savings	0.45 tonnes CO_2/kWp
Space Needed	Panel area – 7-8m^2 per kWp. Roof area larger especially for flat roofs
Lifespan	30+ years (inverter 10-20 years)
Energy Payback	Depends on system type

H.1.3 Technical Considerations

- Orientation – optimum South & Inclination – optimum 30^{o}
- Avoid shading
- Weight of modules on the roof
- Safe access to roof space
- Installation and subsequent access to import/export meters
- Where the electricity will be used, i.e. who will benefit
- Planning constraints
- Over-shading from existing or planned buildings
- Annual and daily electricity demands of the building
- Cleaning access and schedule
- Quality of product

H.1.4 Pros & Cons

Pros

- Simple to install
- No limitations on generation
- Potentially good investment opportunity

Cons

- Still relatively expensive
- Require large amounts of roof space

H.2 Solar Thermal

H.2.1 Overview

Solar water heating is an excellent renewable energy source as it can cater for almost 80% of the hot water load of a dwelling by absorbing solar gains from the sun. There are two different module types available on the market, flat plate and evacuated tubes. A south-facing 1m^2 highly efficient flat plate solar array will provide approximately 396kWh/m^2 of hot water and a highly efficient evacuated tube will provide approximately 520kWh/m^2 of hot water. The array needs to be sized to the meet the demand of the dwelling.

Solar water heating is suitable for houses; however, for blocks of apartments there are a number of complications. If solar water systems are required to serve flats other than those on the top floor there is the requirement for long runs of pipework to serve the apartments. This results in access issues, adds to the long-term maintenance of the system and reduces efficiencies due to pipe losses. Also, if a communal system is to be implemented, then a buffer vessel, expansion vessels and commercial pumps will be required, all of which require a large amount of plant space and maintenance. Within the apartments themselves, a large solar hot water cylinder will be required, but due to spatial requirements, this may not be practical to implement.

H.2.2 General Rules of Thumb

Energy Generated	396kWh/m^2 (Flat Plate (FP)) 520kWh/m^2 (Evacuated Tube (ET))
CO_2 Savings	78kg/m^2 (FP) 103kg/m^2 (ET) Usually around 5-10% of building CO_2 emissions depending on building type and system
Life Span	Approximately 30 years
Energy Payback	Reduced bills plus 8.5p/kWh Renewable Heat Incentive (RHI) for non-domestic (domestic scheme due in 2012)

H.2.3 Technical Considerations

- Avoid shading
- Weight of systems on the roof
- Orientation and inclination
- Drain-back systems
- Needs to be sized to match building demand but can be difficult to quantify at design stage
- Larger duel coil hot ware cylinders for domestic properties (or could be used as pre-feed)
- Pipe run lengths
- Vandalism if collectors exposed
- Safe access for maintenance and cleaning

H.2.4 Pros & Cons

Pros

- Simple to install
- Proven technologies
- Targets a specific component of energy consumption

Cons

- Limited cost savings
- Limited carbon savings

H.3 Wind Turbines

H.3.1 Overview

Wind turbines converts kinetic energy from the wind into mechanical energy, a process known as wind power. There are two different types of turbine, vertical and horizontal axis. Scales of energy generated ranges from 1.5kW to 7MW+. The installation of a large wind turbine is practically impossible on developments in the middle of a city, as there is nowhere to position or mount such a large piece of equipment. Opting for smaller roof-mounted turbines, such as those manufactured by Quiet Revolution (which are more aesthetically pleasing) could be an option.

A typical 15kW turbine in a suburban environment could generate 5,626kWh/month and hence save 3,196kgCO_2. A minimum space of 10m is required between each turbine, which could have a visual impact on the surrounding area. Generally, the available roof space on a scheme is not sufficient for the installation of a large number of the smaller roof-mounted wind turbines. In addition to spacing requirements, the use of turbines in urban areas severely reduces outputs and combined with the low wind speeds can render them ineffective. Recent studies have questioned viability and output from small systems, particularly in urban environments, leading to a number of suppliers of the small-scale turbines leaving the market.

If the electricity generated is greater than the demand, any additional electricity can be exported to the grid. The SAP calculation assumes 30% of the electricity generated is used directly within the dwelling and 70% is exported to the grid.

H.3.2 General Rules of Thumb

Energy Generated	Produces 5626.2 kWh/month
CO_2 Savings	Infinite
Life Span	20-30 years
Payback	The payback for a 15kW wind turbine will be approximately 10 years

H.3.3 Technical Considerations

- If building mounted – physical fixing and vibration

- At least one year of wind speed measurement
- Site location for turbine (obstructions)
- Impact on surrounding area: shadow flicker, toppling distance, radar, noise, bird and bat migration, visual impacts
- Site electricity needs and local grid connectivity
- Loss of space (parking, green, visual)
- Planning restrictions
- Access on site for installation vehicles and equipment
- Space on site for turbine to be lain before installation (hoisted into place)

H.3.4 Pros & Cons

Pros

- Where big turbines work they can deliver the best CO_2 savings for the initial investment

Cons

- Questionable viability for smaller scale systems
- Urban environments severely reduce output
- Lots of initial work to demonstrate viability
- Planning issues

H.4 Heat Pumps

H.4.1 Overview

Heat pumps can deliver heating and cooling by moving heat from one place to another using electricity to drive compression and expansion. There are three types of source heat pumps can use, ground, air and water. The efficiency of heat pumps is referred to as the Coefficient of Performance (CoP), which is the unit of heat delivered for each unit of electricity used. The efficiency for heating drops as the output temperature increases, so heating systems need to be specifically designed for low temperature hot water such as underfloor heating. Systems sometimes include an immersion for hot water.

H.4.1.1 Ground Source Heat Pumps (GSHPs)

The Coefficient of Performance (CoP) of a GSHP for heating is around 3, and for cooling around 5. There are different system set-ups, such as horizontal and vertical and open loop and closed loop. GSHPs are dependent on site ground conditions and available space. A horizontal GSHP will generate 39,600kWh/ear per 50m x 1.5m trench, saving 7,680kg/CO_2/year. The open loop system requires licenses from the EA.

H.4.1.2 Air Source Heat Pumps (ASHPs)

Exhaust air heat pumps extract warm, stale air from the dwelling and use it to heat hot water and heat fresh air entering the property. They do not require an externally-mounted condenser; however, they do have one of the lowest CoP for heat pumps of around 2.5 and are therefore not applicable for an enhanced capital grant from the government. The units themselves can be very heavy and need to be craned into position.

H.4.2 General Rules of Thumb

Energy Generated	Generally 100 kWh of heat generated with just 20-40 kWh of electricity
CO_2 Savings	Heat pump performing at 300% can save approximately 800 kgCO_2/year against an existing gas system and 5,270 kgCO_2/year against an existing electric system
Life Span	15-20 years
Payback	Approximately 10 years

H.4.3 Technical Considerations

- Need an appropriate heating system
- ASHP specific issues
    - Noise
    - Space
- GSHP specific issues
    - EA Licence
    - Ground survey
    - Distance between piles
    - Ground recharging

H.4.4 Pros & Cons

Pros

- Works well off grid when displacing electric heating/oil/lpg
- Heating and cooling systems provide greater CO_2 savings and allow recharging of the ground
- Possible future standard option

Cons

- Limited cost savings/potentially higher running costs
- Limited CO_2 savings
- Lack of certainty of energy returns
- High capital costs.

H.5 Biomass Boilers

H.5.1 Overview

Whilst traditionally most suited to lower density situations (mainly due to the supply and storage of the fuel), more high-density developments are considering this technology. A biomass boiler is best incorporated within a district heating scheme. However, there are issues regarding fuel storage and air pollution. A separate area would be required for the fuel store. We would use woodchip as opposed to pellets due to the embedded energy involved in transporting pellets from the continent – there are doubts as to whether wood pellets are in fact a carbon-neutral fuel. Woodchips can be sourced locally and therefore are more readily available, as well as being more carbon-friendly. The store would need to be adjacent to the plant room where the biomass boiler is located. In comparison to employing wind turbines or photovoltaic panels, this technology is much less demanding of space. Another storage compartment is required in the plant room for the waste ash, which is discharged and collected at the boiler. The ash content can vary from wood chips to pellets but can be substantial and requires regular maintenance and careful disposal.

H.5.2 General Rules of Thumb

Energy Generated	A boiler sized to meet around 50% peak could provide 80% of demand
CO_2 Savings	0.189kg/CO_2 per kWh for chips 0.174kg/CO_2 per kWh for pellets
Life Span	20-30 years
Energy Payback	RHI payment

H.5.3 Technical Considerations

- Fuel type
- Fuel storage
- Local suppliers
- Fuel quality and security
- Access
- Flue design
- Air quality impacts

H.5.4 Pros & Cons

Pros

- Delivers high CO_2 savings (under current calculation methodology)
- Relatively good value for CO_2 savings realised compared to alternatives

Cons

- Significant operational and maintenance issues
- Fuel supply and cost risks (possible increased future demands)
- Planning issues relating to the flue and air quality implications

APPENDIX I – POLICY 5.2 OF THE LONDON PLAN 2011

of carbon dioxide emissions, and this will be principally achieved through the application of Policy 5.2 and the Mayor's energy hierarchy. Further information regarding how the Mayor expects London to achieve this strategic target is outlined in the Mayor's Climate Change Mitigation and Energy Strategy.

POLICY 5.2 MINIMISING CARBON DIOXIDE EMISSIONS

Planning decisions

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

1 Be lean: use less energy
2 Be clean: supply energy efficiently
3 Be green: use renewable energy

B 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)
2013 – 2016	40 per cent
2016 – 2031	Zero carbon

Non-domestic buildings:

Year	Improvement on 2010 Building Regulations
2010 – 2013	25 per cent
2013 – 2016	40 per cent
2016 – 2019	As per building regulations requirements
2019 – 2031	Zero carbon

C 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.

D As a minimum, energy assessments should include the following details:

a calculation of the energy demand and carbon dioxide emissions covered by the 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
b 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)
d proposals to further reduce carbon dioxide emissions through the use of on-site renewable energy technologies.

E 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

APPENDIX J – GROUND SOURCE HEAT PUMP & EXHAUST AIR HEAT PUMP RESULTS COMPARISON

Former Twickenham Sorting Office, TW1

Results for Ground & Air Source Heat Pumps

Job No.: 9698
Date: 2012.07.02

WHITECODE DESIGN ASSOCIATES
BUILDING SERVICES DESIGN CONSULTANTS

	Base Case	Be Lean	Ground Source Heat Pumps	Air Source Heat Pumps
	The following results are for the notional dwelling of the dwelling being calculated.	Heat loss floor u-values – Flats 0.16 W/m2K; House Type A and C end terrace, B and D 0.16 W/m2K; House Type A and C mid terrace 0.14 W/m2K External wall u-values – Flats 0.17 W/m2K; houses 0.14 W/m2K Common area wall u-value – Flats only, 0.25 W/m2K Party wall u-value – Flats and houses, 0 W/m2K (assumed fully filled with sealed edges) Roof u-value – Flats and houses, 0.11 W/m2K Front door – Solid with u-PVC frame; u-value 2 W/m2K Window specification – Double glazed with hard low-E coating; average/unknown overshading; u-PVC frame with draught proofing; g-value of 0.64; frame factor of 0.7; u-value of 1.4 W/m2K Design air permeability rate – Flats 5 m3/hm2 (@50Pa); houses 3 m3/hm2 (@50Pa) Ventilation – Balanced heat recovery, Vortice HRU ECO 3 RF with SFP of 0.58 And heat exchange efficiency of 93% (kitchen + 1 additional wet room) Space heating – Individual boilers, Keston Qudos 28h boiler with efficiency of 90.3%; controlled by time and temperature zone control; interlock and delayed start thermostat included with weather compensator; heat emitted by radiators Water heating – Cylinder located in dwellings; 1bath units to have 120 litre cylinder with declared heat loss of 1.05 kWh/day; 2bath units to have 150 litre cylinder with declared heat loss of 1.31 kWh/day; 3bath units to have 180 litre cylinder with declared heat loss of 1.6 kWh/day Renewables – None Lighting – 100% low energy lighting Thermal bridging – Calculated using Accredited Construction Details for all junctions	Heat loss floor u-values – Flats 0.16 W/m2K; House Type A and C end terrace, B and D 0.16 W/m2K; House Type A and C mid terrace 0.14 W/m2K External wall u-values – Flats 0.17 W/m2K; houses 0.14 W/m2K Common area wall u-value – Flats only, 0.25 W/m2K Party wall u-value – Flats and houses, 0 W/m2K (assumed fully filled with sealed edges) Roof u-value – Flats and houses, 0.11 W/m2K Front door – Solid with u-PVC frame; u-value 2 W/m2K Window specification – Double glazed with hard low-E coating; average/unknown overshading; u-PVC frame with draught proofing; g-value of 0.64; frame factor of 0.7; u-value of 1.4 W/m2K Design air permeability rate – Flats 5 m3/hm2 (@50Pa); houses 3 m3/hm2 (@50Pa) Ventilation – Balanced heat recovery, Vortice HRU ECO 3 RF with SFP of 0.58 And heat exchange efficiency of 93% (kitchen + 1 additional wet room) Space heating – Ground Source Heat Pumps, Greenstore System 6kW; controlled by time and temperature zone control; interlock and weather compensator; heat emitted by underfloor heating Water heating – Cylinder located in dwellings; 1bath units to have 120 litre cylinder with declared heat loss of 1.05 kWh/day; 2bath units to have 150 litre cylinder with declared heat loss of 1.31 kWh/day; 3bath units to have 180 litre cylinder with declared heat loss of 1.6 kWh/day Renewables – None Lighting – 100% low energy lighting Thermal bridging – Calculated using Accredited Construction Details for all junctions	Heat loss floor u-values – Flats 0.16 W/m2K; House Type A and C end terrace, B and D 0.16 W/m2K; House Type A and C mid terrace 0.14 W/m2K External wall u-values – Flats 0.17 W/m2K; houses 0.14 W/m2K Common area wall u-value – Flats only, 0.25 W/m2K Party wall u-value – Flats and houses, 0 W/m2K (assumed fully filled with sealed edges) Roof u-value – Flats and houses, 0.11 W/m2K Front door – Solid with u-PVC frame; u-value 2 W/m2K Window specification – Double glazed with hard low-E coating; average/unknown overshading; u-PVC frame with draught proofing; g-value of 0.64; frame factor of 0.7; u-value of 1.4 W/m2K Design air permeability rate – Flats 5 m3/hm2 (@50Pa); houses 3 m3/hm2 (@50Pa) Ventilation – Balanced heat recovery, Vortice HRU ECO 3 RF with SFP of 0.58 And heat exchange efficiency of 93% (kitchen + 1 additional wet room) Space heating – Air Source Heat Pumps, Greensource System 6kW; controlled by time and temperature zone control; interlock and weather compensator; heat emitted by underfloor heating Water heating – Cylinder located in dwellings; 1bath units to have 120 litre cylinder with declared heat loss of 1.05 kWh/day; 2bath units to have 150 litre cylinder with declared heat loss of 1.31 kWh/day; 3bath units to have 180 litre cylinder with declared heat loss of 1.6 kWh/day Renewables – None Lighting – 100% low energy lighting Thermal bridging – Calculated using Accredited Construction Details for all junctions

Plot No.:	Area (m2):	No. of Occupants:	Type:	Floor:	DER	TER	Improvement on TER:	DER	TER	Improvement on TER:	DER	TER	Improvement on TER:	DER	TER	Improvement on TER:
22	174.44	7	4Bed	Type A	15.82	15.82	0.00%	12.24	15.82	22.63%	12.67	15.82	19.91%	12.67	15.82	19.91%
23	174.44	7	4Bed	Type A	13.69	13.69	0.00%	10.93	13.69	20.16%	11.51	13.69	15.92%	11.03	13.69	19.43%
24	183.75	8	4/5Bed	Type B	16.43	16.43	0.00%	13.76	16.43	16.25%	14.03	16.43	14.61%	13.79	16.43	16.07%
25	170.8	8	4Bed	Type C	15.76	15.76	0.00%	12.73	15.76	19.23%	13.13	15.76	16.69%	12.74	15.76	19.16%
26	170.8	8	4Bed	Type C	13.86	13.86	0.00%	11.53	13.86	16.81%	12.07	13.86	12.91%	11.60	13.86	16.31%
27	170.8	8	4Bed	Type C	15.76	15.76	0.00%	12.35	15.76	21.64%	12.80	15.76	18.78%	12.39	15.76	21.38%
28	170.8	8	4Bed	Type C	13.86	13.86	0.00%	11.17	13.86	19.41%	11.76	13.86	15.15%	11.26	13.86	18.76%
29	183.75	8	4/5Bed	Type B	16.43	16.43	0.00%	13.38	16.43	18.56%	13.68	16.43	16.74%	13.42	16.43	18.32%
30	159.6	8	4Bed	Type D	15.88	15.88	0.00%	12.77	15.88	19.58%	13.30	15.88	16.25%	12.85	15.88	19.08%
31	159.6	8	4Bed	Type D	13.97	13.97	0.00%	11.82	13.97	15.39%	12.46	13.97	10.81%	11.93	13.97	14.60%
					15.15	**15.15**	**0.00%**	**12.27**	**15.15**	**18.97%**	**12.74**	**15.15**	**15.78%**	**12.37**	**15.15**	**18.30%**

APPENDIX K – EXAMPLE BRUKL DOCUMENT FOR COMMERCIAL UNITS – BASE CASE

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L 2010

Project name **Shell and Core**

Twickenham sorting office

As designed

Date: Wed Jun 27 16:10:23 2012

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v4.1.c.3

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: v6.4.0

BRUKL compliance check version: v4.1.c.2

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building should not exceed the target

The building does not comply with England and Wales Building Regulations Part L 2010

1.1	CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	44.5
1.2	Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	44.5
1.3	Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	46.3
1.4	Are emissions from the building less than or equal to the target?	BER > TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

2.a Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.26	0.26	BSMN0001_W1_-1
Floor	0.25	0.22	0.22	BSMN0001_F_-1
Roof	0.25	0.18	0.18	GRND0001_C_1
Windows***, roof windows, and rooflights	2.2	1.4	1.4	BSMN0001_W1-W0
Personnel doors	2.2	2	2	GRND0005_W10-W0
Vehicle access & similar large doors	1.5	-	-	"No heat loss vehicle access doors"
High usage entrance doors	3.5	-	-	"No heat loss high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	5

2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Main system

Heating seasonal efficiency	**Cooling seasonal efficiency**	**SFP [W/(l/s)]**	**HR seasonal efficiency**
0.89	3.13	-	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			YES

1- SYST0000-DHW

Heating seasonal efficiency	**Hot water storage loss factor [kWh/litre per day]**
Hot water provided by HVAC system	-

Local mechanical ventilation and exhaust

Zone	**Supply/extract SFP [W/(l/s)]**	**HR seasonal efficiency**	**Exhaust SFP [W/(l/s)]**
Community Space	-	-	0.5
Restaurant	-	-	0.5
Community Space	-	-	0.5
Restaurant	-	-	0.5
Restaurant	-	-	0.5

Shell and core configuration

Zone	**Assumed shell?**
Community Space	NO
Restaurant	NO
Community Space	NO
Restaurant	NO
Restaurant	NO
Youth Facility	NO
Youth Facility	NO
Youth Facility	NO

General lighting and display lighting

Zone	**General lighting [W]**	**Display lamps efficacy [lm/W]**
Community Space	700	-
Restaurant	550	15
Community Space	900	-
Restaurant	1050	15
Restaurant	650	15
Youth Facility	2700	-
Youth Facility	2700	-
Youth Facility	2700	-

Criterion 3: The spaces in the building should have propriate passive control measures to limit solar gains

Zone	**Solar gain limit exceeded? (%)**	**Internal blinds used?**
Community Space	NO (-64.2%)	NO
Restaurant	NO (-74.3%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Community Space	NO (-68.8%)	NO
Restaurant	NO (-77.4%)	NO
Restaurant	NO (-75.5%)	NO
Youth Facility	NO (-52.6%)	NO
Youth Facility	NO (-52.6%)	NO
Youth Facility	NO (-52.6%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	2196.9	2196.9
External area [m^2]	3929.1	3929.1
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	5
Average conductance [W/K]	1187.6	1911.5
Average U-value [W/m^2K]	0.3	0.49
Alpha value* [%]	19.9	14.88

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
32	**A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways**
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
68	**D1 Non-residential Inst.: Community/Day Centre**
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Telephone exchanges
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	40.76	59.47
Cooling	18.7	15.07
Auxiliary	0.97	0.76
Lighting	35.72	28.68
Hot water	48.52	49.07
Equipment*	39.51	38.52
TOTAL	**144.67**	**153.05**

* Energy used by equipment does not count towards the total for calculating emissions.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Indicative Target
Heating + cooling demand [MJ/m^2]	304.17	369.92
Total consumption [kWh/m^2]	144.67	153.05
Total emissions [kg/m^2]	46.3	44.5

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity										
	Actual	128.1	176.1	40.8	18.7	1	0.87	2.62	0.89	3.5
	Notional	169.6	200.4	59.5	15.1	0.8	0.79 / 0.81	3.6	----	----

Key to terms

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

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.26	BSMN0001_W1_-1
Floor	0.2	0.22	BSMN0001_F_-1
Roof	0.15	0.18	GRND0001_C_1
Windows, roof windows, and rooflights	1.5	1.4	BSMN0001_W1-W0
Personnel doors	1.5	2	GRND0005_W10-W0
Vehicle access & similar large doors	1.5	-	"No heat loss vehicle access doors"
High usage entrance doors	1.5	-	"No heat loss high usage entrance doors"

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

APPENDIX L – EXAMPLE BRUKL DOCUMENT FOR COMMERCIAL UNITS – BE LEAN

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L 2010

Project name **Shell and Core**

Twickenham sorting office

As designed

Date: Wed Jun 27 16:40:03 2012

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v4.1.c.3

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: v6.4.0

BRUKL compliance check version: v4.1.c.2

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building should not exceed the target

1.1	CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	44.5
1.2	Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	44.5
1.3	Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	43.3
1.4	Are emissions from the building less than or equal to the target?	BER =< TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

2.a Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.17	0.17	BSMN0001_W1_-1
Floor	0.25	0.16	0.16	BSMN0001_F_-1
Roof	0.25	0.11	0.11	GRND0001_C_1
Windows***, roof windows, and rooflights	2.2	1.4	1.4	BSMN0001_W1-W0
Personnel doors	2.2	2	2	GRND0005_W10-W0
Vehicle access & similar large doors	1.5	-	-	"No heat loss vehicle access doors"
High usage entrance doors	3.5	-	-	"No heat loss high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Main system

Heating seasonal efficiency	**Cooling seasonal efficiency**	**SFP [W/(l/s)]**	**HR seasonal efficiency**
0.89	3.13	-	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			YES

1- SYST0000-DHW

Heating seasonal efficiency	**Hot water storage loss factor [kWh/litre per day]**
0.98	-

Local mechanical ventilation and exhaust

Zone	**Supply/extract SFP [W/(l/s)]**	**HR seasonal efficiency**	**Exhaust SFP [W/(l/s)]**
Community Space	-	-	0.5
Restaurant	-	-	0.5
Community Space	-	-	0.5
Restaurant	-	-	0.5
Restaurant	-	-	0.5

Shell and core configuration

Zone	**Assumed shell?**
Community Space	NO
Restaurant	NO
Community Space	NO
Restaurant	NO
Restaurant	NO
Youth Facility	NO
Youth Facility	NO
Youth Facility	NO

General lighting and display lighting

Zone	**General lighting [W]**	**Display lamps efficacy [lm/W]**
Community Space	500	-
Restaurant	400	15
Community Space	650	-
Restaurant	800	15
Restaurant	500	15
Youth Facility	2000	-
Youth Facility	2000	-
Youth Facility	2000	-

Criterion 3: The spaces in the building should have propriate passive control measures to limit solar gains

Zone	**Solar gain limit exceeded? (%)**	**Internal blinds used?**
Community Space	NO (-63.8%)	NO
Restaurant	NO (-74.1%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Community Space	NO (-68.4%)	NO
Restaurant	NO (-77.1%)	NO
Restaurant	NO (-75.3%)	NO
Youth Facility	NO (-52.1%)	NO
Youth Facility	NO (-52.1%)	NO
Youth Facility	NO (-52.1%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	2196.9	2196.9
External area [m^2]	3929.1	3929.1
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	5
Average conductance [W/K]	911.01	1911.5
Average U-value [W/m^2K]	0.23	0.49
Alpha value* [%]	25.94	14.88

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
32	**A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways**
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
68	**D1 Non-residential Inst.: Community/Day Centre**
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Telephone exchanges
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	38.92	59.47
Cooling	21.59	15.07
Auxiliary	0.97	0.76
Lighting	30.31	28.68
Hot water	41.86	49.07
Equipment*	39.51	38.52
TOTAL	**133.64**	**153.05**

* Energy used by equipment does not count towards the total for calculating emissions.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Indicative Target
Heating + cooling demand [MJ/m^2]	325.63	369.92
Total consumption [kWh/m^2]	133.64	153.05
Total emissions [kg/m^2]	43.3	44.5

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity										
	Actual	122.3	203.3	38.9	21.6	1	0.87	2.62	0.89	3.5
	Notional	169.6	200.4	59.5	15.1	0.8	0.79 / 0.81	3.6	----	----

Key to terms

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

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.17	BSMN0001_W1_-1
Floor	0.2	0.16	BSMN0001_F_-1
Roof	0.15	0.11	GRND0001_C_1
Windows, roof windows, and rooflights	1.5	1.4	BSMN0001_W1-W0
Personnel doors	1.5	2	GRND0005_W10-W0
Vehicle access & similar large doors	1.5	-	"No heat loss vehicle access doors"
High usage entrance doors	1.5	-	"No heat loss high usage entrance doors"

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

APPENDIX M – EXAMPLE BRUKL DOCUMENT FOR COMMERCIAL UNITS – BE CLEAN

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L 2010

Project name **Shell and Core**

Twickenham sorting office

As designed

Date: Wed Jun 27 16:54:41 2012

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v4.1.c.3

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: v6.4.0

BRUKL compliance check version: v4.1.c.2

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building should not exceed the target

1.1	CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	44.5
1.2	Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	44.5
1.3	Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	41.8
1.4	Are emissions from the building less than or equal to the target?	BER =< TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

2.a Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.17	0.17	YTHF0000_W1_-1
Floor	0.25	0.16	0.16	YTHF0000_F_-1
Roof	0.25	0.11	0.11	YTHF0002_C_-1
Windows***, roof windows, and rooflights	2.2	1.4	1.4	YTHF0000_W1-W0
Personnel doors	2.2	2	2	GRND0005_W10-W0
Vehicle access & similar large doors	1.5	-	-	"No heat loss vehicle access doors"
High usage entrance doors	3.5	-	-	"No heat loss high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Main system CHP

Heating seasonal efficiency	**Cooling seasonal efficiency**	**SFP [W/(l/s)]**	**HR seasonal efficiency**
0.89	3.13	-	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			YES

2- Main system

Heating seasonal efficiency	**Cooling seasonal efficiency**	**SFP [W/(l/s)]**	**HR seasonal efficiency**
0.89	3.13	-	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			YES

1- SYST0000-DHW

Heating seasonal efficiency	**Hot water storage loss factor [kWh/litre per day]**
0.98	-

Local mechanical ventilation and exhaust

Zone	**Supply/extract SFP [W/(l/s)]**	**HR seasonal efficiency**	**Exhaust SFP [W/(l/s)]**
Community Space	-	-	0.5
Restaurant	-	-	0.5
Community Space	-	-	0.5
Restaurant	-	-	0.5
Restaurant	-	-	0.5

Shell and core configuration

Zone	**Assumed shell?**
Youth Facility	NO
Youth Facility	NO
Youth Facility	NO
Community Space	NO
Restaurant	NO
Community Space	NO
Restaurant	NO
Restaurant	NO

General lighting and display lighting

Zone	**General lighting [W]**	**Display lamps efficacy [lm/W]**
Youth Facility	2000	-
Youth Facility	2000	-
Youth Facility	2000	-
Community Space	500	-
Restaurant	400	15
Community Space	650	-
Restaurant	800	15
Restaurant	500	15

Criterion 3: The spaces in the building should have propriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Youth Facility	NO (-52.1%)	NO
Youth Facility	NO (-52.1%)	NO
Youth Facility	NO (-52.1%)	NO
Community Space	NO (-63.8%)	NO
Restaurant	NO (-74.1%)	NO
Community Space	NO (-68.4%)	NO
Restaurant	NO (-77.1%)	NO
Restaurant	NO (-75.3%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	2196.9	2196.9
External area [m^2]	3929.1	3929.1
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	5
Average conductance [W/K]	911.01	1911.5
Average U-value [W/m^2K]	0.23	0.49
Alpha value* [%]	25.94	14.88

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
32	**A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways**
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
68	**D1 Non-residential Inst.: Community/Day Centre**
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Telephone exchanges
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	33.44	59.47
Cooling	21.59	15.07
Auxiliary	0.97	0.76
Lighting	30.31	28.68
Hot water	41.86	49.07
Equipment*	39.51	38.52
TOTAL	**128.17**	**153.05**

* Energy used by equipment does not count towards the total for calculating emissions.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	3.23	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Indicative Target
Heating + cooling demand [MJ/m^2]	308.43	369.92
Total consumption [kWh/m^2]	128.17	153.05
Total emissions [kg/m^2]	41.8	44.5

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity										
	Actual	24.4	79.6	7.8	8.5	0	0.87	2.62	0.89	3.5
	Notional	79.2	91.6	27.8	6.9	0	0.79 / 0.81	3.6	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity										
	Actual	214.6	371.2	68.3	39.4	2.3	0.87	2.62	0.89	3.5
	Notional	292.3	348	102.5	26.2	1.8	0.79 / 0.81	3.6	----	----

Key to terms

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

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.17	YTHF0000_W1_-1
Floor	0.2	0.16	YTHF0000_F_-1
Roof	0.15	0.11	YTHF0002_C_-1
Windows, roof windows, and rooflights	1.5	1.4	YTHF0000_W1-W0
Personnel doors	1.5	2	GRND0005_W10-W0
Vehicle access & similar large doors	1.5	-	"No heat loss vehicle access doors"
High usage entrance doors	1.5	-	"No heat loss high usage entrance doors"

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

APPENDIX B

Project Status

Apartments

The current project status of sections completed
on the BRE Global Code for Sustainable Homes Automated Assessment Processing System is

4 / 34

Category 1 : Energy								
Code:	**Category:**	**Outstanding Evidence:**	**Action required By:**	**Evidence received to date:**	**Open/Closed**	**Available Credits**	**Credits achieved**	**Credits assumed**
Ene 1	Dwelling Emission Rate	• Design Stage SAP Worksheets • Design Stage Building Regs Checklist • Plans, elevations and sections	• WDA • WDA • JTP	• WDA Energy Strategy	O	10		3
Ene 2	Building Fabric	• Design Stage SAP Worksheets • Design Stage Building Regs Checklist • Plans, elevations and sections	• WDA • WDA • JTP	• WDA Energy Strategy	O	9		4
Ene 3	Energy Display Device	• Confirmarion that the correctly specified Energy Display Device is dedicated to each dwelling • Confirmation of the consumption data displayed by the energy display device.	• SJG • SJG		O	2		2
Ene 4	Drying Space	Credits not Sought			C	1	0	0
Ene 5	Energy Labelled White Goods	• Literature stating make and model and EU Energy Efficiency Labelling Scheme rating of all white goods (fridge-freezers A+, washing machines and dishwashers A and tumble dryers/washer-dryers B) • Confirmation that the Labelling Scheme leaflet will distributed to all dwellings.	• SJG • SJG		O	2		2
Ene 6	External Lighting	• Drawings showing location of all external light fittings • Confirmation of the types of light fittings and efficacy in lumens per circuit watt for all lamps • Confirmation of the control systems applicable to each light fitting or group of fittings.	• WDA • WDA • WDA		O	2		2
Ene 7	Low or Zero Carbon (LZC) Technologies.				O	2		2
Ene 8	Cycle Storage	• Drawings or specification text detailing the location, type and size of storage • Confirmation of convenient access to cycle store (as per definition in Technical Guide) • Details of any security measures	• JTP • JTP • JTP	• Accommodation Schedule	O	2		2
Ene 9	Home Office	• Drawings showing the location of and sufficient space for home office (1.8m wall space). • WDA drawings to show location and number of sockets, telephone points, adequate ventilation, • Confirmation that average daylight factor of 1.5% is achieved.	• JTP • WDA • Anstey Horne		O	1		1
					Total:	31	0	18
					Total percentage:	36.4	0	21.13

Category 2 : Water								
Code:	**Category:**	**Outstanding Evidence:**	**Action required By:**	**Evidence received to date:**	**Open/Closed**	**Available Credits**	**Credits achieved**	**Credits assumed**
Wat 1	Indoor Water Usage	• Drawings showing location of all appliances / fittings which use water in the dwellings. • Confirmation of flow rates must be supplied including details on any flow restrictors to be fitted. • WDA mechanical drawings to state that hot and cold water system will be designed to prevent risk of microbial contamination.	• JTP • SJG • WDA		O	5		3
Wat 2	External Water Usage	• Confirmation of the type, size and location of any rainwater collection systems.	• JTP / SJG		O	1		1
					Total:	6	0	4
					Total Percentage:	9	0	6

Category 3 : Materials								
Code:	**Category:**	**Outstanding Evidence:**	**Action required By:**	**Evidence received to date:**	**Open/Closed**	**Available Credits**	**Credits Achieved**	**Credits Assumed**
Mat 1	Environmental Impact of materials	• Drawings or specifications detailing the material make up of the following elements: a) Roof b) External Walls c) Internal Walls d) Upper and Ground Floors e) Windows	• JTP		O	15		7
Mat 2	Responsible sourcing of materials - basic building elements	**Credits not sought**			C	6		0
Mat 3	Responsible sourcing of materials - finishing elements	**Credits not sought**			C	3		0
					Total:	24	0	7
					Total Percentage:	7.2	0	2.1

Category 4: Surface Water Run-Off								
Code:	**Category:**	**Outstanding Evidence:**	**Action required By:**	**Evidence received to date:**	**Open/Closed**	**Available Credits**	**Credits Achieved**	**Credits Assumed**
Sur 1	Management of Surface Water Runoff from developments	• Please see attached Technical Guidance for details of evidence requirements.	• PBA		O	2		2
Sur 2	Flood Risk	• Flood Risk Assessment confirming low risk of flooding from all sources considered in PPS 25.	• PBA		O	2		2
					Total:	4	0	4
					Total Percentage:	2.2	0	2.2

Category 5 : Waste								
code:	**Category:**	**Outstanding Evidence:**	**Action required By:**	**Evidence received to date:**	**Open/Closed**	**Available Credits**	**Credits Achieved**	**Credits Assumed**
Was 1	Storage of non-recyclable waste and recyclable household waste	• Completed IDP checklist and evidence of compliance (notes on drawings is acceptable). • Drawings showing internal bin location with notes about volume and confirmation that bin will be in a fixed location and not free standing.	• JTP • JTP	• LA collection service information • Ground floor drawngs showing bin store location and bin capacities	O	4		4
Was 2	Construction Site Waste Management	• A copy of the compliant SWMP containing the appropriate benchmarks, commitments and procedures for waste minimisation and diversion from landfill in line with with Checklists Was 2a, Was 2b and Was 2c	• SJG		O	3		3
Was 3	Composting	Credits not sought			C	1	0	0
					Total:	8	0	7
					Total Percentage:	6.4	0	5.6

Category 6 : Pollution								
Code:	**Category:**	**Outstanding Evidence:**	**Action required By:**	**Evidence received to date:**	**Open/Closed**	**Available Credits**	**Credits Achieved**	**Credits Assumed**
Pol 1	Global Warming Potential (GWP) of Insulants	• Complete Pol 1 checklist with insulation type and manufacturer for each element. • WDA will ascertain the GWP once completed.	• JTP • WDA		O	1		1
Pol 2	NO_x Emissions	• Confirmation of the primary and secondary heating systems and flue type • Dry Nox levels of primary and secondary heating systems	• WDA • WDA		O	3		3
					Total:	4	0	4
					Total Percentage:	2.8	0	2.8

Category 7 : Health and Wellbeing								
Code:	**Category:**	**Outstanding Evidence:**	**Action required By:**	**Evidence received to date:**	**Open/Closed**	**Available Credits**	**Credits Achieved**	**Credits Assumed**
Hea 1	Daylighting	• Average daylight factor calculations • Position od no-sky line and % of area of working plane that receives direct light from the sky. • Confirmation from SJG that the calculations are true reflection of dwellings.	• Anstey Horne • Anstey Horne • SJG		O	3		1
Hea 2	Sound Insulation	• Where pre-completion testing will be carried out; a letter confirming the intent to meet the relevent sound insulation performance levels and commitment to use a Compliant Test Body to complete testing • Where Robust Details will be used confirmation that the Robust Details chosen will achieve the required performance standards for sound insulation (as applicable) and confirmation that the relevant plots are registered with RDL (the Purchase Statement)	• TBC • TBC		O	4		3
Hea 3	Private Space	• Confirmation of how shared outdoor space is accessible to those residents only. • Completed checklist IDP	• JTP • JTP	• Accommodation Schedule	O	1		1
Hea 4	Lifetime Homes	• Confirmation of compliance with all 16 LTH criteria	• JTP		O	4		4
					Total:	12	0	9
					Total Percentage:	14	0	10.50

Category 8 : Management								
Code:	**Category:**	**Outstanding Evidence:**	**Action required By:**	**Evidence received to date:**	**Open/Closed**	**Available Credits**	**Credits Achieved**	**Credits Assumed**
Man 1	Home User Guide	• Completed checklist Man 1 • Confirmation that the HUG will be supplied to all dwellings	• SJG • SJG		O	3		3
Man 2	Considerate Constructors Scheme	• Commitment to comply with the Considerate Constructors Scheme and achieve formal certification under the scheme with either a score of 32 points and above • Confirmation that registration with the Considerate Constructor Scheme has taken place no later than the commencement of the construction phase	• SJG • SJG		O	2		2
Man 3	Construction Site Impacts	• Completed copy of Checklist Man 3 (signed and dated) detailing the procedures that will be employed to minimise construction site impacts	• SJG		O	2		2
Man 4	Security	• Confirmation that an ALO/ CPDA has been consulted with to ensure that the requirements of SBD Section 2 are met • Commitment to follow advice provided by ALO/ CPDA	• SJG • SJG		O	2		2
					Total:	9	0	9
					Total Percentage:	10	0	10

Category 9 : Ecology								
Code:	**Category:**	**Outstanding Evidence:**	**Action required By:**	**Evidence received to date:**	**Open/Closed**	**Available Credits**	**Credits Achieved**	**Credits Assumed**
Eco 1	Ecological Value of Site	• A copy of a report or letter from the ecologist highlighting the information required as set out in the 'Code for Sustainable Homes Ecology Report Template' • Detailed documentary evidence identifying the construction zone and how any areas of ecological value outside the construction zone will remain undisturbed in accordance with the ecologist's recommendations.			O	1		1
Eco 2	Ecological Enhancement	• A copy of the ecologist's report highlighting the information required as set out in 'Code for Sustainable Homes Ecology Report Template' • Detailed documentary evidence stating how the key recommendations and 30% of additional recommendations will be incorporated into the design • The planting schedule of any species to be incorporated from suitably qualified ecologists recommendations			O	1		1
Eco 3	Protection of Ecological Features	• Detailed documentary evidence confirming ecological features present and how they will be protected • Where ecological features are being removed for health and safety and/or conservation reasons; written evidence from an appropriate statutory body / arboriculturalist confirming the requirement to remove any features • Where ecological features are being removed and are of low ecological value; a copy of the ecologist's report highlighting the information required as set out in the Code for Sustainable Homes Ecology Report Template			O	1		1
Eco 4	Change in Ecological Value of Site	• Code for Sustainable Homes Ecology Report template completed by the ecologist • Written confirmation of how the ecologists recommenndations will be implemented including a planting schedule.			O	4		2
Eco 5	Building Footprint	• Calculation of the building footprint ratio, stating the Net Internal Floor Areas (NIFA) and the Net internal Ground Floor Area (NIGFA)	• JTP		O	2		1
					Total:	9	0	6
					Total Percentage:	12	0	8.00

Totals:		
Available Credits:	Credits Achieved	Credits Assumed
100	0	68.33
Code Level:	0	4

Points	Code Level
36	Level 1
48	Level 2
57	Level 3
68	Level 4
84	Level 5
90	Level 6

Project Status

Houses

The current project status of sections completed
on the BRE Global Code for Sustainable Homes Automated Assessment Processing System is

3 / 34

Category 1 : Energy								
Code:	**Category:**	**Outstanding Evidence:**	**Action required By:**	**Evidence received to date:**	**Open/Closed**	**Available Credits**	**Credits achieved**	**Credits assumed**
Ene 1	Dwelling Emission Rate	• Design Stage SAP Worksheets • Design Stage Building Regs Checklist • Plans, elevations and sections	• WDA • WDA • JTP	• WDA Energy Strategy	O	10		3.5
Ene 2	Building Fabric	• Design Stage SAP Worksheets • Design Stage Building Regs Checklist • Plans, elevations and sections	• WDA • WDA • JTP	• WDA Energy Strategy	O	9		4.5
Ene 3	Energy Display Device	• Confirmarion that the correctly specified Energy Display Device is dedicated to each dwelling • Confirmation of the consumption data displayed by the energy display device.	• SJG • SJG		O	2		2
Ene 4	Drying Space	• Drawings showing location of external drying line. • Confirmation of the line length	• JTP • SJG		O	1		1
Ene 5	Energy Labelled White Goods	• Literature stating make and model and EU Energy Efficiency Labelling Scheme rating of all white goods (fridge-freezers A+, washing machines and dishwashers A and tumble dryers/washer-dryers B) • Confirmation that the Labelling Scheme leaflet will distributed to all dwellings.	• SJG • SJG		O	2		2
Ene 6	External Lighting	• Drawings showing location of all external light fittings • Confirmation of the types of light fittings and efficacy in lumens per circuit watt for all lamps • Confirmation of the control systems applicable to each light fitting or group of fittings.	• WDA • WDA • WDA		O	2		2
Ene 7	Low or Zero Carbon (LZC) Technologies.				O	2		1
Ene 8	Cycle Storage	• Drawings or specification text detailing the location, type and size of storage • Confirmation of convenient access to cycle store (as per definition in Technical Guide) • Details of any security measures	• JTP • JTP • JTP	• Accommodation Schedule	O	2		1
Ene 9	Home Office	• Drawings showing the location of and sufficient space for home office (1.8m wall space). • WDA drawings to show location and number of sockets, telephone points, adequate ventilation, • Confirmation that average daylight factor of 1.5% is achieved.	• JTP • WDA • Anstey Horne		O	1		1
					Total:	31	0	18
					Total percentage:	36.4	0	21.13

Category 2 : Water								
Code:	**Category:**	**Outstanding Evidence:**	**Action required By:**	**Evidence received to date:**	**Open/Closed**	**Available Credits**	**Credits achieved**	**Credits assumed**
Wat 1	Indoor Water Usage	• Drawings showing location of all appliances / fittings which use water in the dwellings. • Confirmation of flow rates must be supplied including details on any flow restrictors to be fitted. • WDA mechanical drawings to state that hot and cold water system will be designed to prevent risk of microbial contamination.	• JTP • SJG • WDA		O	5		3
Wat 2	External Water Usage	• Confirmation of the type, size and location of any rainwater collection systems.	• JTP / SJG		O	1		1
					Total:	6	0	4
					Total Percentage:	9	0	6

Category 3 : Materials								
Code:	**Category:**	**Outstanding Evidence:**	**Action required By:**	**Evidence received to date:**	**Open/Closed**	**Available Credits**	**Credits Achieved**	**Credits Assumed**
Mat 1	Environmental Impact of materials	• Drawings or specifications detailing the material make up of the following elements: a) Roof b) External Walls c) Internal Walls d) Upper and Ground Floors e) Windows	• JTP		O	15		7
Mat 2	Responsible sourcing of materials - basic building elements	**Credits not sought**			C	6		0
Mat 3	Responsible sourcing of materials - finishing elements	**Credits not sought**			C	3		0
					Total:	24	0	7
					Total Percentage:	7.2	0	2.1

Category 4: Surface Water Run-Off								
Code:	**Category:**	**Outstanding Evidence:**	**Action required By:**	**Evidence received to date:**	**Open/Closed**	**Available Credits**	**Credits Achieved**	**Credits Assumed**
Sur 1	Management of Surface Water Runoff from developments	• Please see attached Technical Guidance for details of evidence requirements.	• PBA		O	2		2
Sur 2	Flood Risk	• Flood Risk Assessment confirming low risk of flooding from all sources considered in PPS 25.	• PBA		O	2		2
					Total:	4	0	4
					Total Percentage:	2.2	0	2.2

Category 5 : Waste								
code:	**Category:**	**Outstanding Evidence:**	**Action required By:**	**Evidence received to date:**	**Open/Closed**	**Available Credits**	**Credits Achieved**	**Credits Assumed**
Was 1	Storage of non-recyclable waste and recyclable household waste	• Completed IDP checklist and evidence of compliance (notes on drawings is acceptable). • Drawings showing internal bin location with notes about volume and confirmation that bin will be in a fixed location and not free standing.	• JTP • JTP	• LA collection service information • Ground floor drawngs showing bin store location and bin capacities	O	4		4
Was 2	Construction Site Waste Management	• A copy of the compliant SWMP containing the appropriate benchmarks, commitments and procedures for waste minimisation and diversion from landfill in line with with Checklists Was 2a, Was 2b and Was 2c	• SJG		O	3		3
Was 3	Composting	Credits not sought			C	1	0	0
					Total:	8	0	7
					Total Percentage:	6.4	0	5.6

Category 6 : Pollution								
Code:	**Category:**	**Outstanding Evidence:**	**Action required By:**	**Evidence received to date:**	**Open/Closed**	**Available Credits**	**Credits Achieved**	**Credits Assumed**
Pol 1	Global Warming Potential (GWP) of Insulants	• Complete Pol 1 checklist with insulation type and manufacturer for each element. • WDA will ascertain the GWP once completed.	• JTP • WDA		O	1		1
Pol 2	NO_x Emissions	• Confirmation of the primary and secondary heating systems and flue type • Dry Nox levels of primary and secondary heating systems	• WDA • WDA		O	3		3
					Total:	4	0	4
					Total Percentage:	2.8	0	2.8

Category 7 : Health and Wellbeing								
Code:	**Category:**	**Outstanding Evidence:**	**Action required By:**	**Evidence received to date:**	**Open/Closed**	**Available Credits**	**Credits Achieved**	**Credits Assumed**
Hea 1	Daylighting	• Average daylight factor calculations • Position od no-sky line and % of area of working plane that receives direct light from the sky. • Confirmation from SJG that the calculations are true reflection of dwellings.	• Anstey Horne • Anstey Horne • SJG		O	3		1
Hea 2	Sound Insulation	• Where pre-completion testing will be carried out; a letter confirming the intent to meet the relevent sound insulation performance levels and commitment to use a Compliant Test Body to complete testing • Where Robust Details will be used confirmation that the Robust Details chosen will achieve the required performance standards for sound insulation (as applicable) and confirmation that the relevant plots are registered with RDL (the Purchase Statement)	• TBC • TBC		O	4		3
Hea 3	Private Space	• Confirmation of how shared outdoor space is accessible to those residents only. • Completed checklist IDP	• JTP • JTP	• Accommodation Schedule	O	1		1
Hea 4	Lifetime Homes	• Confirmation of compliance with all 16 LTH criteria	• JTP		O	4		4
					Total:	12	0	9
					Total Percentage:	14	0	10.50

Category 8 : Management								
Code:	**Category:**	**Outstanding Evidence:**	**Action required By:**	**Evidence received to date:**	**Open/Closed**	**Available Credits**	**Credits Achieved**	**Credits Assumed**
Man 1	Home User Guide	• Completed checklist Man 1 • Confirmation that the HUG will be supplied to all dwellings	• SJG • SJG		O	3		3
Man 2	Considerate Constructors Scheme	• Commitment to comply with the Considerate Constructors Scheme and achieve formal certification under the scheme with either a score of 32 points and above • Confirmation that registration with the Considerate Constructor Scheme has taken place no later than the commencement of the construction phase	• SJG • SJG		O	2		2
Man 3	Construction Site Impacts	• Completed copy of Checklist Man 3 (signed and dated) detailing the procedures that will be employed to minimise construction site impacts	• SJG		O	2		2
Man 4	Security	• Confirmation that an ALO/ CPDA has been consulted with to ensure that the requirements of SBD Section 2 are met • Commitment to follow advice provided by ALO/ CPDA	• SJG • SJG		O	2		2
					Total:	9	0	9
					Total Percentage:	10	0	10

Category 9 : Ecology								
Code:	**Category:**	**Outstanding Evidence:**	**Action required By:**	**Evidence received to date:**	**Open/Closed**	**Available Credits**	**Credits Achieved**	**Credits Assumed**
Eco 1	Ecological Value of Site	• A copy of a report or letter from the ecologist highlighting the information required as set out in the 'Code for Sustainable Homes Ecology Report Template' • Detailed documentary evidence identifying the construction zone and how any areas of ecological value outside the construction zone will remain undisturbed in accordance with the ecologist's recommendations.			O	1		1
Eco 2	Ecological Enhancement	• A copy of the ecologist's report highlighting the information required as set out in 'Code for Sustainable Homes Ecology Report Template' • Detailed documentary evidence stating how the key recommendations and 30% of additional recommendations will be incorporated into the design • The planting schedule of any species to be incorporated from suitably qualified ecologists recommendations			O	1		1
Eco 3	Protection of Ecological Features	• Detailed documentary evidence confirming ecological features present and how they will be protected • Where ecological features are being removed for health and safety and/or conservation reasons; written evidence from an appropriate statutory body / arboriculturalist confirming the requirement to remove any features • Where ecological features are being removed and are of low ecological value; a copy of the ecologist's report highlighting the information required as set out in the Code for Sustainable Homes Ecology Report Template			O	1		1
Eco 4	Change in Ecological Value of Site	• Code for Sustainable Homes Ecology Report template completed by the ecologist • Written confirmation of how the ecologists recommenndations will be implemented including a planting schedule.			O	4		2
Eco 5	Building Footprint	• Calculation of the building footprint ratio, stating the Net Internal Floor Areas (NIFA) and the Net internal Ground Floor Area (NIGFA)	• JTP		O	2		1
					Total:	9	0	6
					Total Percentage:	12	0	8.00

Totals:		
Available Credits:	Credits Achieved	Credits Assumed
100	0	68.33
Code Level:	0	4

Points	Code Level
36	Level 1
48	Level 2
57	Level 3
68	Level 4
84	Level 5
90	Level 6

APPENDIX C

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BREEAM 2011 New Construction Pre-Assessment Estimator

This assessment and indicative BREEAM rating is not a formal certified BREEAM assessment or rating and must not be communicated as such. The score presented is indicative of a buildings potential performance and is based on a simplified pre-formal BREEAM assessment and unverified commitments given at an early stage in the design process.

Building name	Twickenham Sorting Office
Indicative building score (%)	66.58%
Indicative BREEAM rating	Pre-Assessment result indicates potential for BREEAM Very Good rating
Indicative minimum standards level achieved	Pre-Assessment result indicates the minimum standards for Excellent level

MANAGEMENT	Section Weighting	12.00%	Indicative Section Score	7.64%

Man01 Sustainable Procurement

No. of BREEAM credits available	8	Available contribution to overall score	4.36%
No. of BREEAM innovation credits available	1	Minimum standards applicable	Yes

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will roles, responsibilities and a training schedule be defined in accordance with BREEAM?	Yes	1	1	N/A
Will a BREEAM AP be appointed at RIBA stage A/B and performance targets contractually agreed?	Yes	1	1	N/A
Will a BREEAM AP be appointed to monitor and report progress during RIBA stage B-E ?	No	1	0	N/A
Willa BREEAM AP be appointed to monitor and report progress during RIBA stage F-L?	No	1	0	N/A
Will a thermographic survey be conducted and any defects uncovered remedied?	Yes	1	1	Option 1
Will compliant commissioning of building services be carried out?	Yes	1	1	Option 1
Will compliant seasonal commissioning of building services be carried out?	Yes	1	1	Option 1
Will water/energy consumption data be recorded and aftercare support provided for 12 months?	Yes	1	1	Option 1
Will water/energy consumption be recorded/reported for 3 years post construction?	No	1	0	N/A

Total indicative BREEAM credits achieved	6
Total indicative contribution to overall building score	3.27%
Total indicative BREEAM innovation credits achieved	0
Indicative minimum standard(s) level	Pre-Assessment result indicates the minimum standards for Outstanding level

Comments/notes:

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Man02 Responsible Construction Practices

No. of BREEAM credits available	2	Available contribution to overall score	1.09%
No. of BREEAM innovation credits available	1	Minimum standards applicable	Yes

Pre-Assessment question/criteria		Shell & Core option?
Which considerate construction scheme will be used or required to be used by the principal contractor?	Considerate Constructors Scheme	
For the required scheme, what will be the target performance level set for the site/contractor?	A CCS score between 32 and 35.5.	N/A

Total indicative BREEAM credits achieved	2
Total indicative contribution to overall building score	1.09%
Total indicative BREEAM innovation credits achieved	0
Indicative minimum standard(s) level	Pre-Assessment result indicates the minimum standards for Outstanding level

Comments/notes:

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Man03 Construction Site Impacts

No. of BREEAM credits available	5	Available contribution to overall score	2.73%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will site energy consumption be metered/monitored?	Yes	1	1	N/A
Will site water consumption be metered/monitored?	Yes	1	1	N/A
Will the transport of construction materials and waste to/from site be measured/monitored?	Yes	1	1	N/A
Will timber be sourced in accordance with the Government's Timber Procurement Policy?		1	0	N/A
Will/does the principal contractor operate a compliant Environmental Management System?		1	0	N/A
Will the principal contractor adopt best practice pollution prevention policies & procedures?	Yes			

Total indicative BREEAM credits achieved	3
Total indicative contribution to overall building score	1.64%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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Man04 Stakeholder Participation

No. of BREEAM credits available	4	Available contribution to overall score	2.18%
No. of BREEAM innovation credits available	0	Minimum standards applicable	Yes

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will an appropriate level of consultation activities be undertaken?	Yes	1	1	N/A
Will an access statement be developed and appropriate building user facilities provided?	Yes	1	1	N/A
Will building user guides and relevant user information be provided?	Yes	1	1	
Will a post occupancy evaluation assessment be undertaken and information disseminated?	No	1	0	

Total indicative BREEAM credits achieved	3
Total indicative contribution to overall building score	1.64%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	Pre-Assessment result indicates the minimum standards for Outstanding level

Comments/notes:

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Man05 Life cycle cost and service life planning

No. of BREEAM credits available	3	Available contribution to overall score	1.64%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will a feasibility stage Life Cycle Cost (LCC) analysis be commissioned and completed?	No	1	0	N/A
Will a strategic and system level LCC be commissioned and completed?	No	1	0	N/A
Will a technical design LCC to be commissioned and completed?	No	1	0	N/A

Total indicative BREEAM credits achieved	0
Total indicative contribution to overall building score	0.00%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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HEALTH & WELLBEING	Section Weighting	15.00%	Indicative Section Score	10.00%

Hea01 Visual Comfort

No. of BREEAM credits available	4	Available contribution to overall score	4.00%
No. of BREEAM innovation credits available	1	Minimum standards applicable	Yes

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will all fluorescent lamps be fitted with high frequency ballasts?	Yes	N/A	N/A	Option 1
Will all relevant building areas be designed to achieve the appropriate daylight factor(s)?		2		N/A
Will the design provide adequate glare control and view out for building users?		1	0	N/A
Will internal/external lighting be specified in accordance with the relevant CIBSE Guides/British Standards?	Yes	1	1	N/A
Will all relevant building areas be designed to achieve exemplary level daylight factor(s)?		1	0	N/A

Total indicative BREEAM credits achieved	1
Total indicative contribution to overall building score	1.00%
Total indicative BREEAM innovation credits achieved	0
Indicative minimum standard(s) level	Pre-Assessment result indicates the minimum standards for Outstanding level

Comments/notes:

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Hea02 Indoor Air Quality

No. of BREEAM credits available	4	Available contribution to overall score	4.00%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will an air quality plan be produced?	Yes	1	1	N/A
Will the building be designed to minimise sources of internal air pollution?	Yes			
Will the relevant products be specified to meet the VOC testing and emission levels required?	Yes	1	1	Option 1
Will formaldehyde and total VOC levels be measured post construction?	No	1	0	N/A
Will the building be designed to, or have the potential to provide, natural ventilation?	No	1	0	N/A

Total indicative BREEAM credits achieved	2
Total indicative contribution to overall building score	2.00%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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Hea03 Thermal Comfort

No. of BREEAM credits available	2	Available contribution to overall score	2.00%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will thermal modelling of the design be carried out?	Yes	1	1	Option 1
Will the modelling inform the development of a thermal zoning and control strategy?	Yes	1	1	Option 1

Total indicative BREEAM credits achieved	2
Total indicative contribution to overall building score	2.00%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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Hea04 Water Quality

No. of BREEAM credits available	1	Available contribution to overall score	1.00%
No. of BREEAM innovation credits available	0	Minimum standards applicable	Yes

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will all water systems be designed to comply with the relevant HSE Approved Code of Practice and Guidance?	Yes	1	1	Option 1
Where humidification is to be provided, will a failsafe humidification system be specified?	Yes			Option 1
Will a wholesome supply of accessible, clean and fresh drinking water be supplied for building users?	Yes			Option 1

Total indicative BREEAM credits achieved	1
Total indicative contribution to overall building score	1.00%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	Pre-Assessment result indicates the minimum standards for Outstanding level

Comments/notes:

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Hea05 Acoustic Performance

No. of BREEAM credits available	2	Available contribution to overall score	2.00%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will/has a suitably qualified acoustician be appointed to provide appropriate design advice?	Yes			
Will the building meet the relevant acoustic performance standards and testing requirements?	Yes	2	2	N/A

Total indicative BREEAM credits achieved	2
Total indicative contribution to overall building score	2.00%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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Hea06 Safety and Security

No. of BREEAM credits available	2	Available contribution to overall score	2.00%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Where external site areas are present, will safe access be designed for pedestrians and cyclists?	Yes	1	1	N/A
Will a suitably qualified security consultant be appointed and security considerations accounted for?	Yes	1	1	N/A

Total indicative BREEAM credits achieved	2
Total indicative contribution to overall building score	2.00%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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ENERGY	Section Weighting	19.00%	Indicative Section Score	9.88%

Ene01 Reduction of CO_2 Emissions

No. of BREEAM credits available	15	Available contribution to overall score	11.40%
No. of BREEAM innovation credits available	5	Minimum standards applicable	Yes

How do you wish to assess the number of BREEAM credits achieved for this issue?	Define a target number of BREEAM credits achieved		
Select the target number of BREEAM credits for the Ene01 issue	7	BREEAM Innovation credits	

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Total indicative BREEAM credits achieved	7
Total indicative contribution to overall building score	5.32%
Total indicative BREEAM innovation credits achieved	0
Indicative minimum standard(s) level	Pre-Assessment result indicates the minimum standards for Excellent level

Comments/notes:

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Ene02 Energy Monitoring

No. of BREEAM credits available	2	Available contribution to overall score	1.52%
No. of BREEAM innovation credits available	0	Minimum standards applicable	Yes

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will a BMS or sub-meters be specified to monitor energy use from major building services systems?	Yes	1	1	Option 1
Will a BMS or sub-meters be specified to monitor energy use by tenant/building function areas?	Yes	1	1	N/A

Total indicative BREEAM credits achieved	2
Total indicative contribution to overall building score	1.52%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	Pre-Assessment result indicates the minimum standards for Outstanding level

Comments/notes:

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Ene03 External Lighting

No. of BREEAM credits available	1	Available contribution to overall score	0.76%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will external light fittings and controls be specified in accordance with the BREEAM criteria?	Yes	1	1	Option 1

Total indicative BREEAM credits achieved	1
Total indicative contribution to overall building score	0.76%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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Ene04 Low and Zero Carbon Technology

No. of BREEAM credits available	5	Available contribution to overall score	3.80%
No. of BREEAM innovation credits available	1	Minimum standards applicable	Yes

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Compliant LZC feasibility study to be undertaken	Yes	2	1	N/A
What will be the intended scope of the feasibility study?	Operational stage carbon savings/emissions			
Target percentage net reduction in operational stage CO2 emissions		2	0	N/A
Please confirm the intended energy source of the Low and/or zero carbon system?	Please select			
Please select	No	1	0	N/A

Total indicative BREEAM credits achieved	1
Total indicative contribution to overall building score	0.76%
Total indicative BREEAM innovation credits achieved	0
Indicative minimum standard(s) level	Pre-Assessment result indicates the minimum standards for Outstanding level

Comments/notes:

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Ene05 Energy Efficient Cold Storage — **Assessment Issue Not Applicable**

No. of BREEAM credits available	N/A	Available contribution to overall score	N/A
No. of BREEAM innovation credits available	N/A	Minimum standards applicable	N/A

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?

Total indicative BREEAM credits achieved	N/A
Total indicative contribution to overall building score	N/A
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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Ene06 Energy Efficient Transportation Systems — **Assessment Issue Not Applicable**

No. of BREEAM credits available	N/A	Available contribution to overall score	N/A
No. of BREEAM innovation credits available	N/A	Minimum standards applicable	N/A

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?

Total indicative BREEAM credits achieved	N/A
Total indicative contribution to overall building score	N/A
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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Ene07 Energy Efficient Laboratory Systems — **Assessment Issue Not Applicable**

No. of BREEAM credits available	N/A	Available contribution to overall score	N/A
No. of BREEAM innovation credits available	N/A	Minimum standards applicable	N/A

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?

Total indicative BREEAM credits achieved	N/A
Total indicative contribution to overall building score	N/A
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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Ene08 Energy Efficient Equipment

No. of BREEAM credits available	2	Available contribution to overall score	1.52%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria		
Which of the following will be present and likely to be a/the major contributor to 'unregulated' energy use:	Present	Significant majority contributor
Small power/plug in equipment?	Yes	Yes
Swimming pool?	No	
Communal laundry?	No	
Data centre?	No	
IT-intensive operation areas?	No	
Residential areas?	No	
Healthcare?	No	
Kitchen and catering facilities?	Yes	Yes

	Indicative compliance?	Credits available	Indicative credits achieved	Shell & Core option?
Will the significant majority contributor(s) to 'unregulated' energy use (above) meet the BREEAM criteria?	Yes	2	2	N/A

Total indicative BREEAM credits achieved	2
Total indicative contribution to overall building score	1.52%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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Ene09 Drying Space — **Assessment Issue Not Applicable**

No. of BREEAM credits available	N/A	Available contribution to overall score	N/A
No. of BREEAM innovation credits available	N/A	Minimum standards applicable	N/A

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?

Total indicative BREEAM credits achieved	N/A
Total indicative contribution to overall building score	N/A
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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TRANSPORT	Section Weighting	8.00%	Indicative Section Score	6.22%

Tra01 Public Transport Accessibility

No. of BREEAM credits available	5	Available contribution to overall score	4.44%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria

What is the building type category (for the purpose of Tra01 issue assessment)?	Retail
What is the degree of public transport provision for the building's location?	Excellent provision of public transport, i.e. medium urban centre
Building's indicative Accessibility Index	12
Does the building have a dedicated bus service?	

Total indicative BREEAM credits achieved	4
Total indicative contribution to overall building score	3.56%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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Tra02 Proximity to Amenities

No. of BREEAM credits available	1	Available contribution to overall score	0.89%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will the building be in close proximity of and accessible to applicable amenities?	Yes	1	1	N/A

Total indicative BREEAM credits achieved	1
Total indicative contribution to overall building score	0.89%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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Tra03 Cyclist facilities

No. of BREEAM credits available	2	Available contribution to overall score	1.78%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

What is the building type category (for the purpose of Tra03 issue assessment)?	Retail – Individual retail unit

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will cycle storage spaces be provided?	Yes	2	1	N/A
Will cyclist facilities be provided?	No			N/A

Total indicative BREEAM credits achieved	1
Total indicative contribution to overall building score	0.89%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

10 compliant cycle spaces

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Tra04 Maximum Car Parking Capacity — **Assessment Issue Not Applicable**

No. of BREEAM credits available	N/A	Available contribution to overall score	N/A
No. of BREEAM innovation credits available	N/A	Minimum standards applicable	N/A

Building type category (for the purpose of Tra04 issue)?	
Buildings indicative Accessibility Index (sourced from issue Tra01)	

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will the building meet BREEAM's maximum parking capacity criteria for this building type/Accessibility Index?				

Total indicative BREEAM credits achieved	N/A
Total indicative contribution to overall building score	N/A
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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Tra05 Travel Plan

No. of BREEAM credits available	1	Available contribution to overall score	0.89%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will a transport plan based on site specific travel survey/assessment be developed?	Yes	1	1	N/A

Total indicative BREEAM credits achieved	1
Total indicative contribution to overall building score	0.89%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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WATER	Section Weighting	6.00%	Indicative Section Score	3.75%

Wat01 Water Consumption

No. of BREEAM credits available	5	Available contribution to overall score	3.75%
No. of BREEAM innovation credits available	1	Minimum standards applicable	Yes

		Shell & Core option?
Select the level that corresponds closely to the target or likely water component specification?	Level 2 - Two credits	N/A

Total indicative BREEAM credits achieved	2
Total indicative contribution to overall building score	1.50%
Total indicative BREEAM innovation credits achieved	0
Indicative minimum standard(s) level	Pre-Assessment result indicates the minimum standards for Outstanding level

Comments/notes:

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Wat02 Water Monitoring

No. of BREEAM credits available	1	Available contribution to overall score	0.75%
No. of BREEAM innovation credits available	0	Minimum standards applicable	Yes

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will there be a water meter on the mains water supply to the building(s)?	Yes	1	1	Option 1
Will metering/monitoring equipment be specified on the water supply to any relevant plant/building areas?	Yes			
Will all specified water meters have a pulsed output?	Yes			
If the site/building has an existing BMS connection, will all pulsed meters be connected to the BMS?	Yes			

Total indicative BREEAM credits achieved	1
Total indicative contribution to overall building score	0.75%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	Pre-Assessment result indicates the minimum standards for Outstanding level

Comments/notes:

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Wat03 Water Leak Detection and Prevention

No. of BREEAM credits available	2	Available contribution to overall score	1.50%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will a mains water leak detection system be installed on the building's mains water supply?	Yes	1	1	N/A
Will flow control devices be installed in each sanitary area/facility?	Yes	1	1	Option 1

Total indicative BREEAM credits achieved	2
Total indicative contribution to overall building score	1.50%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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Wat04 Water Efficient Equipment — **Assessment Issue Not Applicable**

No. of BREEAM credits available	N/A	Available contribution to overall score	N/A
No. of BREEAM innovation credits available	N/A	Minimum standards applicable	N/A

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?

Total indicative BREEAM credits achieved	N/A
Total indicative contribution to overall building score	N/A
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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MATERIALS	Section Weighting	12.50%	Indicative Section Score	9.38%

Mat01 Life Cycle Impacts

No. of BREEAM credits available	5	Available contribution to overall score	5.21%
No. of BREEAM innovation credits available	1	Minimum standards applicable	No

Pre-Assessment question/criteria

How do you wish to assess the number of BREEAM credits achieved for this issue?	Define a target number of BREEAM credits to be achieved		
Select the number of BREEAM credits being targeted for the Mat01 issue	3	BREEAM Innovation credits	

Total indicative BREEAM credits achieved	3
Total indicative contribution to overall building score	3.13%
Total indicative BREEAM innovation credits achieved	0
Indicative minimum standard(s) level	N/A

Comments/notes:

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Mat02 Hard Landscaping and Boundary Protection

No. of BREEAM credits available	1	Available contribution to overall score	1.04%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will ≥80% of all external hard landscaping and boundary protection achieve a Green Guide A or A+ rating?	Yes	1	1	N/A

Total indicative BREEAM credits achieved	1
Total indicative contribution to overall building score	1.04%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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Mat03 Responsible Sourcing

No. of BREEAM credits available	3	Available contribution to overall score	3.13%
No. of BREEAM innovation credits available	1	Minimum standards applicable	Yes

Pre-Assessment question/criteria

How do you wish to assess the number of BREEAM credits achieved for this issue?	Define a target number of BREEAM credits		
Select the number of BREEAM credits being targeted for the Mat03 issue	2	BREEAM Innovation credits	
Will all timber used on the project be sourced in accordance with the UK Govt's Timber Procurement Policy?	Yes		

Total indicative BREEAM credits achieved	2
Total indicative contribution to overall building score	2.08%
Total indicative BREEAM innovation credits achieved	0
Indicative minimum standard(s) level	Pre-Assessment result indicates the minimum standards for Outstanding level

Comments/notes:

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Mat04 Insulation

No. of BREEAM credits available	2	Available contribution to overall score	2.08%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Is the building targeting an insulating index of 2 or more?	Yes	1	1	N/A
Will the building's insulating materials be responsibly sourced?	Yes	1	1	N/A

Total indicative BREEAM credits achieved	2
Total indicative contribution to overall building score	2.08%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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Mat05 Designing for Robustness

No. of BREEAM credits available	1	Available contribution to overall score	1.04%
No. of BREEAM innovation credits available	0	Minimum standards applicable	N/A

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will suitable durability/protection measures be specified and installed to vulnerable areas of the building?	Yes	1	1	Option 1

Total indicative BREEAM credits achieved	1
Total indicative contribution to overall building score	1.04%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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WASTE	Section Weighting	7.50%	Indicative Section Score	6.25%

Wst01 Construction Waste Management

No. of BREEAM credits available	4	Available contribution to overall score	5.00%
No. of BREEAM innovation credits available	1	Minimum standards applicable	Yes

Pre-Assessment question/criteria

How do you wish to assess the number of BREEAM credits achieved for this issue?	Define a target number of BREEAM credits to be achieved		
Select the number of BREEAM credits being targeted for the Wst01 issue	3	BREEAM Innovation credits	

Total indicative BREEAM credits achieved	3
Total indicative contribution to overall building score	3.75%
Total indicative BREEAM innovation credits achieved	0
Indicative minimum standard(s) level	Pre-Assessment result indicates the minimum standards for Outstanding level

Comments/notes:

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Wst02 Recycled Aggregates

No. of BREEAM credits available	1	Available contribution to overall score	1.25%
No. of BREEAM innovation credits available	1	Minimum standards applicable	No

Pre-Assessment question/criteria

How do you wish to assess the number of BREEAM credits achieved for this issue?	Define a target number of BREEAM credits to be achieved		
Select the number of BREEAM credits being targeted for the Wst02 issue	1	BREEAM Innovation credits	

Total indicative BREEAM credits achieved	1
Total indicative contribution to overall building score	1.25%
Total indicative BREEAM innovation credits achieved	0
Indicative minimum standard(s) level	N/A

Comments/notes:

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Wst03 Operational Waste

No. of BREEAM credits available	1	Available contribution to overall score	1.25%
No. of BREEAM innovation credits available	0	Minimum standards applicable	Yes

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will appropriate facilities for the storage of operational recyclable waste volumes be provided?	Yes	1	1	N/A
If relevant, will a static waste compactor(s) or baler(s) be specified/installed?	N/A			N/A
If relevant, will a vessel for composting suitable organic waste be specified/installed?	N/A			N/A

Total indicative BREEAM credits achieved	1
Total indicative contribution to overall building score	1.25%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	Pre-Assessment result indicates the minimum standards for Outstanding level

Comments/notes:

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Wst04 Speculative Floor and Ceiling Finishes — **Assessment Issue Not Applicable**

No. of BREEAM credits available	N/A	Available contribution to overall score	N/A
No. of BREEAM innovation credits available	N/A	Minimum standards applicable	N/A

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?

Total indicative BREEAM credits achieved	N/A
Total indicative contribution to overall building score	N/A
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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LAND USE & ECOLOGY	Section Weighting	10.00%	Indicative Section Score	5.00%

LE01 Site Selection

No. of BREEAM credits available	2	Available contribution to overall score	2.00%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will at least 75% of the proposed development's footprint be located on previously been developed land?	Yes	1	1	N/A
Is the site deemed to be significantly contaminated?	No	1	0	N/A

Total indicative BREEAM credits achieved	1
Total indicative contribution to overall building score	1.00%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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LE02 Ecological Value of Site and Protection of Ecological Features

No. of BREEAM credits available	1	Available contribution to overall score	1.00%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Can the land within the construction zone be defined as 'land of low ecological value'?	Yes	1	1	N/A
Will all features of ecological value surrounding the construction zone/site boundary be protected?	Yes			N/A

Total indicative BREEAM credits achieved	1
Total indicative contribution to overall building score	1.00%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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LE03 Mitigating Ecological Impact

No. of BREEAM credits available	2	Available contribution to overall score	2.00%
No. of BREEAM innovation credits available	0	Minimum standards applicable	Yes

Pre-Assessment question/criteria

What is the likely change in ecological value (plant species richness) as a result of the sites development?	Small negative change in plant species richness

Total indicative BREEAM credits achieved	1
Total indicative contribution to overall building score	1.00%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	Pre-Assessment result indicates the minimum standards for Outstanding level

Comments/notes:

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LE04 Enhancing Site Ecology

No. of BREEAM credits available	3	Available contribution to overall score	3.00%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will a suitably qualified ecologist be appointed to report on enhancing and protecting site ecology?	Yes	3	2	N/A
Will the suitably qualified ecologists general recommendations be implemented?	Yes			
What is the targeted/intended improvement in ecological value as a result of enhancement actions?	Small improvement in plant species richness			

Total indicative BREEAM credits achieved	2
Total indicative contribution to overall building score	2.00%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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LE05 Long Term Impact on Biodiversity

No. of BREEAM credits available	2	Available contribution to overall score	2.00%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will the building meet BREEAM's mandatory criteria for this BREEAM issue?		2	0	N/A
Will a Biodiversity Champion be appointed to monitor/minimise impacts of site activities on biodiversity?				
Will the contractor provide training for the site workforce on how to protect ecology during the project?				
Will the contractor record actions to protect biodiversity and monitor their effectiveness during construction?				
Will a new ecologically valuable habitat, appropriate to the local area, be created?				
Where flora/fauna habitats exist on site, will the contractor programme site works to minimise disturbance?				

Total indicative BREEAM credits achieved	0
Total indicative contribution to overall building score	0.00%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

BREEAM®

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POLLUTION	Section Weighting	10.00%	Indicative Section Score	8.46%

Pol01 Impact of Refrigerants

No. of BREEAM credits available	3	Available contribution to overall score	2.31%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will refrigerant containing systems be installed in the assessed building?	Yes	2	2	Option 1
Is the Global Warming Potential of the specified refrigerant(s) likely to be 10 or less?	Yes			
What is the target range Direct Effect Life Cycle CO_2eq. emissions for the system?		kgCO2eq/kW coolth capacity		
Will a refrigerant leak detection and containment system be specified/installed?	Yes	1	1	Option 1

Total indicative BREEAM credits achieved	3
Total indicative contribution to overall building score	2.31%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

BREEAM®

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Pol02 NO_x Emissions

No. of BREEAM credits available	3	Available contribution to overall score	2.31%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response		Shell & Core option?
Please enter the target/maximum NO_x emission level for space heating system	40.00	mg/kWh	Option 1

Total indicative BREEAM credits achieved	3
Total indicative contribution to overall building score	2.31%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

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Pol03 Surface Water Run off

No. of BREEAM credits available	5	Available contribution to overall score	3.85%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
What is the actual/likely annual probability of flooding for the assessed site?	High	2	1	N/A
Will a Flood Risk Assessment be undertaken and ground level of the building/access meet BREEAM criteria?	Yes			N/A
Will the site meet the BREEAM criteria for peak rate surface water run off?	Yes	1	1	N/A
Will the site meet the criteria for surface water run off volume, attenuation and/or limiting discharge?	Yes	1	1	N/A
Will the site be designed to minimise watercourse pollution in accordance with the BREEAM criteria?	No	1	0	N/A

Total indicative BREEAM credits achieved	3
Total indicative contribution to overall building score	2.31%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

BREEAM®

BREEAM 2011 New Construction Pre-Assessment Estimator

Pol04 Reduction of Night Time Light Pollution

No. of BREEAM credits available	1	Available contribution to overall score	0.77%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will the external lighting be designed to reduce light pollution?	Yes	1	1	Option 1

Total indicative BREEAM credits achieved	1
Total indicative contribution to overall building score	0.77%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

BREEAM®

BREEAM 2011 New Construction Pre-Assessment Estimator

Pol05 Noise Attenuation

No. of BREEAM credits available	1	Available contribution to overall score	0.77%
No. of BREEAM innovation credits available	0	Minimum standards applicable	No

Pre-Assessment question/criteria	Response	Credits available	Indicative credits achieved	Shell & Core option?
Will there be, or is there noise-sensitive areas/buildings within 800m radius of the development?	Yes	1	1	
Will a noise impact assessment be completed and, if applicable, noise attenuation measures specified?	Yes			N/A

Total indicative BREEAM credits achieved	1
Total indicative contribution to overall building score	0.77%
Total indicative BREEAM innovation credits achieved	N/A
Indicative minimum standard(s) level	N/A

Comments/notes:

BREEAM®

BREEAM 2011 New Construction Pre-Assessment Estimator

INNOVATION	Section Weighting	10.00%	Indicative Section Score	0.00%

Inn01 Innovation

No. of BREEAM innovation credits available	10	Available contribution to overall score	10.00%
		Minimum standards applicable	No

Pre-Assessment question/criteria	Exemplary level achieved	Credits available	Indicative credits achieved
Man01 Sustainable Procurement	No	1	0
Man02 Responsible Construction Practices	No	1	0
Hea01 Visual Comfort	No	1	0
Ene01 Reduction of CO2 Emissions	No	5	0
Ene04 Low and Zero Carbon Technology	No	1	0
Ene05 Energy Efficient Cold Storage	N/A	N/A	N/A
Wat01 Water Consumption	No	1	0
Mat01 Life Cycle Impacts	No	1	0
Mat03 Responsible Sourcing of Materials	No	1	0
Wst01 Construction Waste Management	No	1	0
Wst02 Recycled Aggregates	No	1	0

Total indicative BREEAM credits achieved	0
Total indicative contribution to overall building score	0.00%
Indicative minimum standard(s) level	N/A

Comments/notes:

APPENDIX D

LBRUT SUSTAINABLE CONSTRUCTION CHECKLIST

TO BE FILLED IN FOR ALL RESIDENTIAL DEVELOPMENT PROVIDING ONE OR MORE NEW RESIDENTIAL UNITS, AND ALL OTHER FORMS OF DEVELOPMENT PROVIDING 100sqm OR MORE OF NON-RESIDENTIAL DEVELOPMENT

ALL OTHER CLASSES OF DEVELOPMENT ARE ENCOURAGED TO COMPLY WITH THIS CHECKLIST

This document forms part of the Sustainable Construction Checklist SPD, and **should be read in conjunction with the associated Guidance Document**. Where further information is requested, please either fill in the relevant section, or refer to the document where this information may be found in detail, e.g. Flood Risk Assessment or similar. Scores will be awarded for different achievements on site, and a final score attributed to the site as a whole.

Property Name (if relevant):	Former Royal Mail Sorting Office, Twickenham	Application No. (if known):	
Development Type	Residential - led mixed use development		
Address (include. postcode)	The Former Royal Mail Sorting Office, Twickenham, TW1 1AA		
Completed by:	St James Group Ltd		

MINIMUM POLICY COMPLIANCE

Please check the Sustainable Construction webpage for the policy requirements

Environmental Rating of development:

	Rating achieved		
Residential new-build			
Code for Sustainable Homes Level	Code Level 4	A pre-assessment is required to support this. Has this been provided?	☐
Non-Residential new-build (100sqm or more)			
BREEAM Level	BREEAM Very Good	A pre-assessment is required to support this. Has this been provided?	☐
Extensions and conversions (residential dwellings)			
EcoHomes Level	Please Select	A pre-assessment is required to support this. Has this been provided?	☐
If other environmental rating sought please state:			

Score awarded for Environmental Rating (this will only be awarded once a pre-assessment is submitted to verify the level achieved): **Score** 8

CSH: Level 3 = *4*, Level 4 = *8*, Level 5 = *16*, Level 6 = *20*
BREEAM: Good = *0*, Very Good = *0*, Excellent = *8*, Outstanding = *16*
EcoHomes: Good = *0*, Very Good = *0*, Excellent = *8*

Accredited Assessors *(Please see Guidance document for more details on accredited assessors)*

Have you used a licensed Code for Sustainable Homes, EcoHomes and BREEAM Accredited Assessor respectively? ☐

Energy Assessment *(Please see Justification & Guidance document for more details on how to prepare an Energy Assessment)*

An energy assessment is required that demonstrates the expected energy and carbon dioxide emissions saving from energy efficiency and renewable energy measures, including the feasibility of CHP/CCHP and community heating systems. Has this been submitted? If yes, please tick. ☐

Carbon Dioxide emissions reduction *(Please see Justification & Guidance document for more details on how to calculate these figures as part of the Energy Assessment)*

- Percentage of **total** site CO_2 emissions saved through renewable energy installation? 18.8
- Percentage of **regulated** CO_2 emissions saved below Building Regulations target level through all low carbon measures? 35.5

1. ENERGY USE AND POLLUTION

1.1 Need for Cooling — *Score*

a. How does the development incorporate cooling measures? Tick all that apply:

- Energy efficient design incorporating specific heat demand to less than or equal to 15 kWh/sqm — *6* ☐
- Reduce heat entering a building through providing/improving insulation and living roofs and walls — *2* ☐
- Reduce heat entering a building through shading — *3* ☐
- Exposed thermal mass and high ceilings — *4* ☐
- Passive ventilation — *3* ☐
- Mechanical ventilation with heat recovery — *1* ☐
- Active cooling systems, i.e. Air Conditioning Unit — *0* ☐

1.2 Heat Generation

b. How have the heating and cooling systems, with preference to the heating system hierarchy, been selected (defined in London Plan policy 4A.6)? Tick the heating and cooling system that will be used in the development:

- Connect to existing CCHP/CHP networks — *6* ☐
- Site-wide CCHP/CHP powered by renewable energy — *5* ☐
- Gas-fired CCHP/CHP — *4* ☐
- Communal heating/cooling powered by renewable energy — *3* ☐
- Communal heating/cooling powered by gas — *2* ☐
- Individual heating/cooling powered by renewable energy — *1* ☐
- Individual heating/cooling powered by gas or electricity — *0* ☐

1.3 Pollution: Air, Noise and Light

a. Does the development plan to implement reduction strategies for dust emissions from construction sites? — *2* ☐

b. Does the development plan to include a biomass boiler? — *-* ☐

- If yes, please refer to the biomass guidelines for the Borough of Richmond, and see guidance for supplementary information. If the proposed boiler is of a qualifying size, you may need to complete the information request form found on the Richmond websit — *-* ☐

c. Please tick only one option below

- Has the development taken measures to reduce existing noise and enhance the existing soundscape of the site? — *3* ☐
- Has the development taken care to not create any new noise generation/transmission issues in its intended operation? — *1* ☐

d. Has the development taken measures to reduce light pollution impacts on character, residential amenity and biodiversity? — *3* ☐

e. Have you attached a Lighting Pollution Report? — *-* ☐

Subtotal **19.0**

Please give any additional relevant comments to the Energy Use and Pollution Section below

2. TRANSPORT

2.1 Provision for the safe efficient and sustainable movement of people and goods

a. Does your development provide opportunities for occupants to use innovative travel technologies, such as electric cars? *2*

b. **For major developments ONLY**: Has a Transport Assessment been produced for your development based on TfL's Best Practice Guidance?
- If you have provided a Transport Assessment as part of your planning application, please tick here and move to Section 3 of this Checklist. *5*

c. **For smaller developments ONLY**: Have you provided a Transport Statement? *5*

d. Does your development provide cycle storage? *2*
- If so, for how many bicycles?
- Is this shown on the site plans? *-*

e. Will the development create or improve links with local and wider transport networks? If yes, please provide details below. *2*

Subtotal 7.0

Please give any additional relevant comments to the Transport Section below

Riverside footpath, permeability through site

3 BIODIVERSITY

3.1 Minimising the threat to biodiversity from new buildings, lighting, hard surfacing and people

a. Does your development involve the loss of an ecological feature or habitat, including a loss of garden or other green space compared to the pre-development site? (Tick if yes) *-2*
- If so, please state how much in sqm? sqm

b. Does your development involve the removal of any tree(s)? (Tick if yes) *-*
- If so, has a tree report been provided in support of your application? (Tick if yes) *-*

c. Does your development plan to add any tree(s) on site? (Tick if yes) *-*

d. Please indicate which features and/or habitats that your development will incorporate to improve on site biodiversity:

• Pond, reedbed or extensive native planting	*6*	Area provided:		sqm
• An extensive green roof	*5*	Area provided:		sqm
• An intensive green roof	*4*	Area provided:		sqm
• A brown roof	*1*	Area provided:		sqm
• Garden space	*4*	Area provided:	1274.8	sqm
• Additional native and/or wildlife friendly planting to peripheral areas	*3*	Area provided:		sqm
• Additional planting to peripheral areas	*2*	Area provided:		sqm
• A living wall	*2*	Area provided:		sqm
• Bat boxes	*0.5*			
• Bird boxes	*0.5*			
• Other	*0.5*			

Subtotal 13.0

Please give any additional relevant comments, including specific reasons why living roofs cannot be incorporated in proposals with roof plate areas of 100sqm or more should this be the case, to the Biodiversity Section below

4 FLOODING AND DRAINAGE

4.1 Reducing and mitigating the risks of flooding and other impacts of climate change in the borough

a. Is your site located in an area at risk of flooding? (Tick if yes) - ☐

If yes, please tick only ONE option below:

- New development in a high flood risk zone (3a) *-2* ☐
- New development in a medium flood risk zone (2) *-1* ☐
- Redevelopment of an existing building or conversion *0* ☐

Is your development within 20 metres of a watercourse or a flood defence? (Tick if yes) - ☐

Have you submitted a Flood Risk Assessment? (Tick if yes) - ☐

b. Which of the following measures of the drainage hierarchy are incorporated onto your site? (tick all that apply)

- Store rainwater for later use *5* ☐
- Use of infiltration techniques such as porous surfacing materials to allow drainage on-site *3* ☐
- Attenuate rainwater in ponds or open water features *4* ☐
- Store rainwater in tanks for gradual release to a watercourse *3* ☐
- Discharge rainwater directly to watercourse *2* ☐
- Discharge rainwater to surface water drain *1* ☐
- Discharge rainwater to combined sewer *0* ☐

c. Please give the change in area of permeable surfacing which will result from your development proposal: +2021 sqm

Please provide details of the permeable surfacing below *please represent a loss in permeable area as a negative number*

Subtotal **8.0**

Please give any additional relevant comments to the Flooding and Drainage Section below

The site is divided into 3 sub catchments for assessing the drainage and there is an overall reduction in the IMPermeable area across the site through reducing hardstanding areas and providing soft landscaping measures: catchment A- no change in permeable area; catchment B- increase of 400m2 permeable area, catchment C - increase of 1,621m2 permeable area- this information is provided on RSK Figure 1: Drainge Layout

5 IMPROVING RESOURCE EFFICIENCY

5.1 Reduce waste generated and amount disposed of by landfill though increasing level of re-use and recycling

a. Will demolition be required on your site prior to construction? 0
- Will 10% of demolition waste or more be reused in the new development? 1
- Will 15% of demolition waste or more be recycled? 1

b. Does your site have any contaminated land or has the site previously been used for potentially contaminating uses? 1
- Have you submitted an assessment of the site contamination? 2
- Are plans in place to remediate the contamination? 2
- Have you submitted a remediation plan? 1

c. Are plans in place to include composting on site? 1

5.2 Reducing levels of water waste

a. Will the following measures of water conservation be incorporated into the development? (Please tick all that apply):
- Fitting of water efficient taps, shower heads, dual flush toilets etc 1
- Use of water efficient A or B rated appliances 1
- Rainwater harvesting for internal use 4
- Greywater systems 4
- Fit a water meter 1

b. What is the water consumption target of the development (in litres per person per day?) 105 litres per person per day
- The recommended target for conversions or other small scale residential properties is 105 litres/person/day. Will this be met? (Indicate if yes) 1

c. If applicable, have you submitted evidence that capacity exists in the public sewerage and water supply network?

Subtotal 11.0

Please give any additional relevant comments, including reasons why the water consumption target has not been met should this be the case, to the Improving Resource Efficiency Section below

6 DESIGN STANDARDS AND ACCESSIBILITY

6.1 Ensure flexible adaptable and long-term use of structures

a. **If the development is residential**, will it meet the requirements set out in the Residential Design Standards SPD for internal space and layout? *1*

- If the standards are not met, in the space below, please provide details of the functionality of the internal space and layout.

AND

b. **If the development is residential**, will it meet the criteria included in the Lifetime Home Standards? *2*

- If not all Lifetime Homes criteria are to be met, in the space below, please provide details of any accessibility measures included in the development.

c.

- Are 10% or more of the units in the development wheelchair accessible? *1*

OR

d. **If the development is non-residential,** does it comply with requirements included in Richmond's Design for Maximum Access SPG? *2*

- Please provide details of the accessibility measures specified in the Maximum Access SPG that will be included in the development

Pedestrian ramp & steps to riverside - to specifications of 4.0 of SPG. Entrances/Doors/Lobbies to specifications of 5.0. Toilets to specifications of 6.0.

Subtotal 4

Please give any additional relevant comments to the Design Standards and Accessibility Section below

A total of 9 of the 82 apartments have been designed as wheelchair adaptable apartments. This equates to 10.9% of the apartments, and 8.2% of the overall units. Points have also been taken for compliance with Richmond's Design for Maximum Access SPG as part of the development is for non-residential uses.

LBRUT Sustainable Construction Checklist- Scoring Matrix

TOTAL *70*

Score for new construction	Score for extensions or conversions	Rating	Significance
80 or more	*70 or more*	*A+*	Project strives to achieve highest standard in energy efficient sustainable development
71-79	*61-69*	*A*	Makes a major contribution towards achieving sustainable development in Richmond
51-70	*41-60*	*B*	Helps to significantly improve the Borough's stock of sustainable developments
36-50	*26-40*	*C*	Minimal effort to increase sustainability beyond general compliance
35 or less	*25 or less*	*FAIL*	Does not comply with planning policies on sustainabililty and climate change

Authorisation:

I herewith declare that I have filled in this form to the best of my knowledge

Signature _____ Date _____