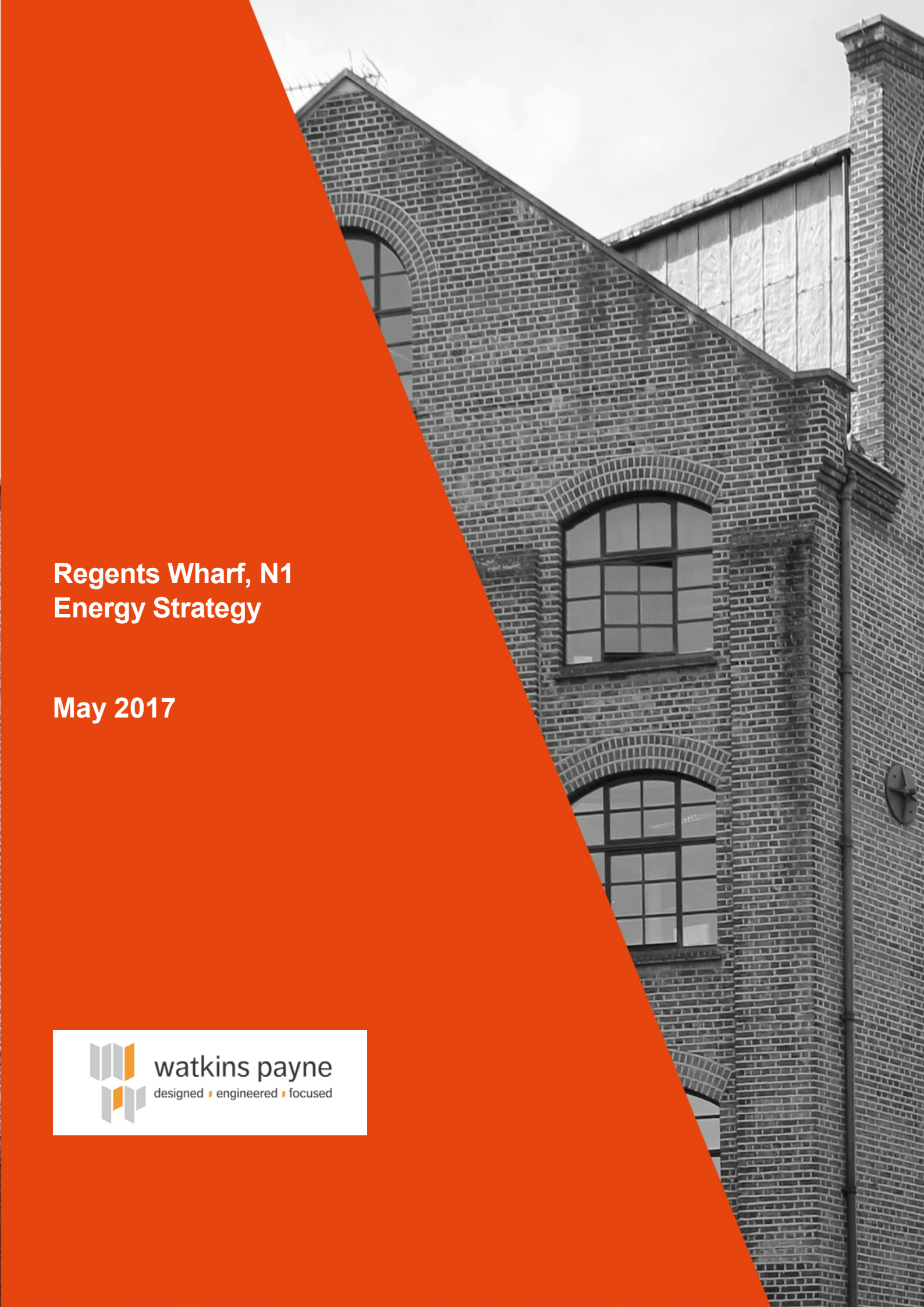

Regents Wharf, N1
Energy Strategy

May 2017

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designed engineered focused

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designed engineered focused

Regent's Wharf
London

Energy Strategy

For Planning Submission

Client Name:	Regent's Wharf Unit Trust
Client Address:	4 Sloane Terrace London SW1X 9DQ
Property:	Regent's Wharf
Project Reference:	3840
Issue:	For Planning Submission
Date:	May 2017
Prepared by:	AC
Checked by:	SRM
Validated by:	SRM

CONTENTS

EXECUTIVE SUMMARY

The energy strategy adopts a hierarchical approach using passive and low energy design technologies to reduce baseline energy demand and CO_2 emissions followed by the application of low and zero carbon technologies. This strategy is in line with the relevant GLA Policies from the Further Alterations to the London Plan 2015 and the related supplementary guidance. In accordance with the April 2014 issue of the GLA SPG 'Sustainable Design and Construction' the target carbon emission savings for this energy strategy are 35% less than a Building Regulations Part L2A:2013 baseline.

The document will also assess and report the energy efficiency and CO2 reduction opportunities for the development based on policy and guidance from the Islington Council.

The focus of this energy strategy is on CO_2 reduction by using a highly efficient building envelope with high efficiency mechanical and electrical services, communal heating and cooling systems and renewable technology. The result is a proposed development with predicted performance of:

- The development achieves a 37.44 % reduction in carbon when compared to a Building Regulation 2013 compliant building as required by the London Plan.
- CO_2 emissions reduction of 28.41 % over the Building Regulations 2013 compliant baseline scheme when regulated and unregulated energy use is taken into account.
- The energy strategy is predicted, using the Building Regulations calculation methodologies, to achieve an annual development carbon emission saving of 78.02 tonnes over the baseline scheme.

The carbon dioxide emission and savings values for the development as a whole are as follows:

	CO_2 Emissions (Tonnes per annum)	
	Regulated	**Unregulated**
Baseline Building Regulations 2013 Part L Compliant Development	208.39	513.03
After passive/low energy (energy demand) reduction	164.45	401.36
After renewable energy	130.37	367.28

	Regulated CO_2 Savings	
	Tonnes per annum	**%**
Savings from passive/low energy (energy demand) reduction	43.94	21.09
Savings from renewable energy	34.08	16.35
Total Cumulative Savings	**78.02**	**37.44**

1.00 INTRODUCTION

1.01 Purpose

This report has been prepared on behalf of Regent's Wharf Unit Trust for the proposed Regent's Wharf development. The report contains the predicted energy and carbon emission assessment results and identifies savings from proposed low and zero carbon (renewable) technologies to be incorporated into the scheme.

The energy and carbon dioxide emission assessment has been undertaken using dynamic simulation modelling software TAS Version 9.4 for the commercial areas. Based on the building design submitted with the planning application the modelling will identify the energy and carbon dioxide savings related to the building envelope design and efficient mechanical and electrical services systems followed by the improvement using the proposed low and zero carbon (renewable) technologies for the scheme.

1.02 Existing Buildings

The existing buildings 10, 12, 14, 16 and 18 at Regents Wharf comprise general office accommodation. A restaurant unit is provided at ground level facing the Regent's Canal.

1.03 Proposed Development

Redevelopment of the site at Regent's Wharf including the demolition of 14, 16 and 18 Regent's Wharf; construction of a seven storey building providing Class B1 office floor A1/A3/B1/D1/D2 space and class floor space at ground floor; refurbishment and extension of 10-12 Regent's Wharf to provide additional Class B1 floor space with ancillary Class A1/A3 restaurant and Class A1/B1/D1 floor space at ground floor and associated hard and soft landscaping.

1.04 Reservation

This report has been prepared solely for the use of the applicant and Watkins Payne Partnership accept no responsibility for its use by any third parties.

2.00 POLICY REVIEW

2.01 National Policy

The National Planning Policy Framework sets out the planning policies for England that are to be taken into account within local planning policies. The framework itself does not have specific policies but identifies the purpose of achieving sustainable development.

2.02 Further Alterations to the London Plan 2015

The Further Alterations to the London Plan 2015 identifies key policies associated with building design and energy strategy as noted below:

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) outline in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.

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 decentralised 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 through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere.*

Policy 5.5 Decentralised Energy Networks

Strategic

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

Policy 5.6 Decentralised Energy in Development Proposals

Planning Decisions

A *Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.*

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

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

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

Policy 5.7 Renewable Energy

Strategic

A *The Mayor seeks to increase the proportion of energy generated from renewable sources, and expects that the projections for installed renewable energy capacity outlined in the Climate Change Mitigation and Energy Strategy and in supplementary planning guidance will be achieved in London.*

Policy 5.9 Overheating and Cooling

Strategic

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

Planning Decisions

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

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

C Major development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs. New development in London should also be designed to avoid the need for energy intensive air conditioning systems as much as possible.

2.03 GLA Supplementary Planning Guidance

The Further Alterations to the London Plan 2015 (FALP 2015) is supported by various supplementary planning guidance (SPG) that includes "Sustainable Design and Construction" dated April 2014 that relates specifically to sustainability issues.

The Sustainable Design and Construction SPG sets out the Mayor's priorities and the Mayor's best practice for new developments encompassing a wide range of sustainability topics.

The major change to the carbon emission savings targets for the April 2014 edition of the SPG is that the overall saving target is benchmarked against a Building Regulations Part L2A:2013 Baseline and not Part L2A:2010. This change gives a revised carbon emission reduction target of 35% less than Part L2A:2013.

The relevant sections from the Sustainable Design and Construction SPG are as follows:

Energy and Carbon Dioxide Emissions	
Mayor's Priority	**FALP Policy**
The overall carbon dioxide emissions from a development should be minimized through the implementation of the energy hierarchy set out in the FALP 2015 Policy 5.2.	5.2, 5.3
Developments should be designed to meet the following Regulated carbon dioxide standards, in line with FALP 2015 Policy 5.2.	5.2
Non-Domestic Buildings • Year - Improvements beyond 2010 Building Regulations. • 1st October 2013 – 2016 – 40 per cent • 2016 – 2019 – As per Building Regulation requirements • 2019 – 2031 – Zero carbon	
Mayor's Best Practice	**FALP Policy**
Developments should contribute to ensuring resilient energy infrastructure and a reliable energy supply, including from local low and zero carbon sources.	501, 5.5, 5.6, 5.7, 5.8, 5.17
Developers are encouraged to include innovative low and zero carbon technologies to minimize carbon dioxide emissions within developments and keep up to date with rapidly improving technologies.	5.2, 5.17
Energy Demand Assessment	
Mayor's Priority	**FALP Policy**
Development applications are to be accompanied by an energy demand assessment.	5.2
Use Less Energy	
Mayor's Priority	**FALP Policy**
The design of developments should prioritise passive measures.	5.2, 5.3, 5.9
Mayor's Best Practice	**FALP Policy**
Developers should aim to achieve Part L 2013 Building Regulations requirements through design and energy efficiency alone, as far as is practical.	5.2, 5.3
Efficient Energy Supply	
Mayor's Priority	**FALP Policy**
Where borough heat maps have identified district heating opportunities, boroughs should prepare more detailed Energy Master Plans (EMPs) to establish the extent of market competitive district heating networks.	5.5, 5.6
Mayor's Priority	**FALP Policy**
Developers should assess the potential for their development to: • connect to an existing district heating or cooling network; • expand an existing district heating or cooling network, and connect to it; or • establish a site wide network, and enable the connection of existing buildings in the vicinity of the development.	5.5, 5.6

Mayor's Priority	FALP Policy
Where opportunities arise, developers generating energy or waste heat should maximize long term carbon dioxide savings by feeding the decentralized energy network with low or zero carbon hot, and where required, cold water.	5.5, 5.6
Renewable Energy	
Mayor's Priority	**FALP Policy**
Boroughs and neighbourhoods should identify opportunities for the installation of renewable energy technologies in their boroughs and neighbourhoods.	5.4, 5.7
Major development should incorporate renewable energy technologies to minimize overall carbon dioxide emissions, where feasible.	5.7
Carbon Dioxide Off-setting	
Mayor's Priority	**FALP Policy**
Boroughs should establish a carbon off-set fund and identify suitable projects to be funded.	5.2, 5.4
Where developments do not achieve the Mayor's carbon dioxide reduction targets set out in FALP 2015 Policy 5.2, the developer should make a contribution to the local borough's carbon dioxide off-setting fund.	5.2, 5.4
Retrofitting	
Mayor's Priority	**FALP Policy**
Boroughs should set out policies to encourage the retrofitting of carbon dioxide and water saving measures in their borough.	5.4, 5.15
Where works to existing developments are proposed developers should retrofit carbon dioxide and water saving measures.	5.4, 5.15
Monitoring Energy Use	
Mayor's Best Practice	**FALP Policy**
Developers are encouraged to incorporate monitoring equipment and systems where appropriate to enable occupiers to monitor and reduce their energy use.	5.2, 5.3
Supporting a Resilient Energy Supply	
Mayor's Best Practice	**FALP Policy**
Developers are encouraged to incorporate equipment that would enable their schemes to participate in demand side response opportunities.	5.2, 5.3
Climate Change Adaptation	
Tackling Increased Temperature and Drought	
Overheating	
Mayor's Priority	**FALP Policy**
Developers should include measures, in the design of their schemes, in line with the cooling hierarchy set out in FALP 2015 Policy 5.9 to prevent overheating over the schemes life-time.	5.3, 5.9

Summary of relevant Policies from Islington Council

CS10 (A) - promotes zero carbon development by requiring all development to demonstrate it has minimised on-site CO2 emissions, supports development of decentralised energy networks and offsets all remaining CO2 emissions; establishes CO_2 reduction targets for major developments.

DM7.1 – promotes renewable energy development in principle and sets out requirements for submitting details of sustainable design and construction and - for major developments - providing a Green Performance Plan.

DM7.3 - sets out decentralised energy network (DEN) requirements, including around enabling developments to connect to a DEN, making a direct connection to a DEN, and developing and/or connecting to Shared Heat Networks. Promotes development of decentralised energy networks in principle.

DM7.5 – promotes passive design measures to control heat gain and to deliver passive cooling by a hierarchy approach. Sets out measures to protect against overheating.

3.00 ENERGY STRATEGY METHODOLOGY

3.01 Energy Strategy

The fundamental approach adopted for this energy strategy is as follows:

- Establish the baseline energy demand in line with statutory requirements in terms of Building Regulations Part L2A:2013 compliance using accredited thermal modelling software.
- Adopt passive and low energy design techniques in order to reduce the energy demand for the development beyond the baseline energy demand requirements.
- Assess the potential use of decentralised heating, cooling and power.
- Assess the potential use of sitewide district heating type network.
- Assess the potential low and zero carbon (renewable) technologies to suit the development and establish potential energy/carbon dioxide reduction for viable solutions.
- Establish the anticipated energy and carbon dioxide emission reductions for the development using Building Regulations 2013 Calculations Methodology.

This approach is in line with the principles detailed within the relevant policy statements and regulatory guidelines listed in section 2.00.

3.02 Energy Strategy Targets

The target carbon emission savings for this energy strategy are as follows:

- GLA requirement of 35% less than the Building Regulations Part L2A:2013 baseline.
- The Islington Council has advised a target carbon emissions saving of 27% less than the Building Regulations Part L2A:2013 baseline when regulated and unregulated uses are taken into account.

4.00 ENERGY DEMAND ASSESSMENT

4.01 General

4.01.01 Principles

The energy demand assessment work has been undertaken using EDSL TAS dynamic simulation software Version 9.4 that incorporates the SBEM calculation methodology in line with Building Regulations Part L2A:2013 requirements in order to generate a predicted annual CO_2 emission rate.

Within the energy demand assessment the following fuel carbon dioxide emission intensity factors have been used in line with Part L2A:2013.

Fuel	kg CO_2 / kWhr
Natural gas	0.216
Grid supplied electricity	0.519
Grid displaced electricity	0.519

4.01.02 Regulated and Un-regulated Energy

The planning application energy strategy is provided in a format that reflects the recommendations of the GLA document "Energy Planning – GLA Guidance on preparing energy assessments: April 2015".

Therefore this framework energy strategy shows how policy compliance for the "regulated" energy can be achieved at the development and makes reference to the estimated "un-regulated" energy usage by means of energy benchmarks.

For clarity "regulated" and "un-regulated" energy are summarised as follows:

- Regulated Energy — This is the energy covered by Approved Document L2A of the Building Regulations i.e. the energy used in heating, cooling, fans and pumps plus domestic hot water
- Un - regulated Energy — This is energy used within a building that is not covered by the Building Regulations i.e. the energy used for general small power loads, lifts, external lighting, catering electricity, etc.

The GLA planning policy CO_2 reduction targets are based on "regulated" energy only. Hence the % CO_2 emission savings target is not adversely affected by the estimated "un-regulated" energy in a building.

The Islington Council has advised a target carbon emissions saving of 27% less than the Building Regulations Part L2A:2013 baseline when regulated and unregulated uses are taken into account.

The assessed un-regulated energy uses for the proposed development are as follows:

- General small power
- Lifts
- External lighting
- Catering electricity
- Catering gas
- Computer room power

4.01.03 Energy Benchmarks

The “un-regulated” energy use and benchmarks for this energy strategy have been derived from data and guidance taken from the following Chartered Institute of Building Services Engineers (CIBSE) documents:

1. CIBSE Guide F – Energy Efficiency in Buildings: 2012

2. CIBSE Technical Memorandum – Energy Benchmarks TM46: 2008

The un-regulated energy use values have been derived from the CIBSE Guide F Benchmark Section. The specific benchmarks used and the resultant estimated un-regulated energy values are as follows:

Office — Office benchmarks good practice type 3 ('standard' air conditioned office) of 49 kWh/m2/year that equates to 240.4 tonnes per year.

4.02 Baseline Scheme

The baseline demand is the Building Regulations Part L2A:2013 target emission rate (TER).

The Part L2A:2013 TER is derived from the thermal model based on the National Calculation Methodology (NCM). The review has been carried out utilising the TAS dynamic thermal modelling software version 9.4 that has achieved accreditation from the Department of Communities and Local Government (DCLG).

The baseline CO_2 emissions are modelled as follows:-

	CO_2 Emission (kg CO_2/ m^2/year)
	Development
Heating	1.08
Cooling	4.76
Fans & pumps	4.45
Lighting	9.22
Domestic Hot Water	2.86
Part L2A: 2013 TER	**22.37**
Unregulated Uses	32.70
Total	**55.07**

The annual CO_2 emission resulting from the baseline demand equates to the following:

	CO_2 Emission (tonnes CO_2/year)
	Development
Without unregulated uses	208.39
With unregulated uses	513.03

4.03 Energy Efficiency Measures

4.03.01 General

The energy strategy prioritises the reduction in energy consumption and hence CO_2 emissions through the building envelope design together with the use of efficient mechanical and electrical services.

The passive and low energy design principles that have been adopted in the current design include:

- High performance glazing
- Improved building fabric thermal insulation
- Low building air leakage rate for new elements (3 $m^3/hr/m^2$ at 50 Pa which represents a 50 % improvement over the minimum 2013 Building Regulations requirements)
- High efficiency communal heating and cooling plant
- Variable speed fans and pumps
- Low energy lighting (LED lamp sources)
- Automatic lighting control with occupancy and daylight dimming controls
- Mixed mode ventilation

The communal heating plant will comprise high efficiency low NOx boilers connected to variable volume low temperature hot water pipework distribution systems.

The communal cooling plant will comprise high efficiency water cooled chillers connected to adiabatic coolers. Chilled water will be distributed via a variable volume pipework distribution system.

The main office building will be provided with an underfloor air distribution heating, cooling and ventilation system served from the communal heating and cooling plant. Transfer tiles in the raised floor will control air distribution to the space. Perimeter LTHW heating will be provided.

Refurbished and extended office buildings 10 – 12 will be provided with water cooled variable refrigerant flow (VRF) systems served from the communal heating and cooling plant. Natural ventilation will be provided.

The retail/restaurant units will be provided with services served from the communal heating and cooling systems.

4.03.02 Development

All lighting will be LED with occupancy and daylight dimming control.

The Building Regulations thermal model analysis identifies the following CO_2 emissions for the overall Regents Wharf development:

	Part L2A:2013	
	Baseline Scheme (kg CO_2/m^2/year)	**Lean Scheme (kg CO_2/m^2/year)**
Heating	1.08	1.78
Cooling	4.76	2.59

	Part L2A:2013	
	Baseline Scheme (kg CO_2/m^2/year)	**Lean Scheme (kg CO_2/m^2/year)**
Fans and pumps	4.45	5.69
Lighting	9.22	4.68
Domestic Hot Water	2.86	2.91
Part L2A :2013 Total	**22.37**	**17.65**
Unregulated Power	32.70	25.43
Total	**55.07**	**43.08**

The comparison of the energy efficient scheme against the baseline scheme identifies that for the proposed development there is a predicted 21.09 % (Part L2A 2013) improvement in terms of building emission rate (BER) over the baseline scheme (TER) and then a predicted improvement of 21.77 % (Part L2A:2013) when allowance is made for the unregulated uses.

The annual CO_2 emissions resulting from the passive/low energy scheme equates to the following:

	CO_2 Emission (tonnes CO_2/year)
	Part LA:2013
Without unregulated uses	164.45
With unregulated uses	401.36

5.00 DECENTRALISED HEATING, COOLING AND POWER ASSESSMENT

5.01 General

The potential use of decentralised heating, cooling and power for the building has been assessed in relation to the following:

- Decentralised heating
- Decentralised cooling
- Combined heat and power (CHP)
- Combined cooling heat and power (CCHP/trigeneration)

5.02 Decentralised Heating and Cooling

Decentralised heating and cooling relates to a central system that provides the necessary heating and cooling water to more than one use or part of a building or to more than one building. For example a decentralised heating system can comprise central boiler plant that provides heat to separate dwellings and similarly a decentralised cooling system can comprise central refrigeration plant that provides cooling to individual retail units in a shopping centre.

Two types of decentralised heating and cooling schemes have been considered for the development.

1. Connection to a district energy network (DEN)

2. The provision of a development decentralised energy centre

District Energy Network

Investigations into existing or proposed district energy networks to provide decentralised heating and / or cooling to the development in accordance with Islington Policy DM7.3 has established that there are no such current infrastructure arrangements within a reasonable (500 m) distance from the development site.

The London Heat Map has been reviewed and there is not a suitable decentralised energy scheme (DES) available. The Kings Cross heat network is within 500 m of the proposed development. However, the network is located the other side of the Regents Canal and is therefore not practical to connect to.

Therefore the DES is not a viable option for the development site, however connections will be provided for future interfacing with a district energy network or shared heat network (SHN).

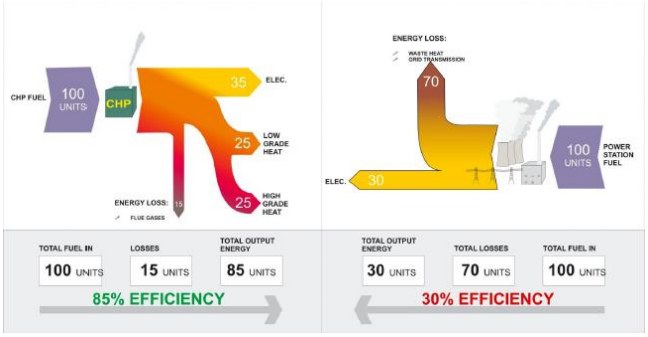
Decentralised Energy Centre

The development will be provided with a decentralised energy centre with communal heating and cooling plant serving both the office and retail uses. The system will incorporate heat exchangers that will be used by the retail tenants as their heat source when in heating mode and heat sink when in cooling mode from their fit out systems. The tenants fit out guide will stipulate that the retail tenants will have to use the communal systems for their primary heating and cooling.

The energy centre will be provided with connections to future proof the interfacing with a future DEN. The energy centre will be located in the basement as indicated on Hawkins Brown drawing No. RGW-HBA-00-B1-DR-A-PL20-0100.

5.03 Combined Heat and Power

Combined Heat and Power (CHP) generates electricity on site and recovers a proportion of the waste heat for use in heating and/or hot water generation for the building. This allows the overall efficiency to be significantly greater than the electricity generated via power stations feeding the National Grid. The CHP plant typically uses gas as the primary energy source and often incorporates a thermal store. Biomass fuelled CHP is possible however this is typically only for very large schemes due to operational difficulties with smaller capacity units.



CHP systems are typically considered only to be viable where they are able to run for at least 5000 hours per annum and have an appropriate year round heating demand.

The domestic hot water service (HWS) requirement for an office development is relatively low. The low HWS demand limits the hours per annum that the CHP can operate. The limited run hours has resulted in CHP technology not being proposed for this scheme.

Where CHP is viable, air quality issues must be considered early on and in detail when assessing CHP viability for a development. Measures that should be adopted include appropriate plant selection, operating a plant efficiently to prevent start-stop operation (that increases emissions) and flue location and glue gas treatment, where viable. An air quality assessment will be required in most instances and the local authority will be contacted at the earliest opportunity.

5.04 Combined Cooling, Heat and Power

Combined Cooling, Heat and Power (CCHP) that is often referred to as trigeneration uses the same principles as detailed above for a CHP system however the heat produced is also used to generate cooling via an absorption chiller. The CCHP plant can make use of heat generated by the CHP plant in buildings with a cooling demand.

The absorption chiller incorporated within a CCHP scheme has a very low efficiency that means due to the building size, load characteristics and use of a high efficiency water cooled system it realistically offers very limited benefits. Therefore a CCHP system is not considered to be suitable for the development.

6.00 COOLING AND OVERHEATING

6.01 The Cooling Hierarchy

Based on the headings set out in the London Plan Policy 5.9 the passive and energy efficient design measures noted below are proposed for and in accordance with Islington Policy DM7.5 the development to help limit any overheating without the need for comfort cooling.

Minimising internal heat generation through energy efficient design:	Section 4.03 of this Energy Strategy summarises the energy efficient design proposed to be incorporated in to the development. Further information is included below.
Reducing the amount of heat entering the building in summer:	The glazing U value is better than the Building Regulations Part L2A: 2013 minimum requirements. As shown on the Unit 1 BRUKL, included in the appendix a U value of 1.2 W/m^2 K is proposed. The glazing also has a good 'g' value of 0.3. In addition to this the roof and wall U values, as shown on the BRUKLs included in the appendix are better than the Building Regulations Part L2A: 2013 minimum requirements.
Use of thermal mass and high ceilings to manage the heat within the building:	A concrete structure is utilised to result in good thermal mass and night purge capability. Floor to ceiling heights are higher than normal within the office provisions to provide heat stratification.
Passive ventilation:	Passive ventilation techniques such as stack ventilation are not proposed. However the development has openable windows to the office accommodation to allow the use of natural ventilation.
Mechanical ventilation:	The office accommodation is to be mechanically ventilated. The supply and extract ventilation system will incorporate heat recovery between the intake and exhaust air.

6.02 Over Heating Risk Analysis

In accordance with London Plan policy 5.9 an overheating risk analysis has been undertaken on the office accommodation for the development. A separate Overheating Risk Analysis Report for the development has been provided with the planning submission. Full details of the analysis can be found in this report. For ease of reference the conclusions of the separate Overheating Risk Analysis Report are repeated below.

The office accommodation in each of the three buildings has been analysed for the overheating risk in free running mode and mechanically comfort cooled mode in accordance with the requirements of TM52 and against the three GLA recommended TM49 design summer years.

For the free running criteria:

- Each assessed zone has a risk of overheating due to failing each of the three TM52 criteria.

The modelling already includes the appropriate passive measures to help mitigate the overheating risk. The measures included are summarised below:

- Openable windows albeit with a restricted opening to the office accommodation.
- High performance glazing that has a 'U' value of 1.20 W/m^{2}K and a 'g' value of 0.30.
- LED lighting to reduce internal casual heat gains.

The provision of openable windows will be maintained in each of the buildings to allow the future tenants the choice of operating the building in free running mode as the prevailing whether conditions allow.

To alleviate the predicted overheating the office accommodation comfort cooling will be provided. The office accommodation in each building passes the TM52 mechanical cooled building overheating criteria.

Therefore, the proposed comfort cooling systems to the office accommodation are appropriate for inclusion in the development.

This report accounts for all relevant design features and includes for the anticipated building usage. Should the final design and/or use of the building differ from the described, or should the actual weather differ from the accredited weather files, then 'out of range' temperature may occur beyond that predicted.

6.03 Active Cooling

The predicted cooling demand for the development has been assessed against the Building Regulations Part L2A notional cooling demand as set out below.

	Area weighted average building cooling demand (MJ/m^2)		
	Building A	Building B & C	Development
Actual Building	131.0	79.4	124.4
Notional Building	159.6	158.3	159.4

As can be seen from the above the predicted cooling demand for the whole industrial development is less than the notional cooling demand. Hence additional passive / energy efficiency measures do not need to be incorporated into the scheme.

As the overheating risk analysis indicates that the overheating may occur the office accommodation is to be comfort cooled by a Hiross system in Building A and a water cooled variable refrigerant flow (VRF) simultaneous heating and comfort cooling air source hat pump system in buildings B and C

7.00 RENEWABLE ENERGY ASSESSMENT

7.01 General

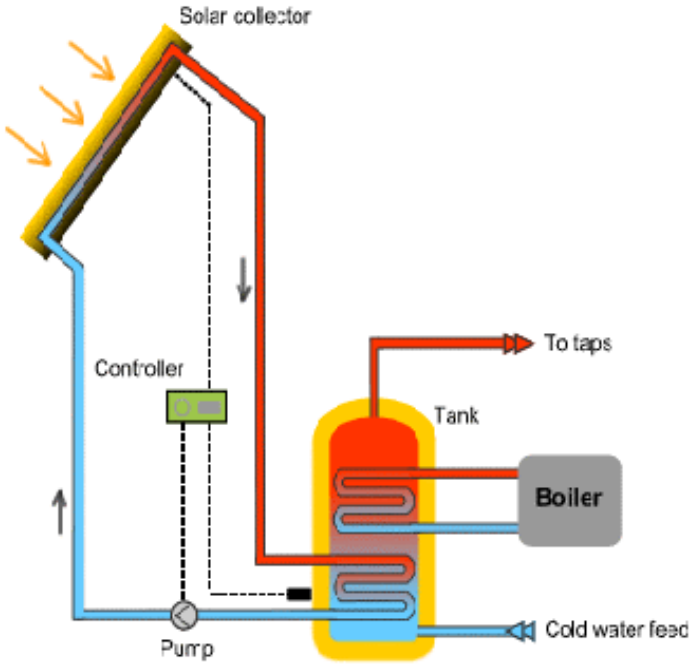
The potential use of renewable energy technology has been undertaken for the following:

- Solar water heating
- Wind turbines
- Photovoltaic cells
- Biomass
- Ground source heating and cooling
- Air source heating and cooling
- Fuel cells
- Canal source heating and cooling

7.02 Solar Water Heating

Solar thermal panels utilise the suns energy to generate hot water for use within the building. The panels are commonly provided in either flat plate or evacuated tube arrangements. The panels are ideally located facing south at an approximate 30° inclination angle in areas where they are not subjected to shade.

The development has the potential to use solar water heating to pre-heat the domestic hot water service. However as Photovoltaic Cells are more beneficial to commercial premises the available roof space has been used to accommodate photovoltaic cells rather than solar water heating.



7.03 Wind Turbines

Wind turbines generate electrical energy derived from kinetic energy provided by the local wind resource. The performance of wind turbines depends greatly on the wind speed and turbulence that in turn is influenced by the terrain and installation height.

In urban areas non-laminar wind flow occurs as a result of turbulence due primarily to adjacent buildings. There is growing evidence of urban wind turbines failing to perform in line with manufacturer's estimated outputs and as a result wind turbines are likely to produce only modest power outputs with corresponding low carbon dioxide emission reduction within urban sites.

For the reasons detailed above wind turbines are not considered viable for the development.

7.04 Photovoltaic Cells

Photovoltaic (PV) panels utilise the sun's energy to generate electricity. The optimum location for PV panels is south facing at an approximate 30° inclination angle in areas where they are not subjected to shade.

The development has unshaded roof areas that could be utilised for PV panels. Based on the various constraints imposed at roof level it has been assessed that an area of 275 m^2 can be provided which results in the following CO_2 reductions:

PV panel area	275 m^2
Approximate peak electrical output	51.0 kWp
Predicted annual carbon emission reduction	17.73 Tonnes CO_2/yr
Offset of the lean scheme CO_2 emissions	10.78 %
Kilowatt-hour output from the solar PV panels	1005.99 kWh/yr

7.05 Biomass

Biomass is considered to be a renewable fuel source as the CO_2 absorbed during the growth period is assessed as being approximately equal to the CO_2 emitted during combustion and hence deemed "carbon neutral". Biomass for boilers is typically wood either in chip or pellet form.

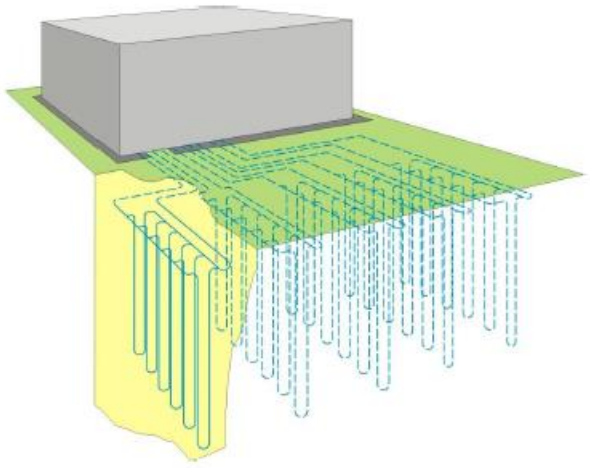
Biomass boilers require fuel storage together with associated transportation and delivery to the store location. Biomass boilers also increase the NOx emissions when compared to gas fired boilers.

For this development there is no viable space within the overall development for fuel storage together with the site constraints related to the associated delivery requirements. In addition there are on-going concerns with regard to the potential impact on local air quality.

For the reasons defined above the use of biomass is not considered viable for the development.

7.06 Ground Source Heating and Cooling

Ground source heating and cooling systems utilises the principle during heating mode of upgrading heat from the ground to a usable temperature and during cooling mode of rejecting heat from the building into the ground. There are two primary methods utilising either open or closed loop systems.



The open loop system extracts water, typically from the chalk aquifer, and uses this water in either the heating or cooling process before rejecting this heat back to the aquifer in a separate borehole. The open loop system requires licence approval from the Environment Agency that typically has a 10 year duration.

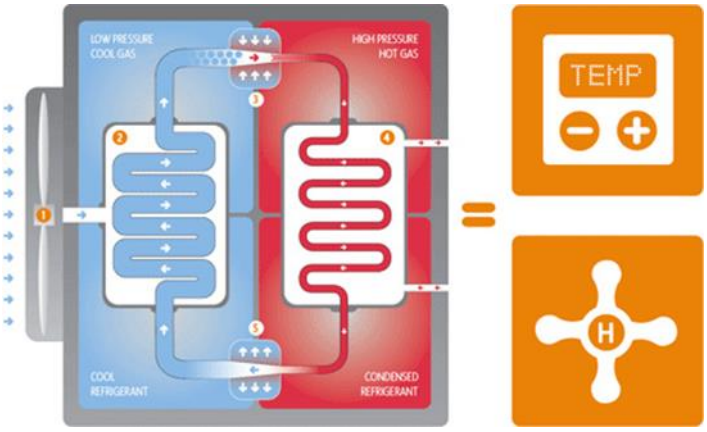
The closed loop system dissipates heat to or extracts heat from the ground via pipework circuits that are typically inserted into vertical boreholes. These generally do not require Environment Agency licences as no extraction of water from the aquifer takes place.
Generally for both the open and closed loop options heat pumps are used in order to generate the heating and cooling water temperatures needed within a building.

The efficiency of the proposed cooling and heating equipment is comparable to that achieved by the GSHP equipment and as such the CO_2 saving by providing GSHP technology is minimal.

For this reason a ground source heating and cooling system is not considered viable for the development.

7.07 Air Source Heating and Cooling

Air sourced heat pump (ASHP) works on the same principles as a ground source heat pump (GSHP) however the medium in which heat is extracted is the external air rather than the ground. The ASHP can be reversed to provide cooling when required. ASHP will generally have a lower seasonal coefficient of performance when compared to GSHP.



The high efficiency of the communal gas fired boilers and water cooled chillers has resulted in this technology not being suitable for this scheme.

7.08 Fuel Cell

The fuel cell technology essentially converts chemical energy into both electrical and heat energy. The cell needs to be continually supplied with hydrogen (derived from either a piped or storage source) and oxygen (derived from air) which are combined and the chemical reaction produces electrical energy, heat energy and water vapour.

The fuel cell requires a hydrogen fuel source that can either be from a piped source (not currently available) or from stored gas. However the more usual approach currently in the UK is to use natural gas in order to generate the hydrogen required to operate the fuel cell.

Fuel cells have various commercial and technical limitations. There is a high initial capital cost together with there being few established suppliers and a very limited specialist design, installation and maintenance capabilities. Certain fuel cell elements require regular replacement imposing a significant on-going cost implication. The fuel cells themselves are generally large, heavy and require fresh air ventilation.

Due to the initial capital cost, space requirements and on-going maintenance costs fuel cells are not considered viable for this development.

7.09 Renewable Energy Analysis

7.09.01 Viable LZCs

The proposed renewable energy sources for the development, applicable to the office and retail areas, are:

Photovoltaic Cells - Electricity generated for use in the development.

The photovoltaic cells are located at roof level and as indicated on the Hawkins Brown Drawing No. RGW-HBA-oo-RF-DR-A-PL20-0110

7.09.02 Development

The results for the development incorporating renewable energy technologies to the offices and the retail units are as follows:

	Baseline Scheme (kg CO_2/m^2/year)	**Lean Scheme (kg CO_2/m^2/year)**	**LZC Scheme (kg CO_2/m^2/year)**
Heating	1.08	1.78	1.37
Cooling	4.76	2.59	2.07
Fans and pumps	4.45	5.69	3.93
Lighting	9.22	4.68	4.12
Domestic Hot Water	2.86	2.91	2.50
Displaced Electricity	0.00	0.00	-1.90
Part L2A : 2013 Total	**22.37**	**17.65**	**13.99**
Unregulated Power	32.70	25.43	25.43
Total	**55.07**	**43.08**	**39.42**

The unregulated power includes plug-in equipment of which the majority is installed by the tenant. The baseline scheme includes typical unregulated loads. The development has been designed and management procedures will be put in place to ensure that the installed unregulated power will follow good practice principles. This is reflected in the lean scheme and LZC scheme unregulated power allowances.

The annual CO_2 emission for the overall development incorporating renewable energy technologies is 13.99 kg CO_2/m^2.

The improvement with renewable energy technologies over the lean scheme is 20.72 % and the improvement with renewable technologies over the baseline scheme is 37.44 %.

The annual CO_2 emissions for the development allowing for un-regulated energy uses with the renewable energy technologies is 39.42 kg CO_2/m^2.

The improvement with renewable energy technologies over the lean scheme when un-regulated energy uses are incorporated is 8.49 % and the improvement with renewable technologies over the baseline scheme is 28.41 %.

The annual CO_2 emission resulting from the green scheme with renewable energy technologies equates to 130.37 tonnes without un-regulated uses and 367.28 tonnes when un-regulated uses are taken into account.

7.10 Canal Source Heat Pumps

An investigation has been carried out into the use of canal water for heat pumps. The investigation carried out by the Canal and River Trust (CRT) concluded that there is not sufficient flow in the canal for the rejection of heat without adversely affecting the canal ecology.

8.00 OVERALL BUILDING ANALYSIS

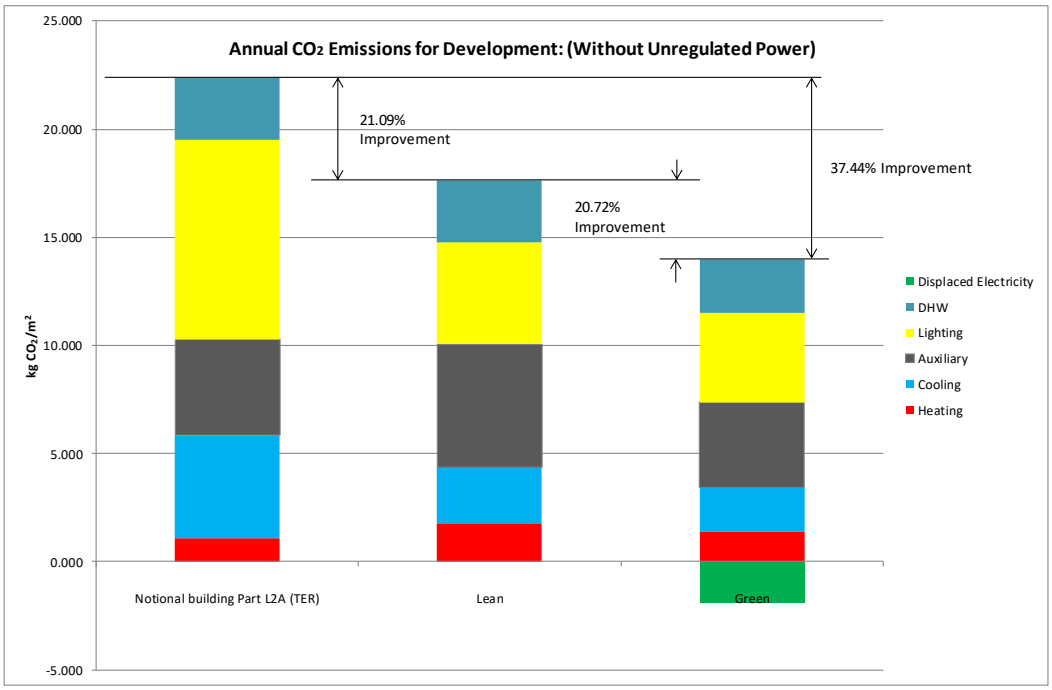
8.01 Carbon Reduction – Building Regulation 2013 Baseline

The overall building analysis is summarised as follows:

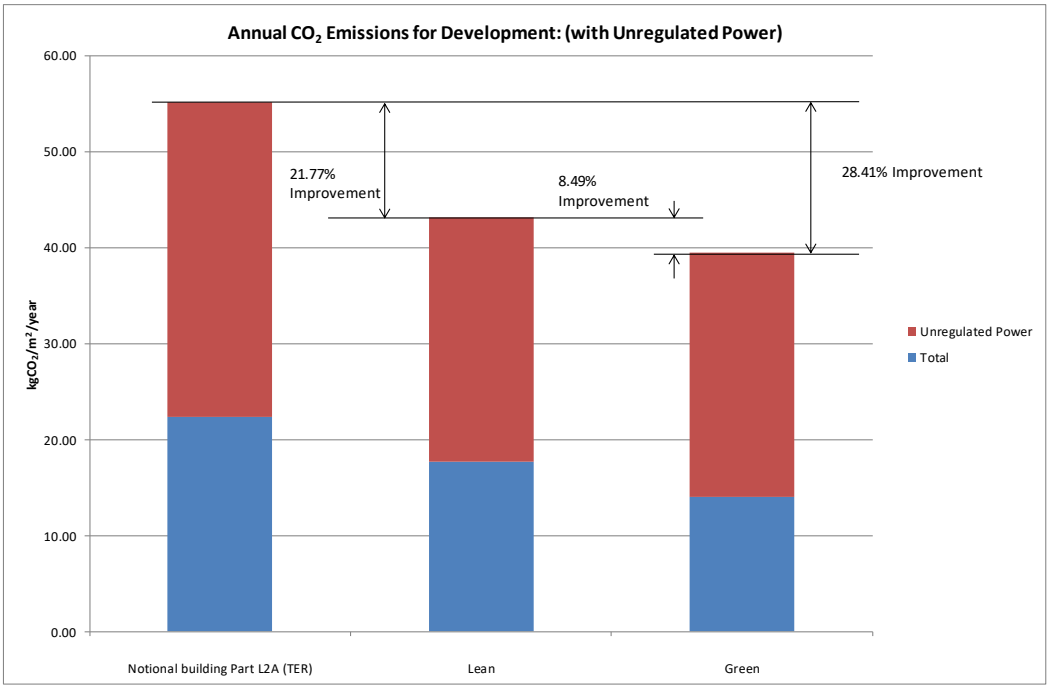
	kg CO_2/m^2		
	Baseline Scheme	**Lean Scheme (with passive/low energy)**	**LZC Scheme**
Building Regulations Compliant	22.37	17.65	13.99
Allowing for Un-regulated Uses	55.07	43.08	39.42

These values are shown in diagrammatic form below that shows the following principles:

- The proposed scheme (LZC) assessment shows a predicted improvement of 37.44 % when compared to the baseline scheme
- The renewable energy technologies shows a predicted improvement of 20.72 % over the lean scheme
- When un-regulated energy uses are taken into account the predicted overall improvement is 28.41 % compared to the baseline scheme with renewable energy technologies showing a predicted 8.49 % improvement over the lean scheme.



Based on the regulated power results indicated above the proposed scheme incorporating a renewable energy technologies provides a carbon emissions reduction of 37.44 % when compared to the baseline Building Regulations 2013 (TER) compliant scheme.



The predicted annual CO_2 emissions data is as follows:

	Tonnes CO_2/year		
	Baseline Scheme	**Lean Scheme (with passive/low energy)**	**LZC Scheme**
Building Regulations Compliant	208.39	164.45	130.37
Allowing for Un-regulated Uses	513.03	401.36	367.28

The carbon emission savings as a result of the proposed measures based on the current design are predicted as follows:

	CO_2 Emission (tonnes CO_2/year)	**With Un-Regulated Uses CO_2 Emission (tonnes CO_2/year)**
Baseline scheme	208.39	513.03
LZC Scheme	130.37	367.28
Saving over baseline scheme	**78.02**	**78.02**

The regulated energy carbon emission savings when compared to the target savings are as follows:

	Regulated CO_2 Savings	
	Tonnes per Annum	**%**
Total Cumulative Savings	78.02	37.44
Total Target Savings	72.94	35.00
Annual Surplus	**5.08**	**2.44**

Hence there is a predicted annual surplus of 5.08 tonnes CO_2/year.

9.00 CONCLUSIONS

In line with the relevant planning policies and guidelines the energy strategy for the proposed development has adopted a hierarchical approach of using passive and low energy design technologies to reduce the baseline energy demand and hence CO_2 emissions followed by the application of low and zero carbon technologies as appropriate.

The focus of the energy strategy is on CO_2 reduction from the building by adopting a highly efficient building envelope solution together with high efficiency communal mechanical and electrical services incorporating heat recovery and mixed mode ventilation. The renewable energy technologies assessment is based on using solutions that are technically proven with low maintenance implications taking into account the energy efficiency strategies being proposed in the current design.

The analysis has shown that by incorporating passive and low energy design measures there is a predicted reduction in the development's annual CO_2 emissions, as indicated in the table below, from the baseline scheme.

Baseline CO_2 Saving (Regulated Power)	
%	Tonnes CO_2/Year
21.09	43.94

This is achieved by the following elements:

- High performance glazing
- Improved building fabric thermal insulation
- Mixed mode ventilation
- Low building air leakage rate
- High efficiency heating plant
- High efficiency water cooled chillers with cooling towers
- Variable speed fans and pumps
- Low energy lighting (LED lighting)
- Automatic lighting control with occupancy and daylight dimming controls

The scheme will be provided with decentralised heating and cooling systems to serve the development. The decentralised assessment has indicated that the application of CHP or CCHP systems are not viable for the scheme, however valved connections will be provided for future district heating connectivity.

The potential renewable energy technologies have been assessed taking into account the particular development constraints. The strategy is to utilise:

- Photovoltaic panels to provide electricity to the development.

The analysis has shown that by incorporating this renewable energy technology in addition to the passive and low energy design measures there is a predicted reduction of annual CO_2 emissions from the baseline scheme as indicated in the table below and in accordance with the GLA requirement of 35 % carbon emission saving:

Green Scheme CO_2 Saving (Regulated Power)	
%	Tonnes CO_2/Year
37.44	78.02

The analysis has shown the following annual CO2 emission for regulated and unregulated power as per the London Borough of Islington policy requirement of 27 % carbon emission saving.

Green Scheme CO_2 Saving (Regulated + Unregulated Power)	
%	Tonnes CO_2/Year
28.41	145.75

APPENDICES

Appendix A – BRUKL Reports

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Regents Wharf - Green Scheme

As designed

Date: Thu Apr 13 16:26:33 2017

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.4.0"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.4.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Moditha Arangi Wickramaratna

Telephone number: 0193 278 1641

Address: 51 Staines Road West, Sunbury-On-Thames, TW16 7AH

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	22
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	22
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	15.5
Are emissions from the building less than or equal to the target?	BER =< TER
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

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	External Wall
Floor	0.25	0.2	1.07	Exposed Floor
Roof	0.25	0.13	0.13	Roof
Windows***, roof windows, and rooflights	2.2	1.2	1.2	W_Gnd-F1
Personnel doors	2.2	1.15	1.2	WD_Gnd-F1
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* 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

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	>0.95

1- Toilets & Showers (17 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

2- Circulation Spaces

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

3- Offices (86 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	5.21	-	1.4	0.7
Standard value	0.91*	2.6	N/A	1.6^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

^ Allowed SFP may be increased by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

4- Office Pods

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

1- New DHW Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	0
Standard value	0.9*	N/A

* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
B - Showers 1	-	90	-	159

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
B - Cycle Store 1	90	-	-	149
B - Electrical Room 1	90	-	-	109
B - Store Room 1	90	-	-	25
B - Circulation 1	-	90	-	99
B - Cleaners Cupboard 1	90	-	-	10
B - Refuse Store 1	90	-	-	50
B - Plant Room 1	90	-	-	275
B - Plant Room 2	90	-	-	94
B - Plant Room 3	90	-	-	136
B - Stair Core 1	-	90	-	68
G - Retail 1	90	-	-	2090
G -Toilet 1	-	90	-	197
G - Office_Int 1	90	-	-	678
G - Circulation 2	-	90	-	133
G - Circulation 3	-	90	-	69
G - Stair Core 1	-	90	-	67
G - Fire Lobby 1	-	90	-	70
G - Cleaners Cupboard 1	90	-	-	10
1st - Office_Int 1	90	-	-	1010
1st - Circulation 1	-	90	-	63
1st - Toilet 1	-	90	-	250
1st - Cleaners Cupboard 1	90	-	-	9
G - Stair Core 2	-	90	-	65
G - Office_Per 1	90	-	-	372
G - Office_Per 2	90	-	-	154
G - Office_Per 3	90	-	-	645
G - Office_Per 4	90	-	-	229
G - Office_Per 5	90	-	-	173
G - Office_Per 6	90	-	-	270
G - Office_Per 7	90	-	-	482
1st - Office_Per 1	90	-	-	331
1st - Office_Per 2	90	-	-	405
1st - Office_Per 3	90	-	-	534
1st - Office_Per 4	90	-	-	139
1st - Office_Per 5	90	-	-	626
1st - Office_Per 6	90	-	-	236
1st - Office_Per 7	90	-	-	167
1st - Office_Per 8	90	-	-	311
1st - Office_Per 9	90	-	-	236
1st - Office_Per 10	90	-	-	929
1st - Office_Per 11	90	-	-	201
1st - Office_Per 12	90	-	-	702
1st - Office_Int 2	90	-	-	453

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1st - Office_Int 3	90	-	-	664
1st - Stair Core 1	-	90	-	57
1st - Stair Core 2	-	90	-	58
1st - Circulation 2	-	90	-	65
2nd - Toilet 1	-	90	-	250
2nd - Stair Core 1	-	90	-	56
2nd - Office_Per 1	90	-	-	331
2nd - Office_Int 1	90	-	-	1010
2nd - Cleaners Cupboard 1	90	-	-	9
2nd - Circulation 1	-	90	-	63
2nd - Office_Int 2	90	-	-	1116
2nd - Office_Per 2	90	-	-	405
2nd - Office_Per 3	90	-	-	534
2nd - Office_Per 4	90	-	-	139
2nd - Office_Per 5	90	-	-	626
2nd - Office_Per 6	90	-	-	402
2nd - Office_Per 7	90	-	-	311
2nd - Office_Per 8	90	-	-	236
2nd - Office_Per 9	90	-	-	929
2nd - Office_Per 10	90	-	-	201
2nd - Office_Per 11	90	-	-	723
2nd - Circulation 2	-	90	-	65
2nd - Stair Core 2	-	90	-	58
3rd - Toilet 1	-	90	-	250
3rd - Stair Core 1	-	90	-	52
3rd - Office_Per 1	90	-	-	331
3rd - Office_Int 1	90	-	-	1010
3rd - Cleaners Cupboard 1	90	-	-	9
3rd - Circulation 1	-	90	-	63
3rd - Circulation 2	-	90	-	65
3rd - Stair Core 2	-	90	-	58
3rd - Office_Int 2	90	-	-	1109
3rd - Office_Per 2	90	-	-	405
3rd - Office_Per 3	90	-	-	534
3rd - Office_Per 4	90	-	-	139
3rd - Office_Per 5	90	-	-	626
3rd - Office_Per 6	90	-	-	402
3rd - Office_Per 7	90	-	-	311
3rd - Office_Per 8	90	-	-	236
3rd - Office_Per 9	90	-	-	930
3rd - Office_Per 10	90	-	-	201
3rd - Office_Per 11	90	-	-	729
4th - Toilet 1	-	90	-	250

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
4th- Stair Core 1	-	90	-	52
4th - Office_Per 1	90	-	-	331
4th - Office_Int 1	90	-	-	1010
4th - Cleaners Cupboard 1	90	-	-	9
4th - Circulation 1	-	90	-	63
4th - Circulation 2	-	90	-	65
4th - Office_Int 2	90	-	-	1109
4th- Stair Core 2	-	90	-	58
4th - Office_Per 2	90	-	-	405
4th - Office_Per 3	90	-	-	534
4th - Office_Per 4	90	-	-	139
4th - Office_Per 5	90	-	-	626
4th - Office_Per 6	90	-	-	402
4th - Office_Per 7	90	-	-	311
4th - Office_Per 8	90	-	-	236
4th - Office_Per 9	90	-	-	929
4th - Office_Per 10	90	-	-	201
4th - Office_Per 11	90	-	-	729
5th - Office_Per 1	90	-	-	446
5th - Circulation 1	-	90	-	67
5th - Toilet 1	-	90	-	174
5th- Stair Core 1	-	90	-	50
5th - Office_Int 1	90	-	-	769
5th- Stair Core 2	-	90	-	42
5th - Circulation 2	-	90	-	79
5th - Office_Int 2	90	-	-	75
5th - Office_Per 2	90	-	-	86
5th - Office_Per 3	90	-	-	654
5th - Office_Per 5	90	-	-	137
5th - Office_Per 6	90	-	-	189
5th - Office_Per 7	90	-	-	167
5th - Office_Per 8	90	-	-	134
5th - Office_Per 9	90	-	-	238
5th - Office_Per 10	90	-	-	136
5th - Office_Per 11	90	-	-	244
5th - Office_Per 12	90	-	-	135
6th - Circulation 1	-	90	-	67
6th - Toilet 1	-	90	-	170
6th- Stair Core 1	-	90	-	50
6th - Office_Per 8	90	-	-	134
6th - Office_Per 9	90	-	-	238
6th - Office_Per 10	90	-	-	136
6th - Office_Per 11	90	-	-	244

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
6th - Office_Per 12	90	-	-	154
6th - Office_Int 2	90	-	-	75
6th - Circulation 2	-	90	-	74
G - Plant 2	90	-	-	227
G - Office_Pod 1	90	-	-	245
5th - Office_Pod 1	90	-	-	189
5th - Office_Pod 2	90	-	-	203
B - Circulation 2	-	90	-	188
5th - Office_Per 13	90	-	-	154
5th - Office_Per 14	90	-	-	87
5th - Toilet 2	-	90	-	86
5th - Circulation 3	-	90	-	17
5th - Circulation 4	-	90	-	68
6th - Office_Int 3	90	-	-	135
6th - Office_Per 13	90	-	-	87
B - Plant Room 4	90	-	-	1423
B - Plant Room 5	90	-	-	302
B - Circulation 3	-	90	-	122
B - Circulation 4	-	90	-	55
B - Electrical Room 2	90	-	-	66
B - Plant Room 6	90	-	-	465
7th - Stair Core 1	-	90	-	42

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
G - Retail 1	NO (-16%)	NO
G - Office_Int 1	NO (-92%)	NO
1st - Office_Int 1	YES (+193%)	NO
G - Office_Per 1	NO (-18%)	NO
G - Office_Per 2	NO (-77%)	NO
G - Office_Per 3	YES (+38%)	NO
G - Office_Per 4	NO (-17%)	NO
G - Office_Per 5	NO (-74%)	NO
G - Office_Per 6	NO (-33%)	NO
G - Office_Per 7	NO (-9%)	NO
1st - Office_Per 1	NO (-58%)	NO
1st - Office_Per 2	NO (-40%)	NO
1st - Office_Per 3	NO (-38%)	NO
1st - Office_Per 4	NO (-78%)	NO
1st - Office_Per 5	YES (+11%)	NO
1st - Office_Per 6	NO (-29%)	NO
1st - Office_Per 7	NO (-80%)	NO
1st - Office_Per 8	NO (-96%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1st - Office_Per 9	NO (-26%)	NO
1st - Office_Per 10	NO (-55%)	NO
1st - Office_Per 11	NO (-44%)	NO
1st - Office_Per 12	NO (-42%)	NO
1st - Office_Int 2	NO (-97%)	NO
1st - Office_Int 3	NO (-76%)	NO
2nd - Office_Per 1	NO (-58%)	NO
2nd - Office_Int 1	YES (+190%)	NO
2nd - Office_Int 2	NO (-72%)	NO
2nd - Office_Per 2	NO (-40%)	NO
2nd - Office_Per 3	NO (-36%)	NO
2nd - Office_Per 4	NO (-77%)	NO
2nd - Office_Per 5	YES (+15%)	NO
2nd - Office_Per 6	NO (-59%)	NO
2nd - Office_Per 7	NO (-96%)	NO
2nd - Office_Per 8	NO (-26%)	NO
2nd - Office_Per 9	NO (-55%)	NO
2nd - Office_Per 10	NO (-45%)	NO
2nd - Office_Per 11	NO (-40%)	NO
3rd - Office_Per 1	NO (-58%)	NO
3rd - Office_Int 1	YES (+191%)	NO
3rd - Office_Int 2	NO (-68%)	NO
3rd - Office_Per 2	NO (-40%)	NO
3rd - Office_Per 3	NO (-34%)	NO
3rd - Office_Per 4	NO (-77%)	NO
3rd - Office_Per 5	YES (+19%)	NO
3rd - Office_Per 6	NO (-55%)	NO
3rd - Office_Per 7	NO (-96%)	NO
3rd - Office_Per 8	NO (-26%)	NO
3rd - Office_Per 9	NO (-55%)	NO
3rd - Office_Per 10	NO (-45%)	NO
3rd - Office_Per 11	NO (-41%)	NO
4th - Office_Per 1	NO (-58%)	NO
4th - Office_Int 1	YES (+190%)	NO
4th - Office_Int 2	NO (-70%)	NO
4th - Office_Per 2	NO (-39%)	NO
4th - Office_Per 3	NO (-32%)	NO
4th - Office_Per 4	NO (-76%)	NO
4th - Office_Per 5	YES (+24%)	NO
4th - Office_Per 6	NO (-50%)	NO
4th - Office_Per 7	NO (-96%)	NO
4th - Office_Per 8	NO (-26%)	NO
4th - Office_Per 9	NO (-55%)	NO
4th - Office_Per 10	NO (-45%)	NO
4th - Office_Per 11	NO (-40%)	NO
5th - Office_Per 1	YES (+10%)	NO
5th - Office_Int 1	NO (-34%)	NO
5th - Office_Int 2	NO (-88%)	NO
5th - Office_Per 2	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
5th - Office_Per 3	NO (-24%)	NO
5th - Office_Per 5	YES (+67%)	NO
5th - Office_Per 6	YES (+28%)	NO
5th - Office_Per 7	NO (-46%)	NO
5th - Office_Per 8	NO (-16%)	NO
5th - Office_Per 9	NO (-50%)	NO
5th - Office_Per 10	YES (+38%)	NO
5th - Office_Per 11	NO (-36%)	NO
5th - Office_Per 12	YES (+1%)	NO
6th - Office_Per 8	NO (-11%)	NO
6th - Office_Per 9	NO (-22%)	NO
6th - Office_Per 10	NO (-23%)	NO
6th - Office_Per 11	NO (-36%)	NO
6th - Office_Per 12	NO (-47%)	NO
6th - Office_Int 2	NO (-89%)	NO
G - Office_Pod 1	NO (-94%)	NO
5th - Office_Pod 1	NO (-94%)	NO
5th - Office_Pod 2	NO (-94%)	NO
5th - Office_Per 13	NO (-48%)	NO
5th - Office_Per 14	NO (-73%)	NO
6th - Office_Int 3	YES (+17%)	NO
6th - Office_Per 13	NO (-61%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	8131	8131
External area [m²]	8551	8551
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	3972	4193
Average U-value [W/m²K]	0.46	0.49
Alpha value* [%]	6.97	6.97

* 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
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**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
	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: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	5.76	4.87
Cooling	4.85	8.13
Auxiliary	9.89	8.9
Lighting	9.15	18.02
Hot water	14.73	14.65
Equipment*	53.25	53.25
TOTAL**	**44.38**	**54.57**

* Energy used by equipment does not count towards the total for calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	2.01	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	109.15	126
Primary energy* [kWh/m²]	96.82	128.65
Total emissions [kg/m²]	15.5	22

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

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] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	32.6	0	11	0	6.1	0.82	0	0.91	0
	Notional	54.1	0	18.3	0	7.8	0.82	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	36	0	12.1	0	1.1	0.82	0	0.91	0
	Notional	41.7	0	14.1	0	1.1	0.82	0	----	----
[ST] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	16.9	131	5.7	7.4	14.4	0.82	4.95	0.91	5.21
	Notional	9.2	159.6	3.1	12.3	12.7	0.82	3.6	----	----
[ST] No Heating or Cooling										
	Actual	121.1	0	33.6	0	0	1	0	1	0
	Notional	238.7	0	81	0	0	0.82	0	----	----

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	0.2	External Wall
Floor	0.2	0.17	Ground Floor
Roof	0.15	0.13	Roof
Windows, roof windows, and rooflights	1.5	1.2	W_Gnd-F1
Personnel doors	1.5	1.08	D_Gnd-L1
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project

$U_{i\text{-}Typ}$ = 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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Regents Wharf - Green Scheme

As designed

Date: Wed Apr 12 16:45:21 2017

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.4.0"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.4.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Moditha Arangi Wickramaratna

Telephone number: 0193 278 1641

Address: 51 Staines Road West, Sunbury-On-Thames, TW16 7AH

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	19.5
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	19.5
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	3.5
Are emissions from the building less than or equal to the target?	BER =< TER
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

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	External Wall
Floor	0.25	-	-	No floors in project
Roof	0.25	0.13	0.13	Roof
Windows***, roof windows, and rooflights	2.2	1.2	1.2	W_Gnd-L2x
Personnel doors	2.2	-	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* 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	25

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	>0.95

1- Toilets & Showers (4 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.9	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

2- Circulation Spaces

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.9	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

3- Offices (8 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.9	4.92	-	-	-
Standard value	2.5*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

4- Office Pods

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- Boiler DHW Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.95	0
Standard value	1	N/A

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
4th - Circulation 1	-	90	-	82
4th- Stair Core 2	-	90	-	37

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
5th - Office_Per 1	90	-	-	388
5th - Toilet 1	-	90	-	135
5th - Office_Int 1	90	-	-	390
5th- Stair Core 2	-	90	-	38
5th - Circulation 2	-	90	-	60
5th - Office_Per 2	90	-	-	446
4th - Toilet 2	-	90	-	132
4th- Stair Core 1	-	90	-	44
4th - Office_Per 1	90	-	-	412
4th - Office_Int 1	90	-	-	391
4th - Circulation 2	-	90	-	56
4th - Office_Per 2	90	-	-	432
5th - Circulation 1	-	90	-	89
5th- Stair Core 1	-	90	-	46
5th - Pods 1	90	-	-	178
5th - Pods 2	90	-	-	183
4th - SME Office 1	90	-	-	1137
4th - Mezzanine 1	90	-	-	2270
5th - Pods 3	90	-	-	182
5th - Pods 4	90	-	-	223
B - Showers 1	-	90	-	36
4th - Toilet 1	-	90	-	95
4th - Cleaners Cupboard 1	-	90	-	13
4th - Circulation 3	-	90	-	21
6th- Stair Core 1	-	90	-	38

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
5th - Office_Per 1	YES (+29%)	NO
5th - Office_Int 1	NO (-88%)	NO
5th - Office_Per 2	NO (-1%)	NO
4th - Office_Per 1	NO (-62%)	NO
4th - Office_Int 1	NO (-95%)	NO
4th - Office_Per 2	NO (-10%)	NO
5th - Pods 1	NO (-93%)	NO
5th - Pods 2	NO (-92%)	NO
4th - SME Office 1	NO (-32%)	NO
4th - Mezzanine 1	NO (-35%)	NO
5th - Pods 3	NO (-92%)	NO
5th - Pods 4	NO (-95%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	1185	1185
External area [m²]	1699	1699
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	25	3
Average conductance [W/K]	575	873
Average U-value [W/m²K]	0.34	0.51
Alpha value* [%]	12.09	12.09

* 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
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**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
	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: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	6.7	9.09
Cooling	3.2	8.29
Auxiliary	1.41	1.8
Lighting	10.01	19.61
Hot water	2.42	2.41
Equipment*	34.12	34.12
TOTAL**	**23.74**	**41.2**

* Energy used by equipment does not count towards the total for calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	15.01	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	157.86	174.24
Primary energy* [kWh/m²]	66.77	112.05
Total emissions [kg/m²]	3.5	19.5

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

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] Central heating using water: radiators, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	89.5	0	4.4	0	16.8	5.64	0	5.9	0
	Notional	61.7	0	7.1	0	22	2.43	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Electricity, [CFT] Electricity										
	Actual	93.3	0	4.6	0	1.1	5.64	0	5.9	0
	Notional	43.8	0	5	0	1.1	2.43	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	98.1	79.4	4.8	4.7	0	5.64	4.67	5.9	4.92
	Notional	11.4	158.3	1.3	12.2	0	2.43	3.6	----	----
[ST] No Heating or Cooling										
	Actual	195.8	0	54.4	0	0	1	0	1	0
	Notional	247.2	0	83.9	0	0	0.82	0	----	----

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	0.2	External Wall
Floor	0.2	-	No floors in project
Roof	0.15	0.13	Roof
Windows, roof windows, and rooflights	1.5	1.2	W_Gnd-L2x
Personnel doors	1.5	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project

$U_{i\text{-}Typ}$ = 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	25

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Regents Wharf - Lean Scheme

As designed

Date: Wed Apr 12 16:23:27 2017

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.4.0"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.4.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Moditha Arangi Wickramaratna

Telephone number: 0193 278 1641

Address: 51 Staines Road West, Sunbury-On-Thames, TW16 7AH

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	22.4
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	22.4
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	16.4
Are emissions from the building less than or equal to the target?	BER =< TER
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

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	External Wall
Floor	0.25	0.2	1.07	Exposed Floor
Roof	0.25	0.13	0.13	Roof
Windows***, roof windows, and rooflights	2.2	1.2	1.2	W_Gnd-F1
Personnel doors	2.2	1.15	1.2	WD_Gnd-F1
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* 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

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	>0.95

1- Toilets & Showers (17 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

2- Circulation Spaces

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

3- Office Pods

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

4- Offices (86 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	5.21	-	1.4	0.7
Standard value	0.91*	2.6	N/A	1.6^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

^ Allowed SFP may be increased by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

1- New DHW Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	0
Standard value	0.9*	N/A

* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	**Luminous efficacy [lm/W]**			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
B - Showers 1	-	90	-	159

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
B - Cycle Store 1	90	-	-	149
B - Electrical Room 1	90	-	-	109
B - Store Room 1	90	-	-	25
B - Circulation 1	-	90	-	99
B - Cleaners Cupboard 1	90	-	-	10
B - Refuse Store 1	90	-	-	50
B - Plant Room 1	90	-	-	275
B - Plant Room 2	90	-	-	94
B - Plant Room 3	90	-	-	136
B - Stair Core 1	-	90	-	68
G - Retail 1	90	-	-	2090
G -Toilet 1	-	90	-	197
G - Office_Int 1	90	-	-	678
G - Circulation 2	-	90	-	133
G - Circulation 3	-	90	-	69
G - Stair Core 1	-	90	-	67
G - Fire Lobby 1	-	90	-	70
G - Cleaners Cupboard 1	90	-	-	10
1st - Office_Int 1	90	-	-	1010
1st - Circulation 1	-	90	-	63
1st - Toilet 1	-	90	-	250
1st - Cleaners Cupboard 1	90	-	-	9
G - Stair Core 2	-	90	-	65
G - Office_Per 1	90	-	-	372
G - Office_Per 2	90	-	-	154
G - Office_Per 3	90	-	-	645
G - Office_Per 4	90	-	-	229
G - Office_Per 5	90	-	-	173
G - Office_Per 6	90	-	-	270
G - Office_Per 7	90	-	-	482
1st - Office_Per 1	90	-	-	331
1st - Office_Per 2	90	-	-	405
1st - Office_Per 3	90	-	-	534
1st - Office_Per 4	90	-	-	139
1st - Office_Per 5	90	-	-	626
1st - Office_Per 6	90	-	-	236
1st - Office_Per 7	90	-	-	167
1st - Office_Per 8	90	-	-	311
1st - Office_Per 9	90	-	-	236
1st - Office_Per 10	90	-	-	929
1st - Office_Per 11	90	-	-	201
1st - Office_Per 12	90	-	-	702
1st - Office_Int 2	90	-	-	453

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1st - Office_Int 3	90	-	-	664
1st - Stair Core 1	-	90	-	57
1st - Stair Core 2	-	90	-	58
1st - Circulation 2	-	90	-	65
2nd - Toilet 1	-	90	-	250
2nd - Stair Core 1	-	90	-	56
2nd - Office_Per 1	90	-	-	331
2nd - Office_Int 1	90	-	-	1010
2nd - Cleaners Cupboard 1	90	-	-	9
2nd - Circulation 1	-	90	-	63
2nd - Office_Int 2	90	-	-	1116
2nd - Office_Per 2	90	-	-	405
2nd - Office_Per 3	90	-	-	534
2nd - Office_Per 4	90	-	-	139
2nd - Office_Per 5	90	-	-	626
2nd - Office_Per 6	90	-	-	402
2nd - Office_Per 7	90	-	-	311
2nd - Office_Per 8	90	-	-	236
2nd - Office_Per 9	90	-	-	929
2nd - Office_Per 10	90	-	-	201
2nd - Office_Per 11	90	-	-	723
2nd - Circulation 2	-	90	-	65
2nd - Stair Core 2	-	90	-	58
3rd - Toilet 1	-	90	-	250
3rd - Stair Core 1	-	90	-	52
3rd - Office_Per 1	90	-	-	331
3rd - Office_Int 1	90	-	-	1010
3rd - Cleaners Cupboard 1	90	-	-	9
3rd - Circulation 1	-	90	-	63
3rd - Circulation 2	-	90	-	65
3rd - Stair Core 2	-	90	-	58
3rd - Office_Int 2	90	-	-	1109
3rd - Office_Per 2	90	-	-	405
3rd - Office_Per 3	90	-	-	534
3rd - Office_Per 4	90	-	-	139
3rd - Office_Per 5	90	-	-	626
3rd - Office_Per 6	90	-	-	402
3rd - Office_Per 7	90	-	-	311
3rd - Office_Per 8	90	-	-	236
3rd - Office_Per 9	90	-	-	930
3rd - Office_Per 10	90	-	-	201
3rd - Office_Per 11	90	-	-	729
4th - Toilet 1	-	90	-	250

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
4th- Stair Core 1	-	90	-	52
4th - Office_Per 1	90	-	-	331
4th - Office_Int 1	90	-	-	1010
4th - Cleaners Cupboard 1	90	-	-	9
4th - Circulation 1	-	90	-	63
4th - Circulation 2	-	90	-	65
4th - Office_Int 2	90	-	-	1109
4th- Stair Core 2	-	90	-	58
4th - Office_Per 2	90	-	-	405
4th - Office_Per 3	90	-	-	534
4th - Office_Per 4	90	-	-	139
4th - Office_Per 5	90	-	-	626
4th - Office_Per 6	90	-	-	402
4th - Office_Per 7	90	-	-	311
4th - Office_Per 8	90	-	-	236
4th - Office_Per 9	90	-	-	929
4th - Office_Per 10	90	-	-	201
4th - Office_Per 11	90	-	-	729
5th - Office_Per 1	90	-	-	446
5th - Circulation 1	-	90	-	67
5th - Toilet 1	-	90	-	174
5th- Stair Core 1	-	90	-	50
5th - Office_Int 1	90	-	-	769
5th- Stair Core 2	-	90	-	42
5th - Circulation 2	-	90	-	79
5th - Office_Int 2	90	-	-	75
5th - Office_Per 2	90	-	-	86
5th - Office_Per 3	90	-	-	654
5th - Office_Per 5	90	-	-	137
5th - Office_Per 6	90	-	-	189
5th - Office_Per 7	90	-	-	167
5th - Office_Per 8	90	-	-	134
5th - Office_Per 9	90	-	-	238
5th - Office_Per 10	90	-	-	136
5th - Office_Per 11	90	-	-	244
5th - Office_Per 12	90	-	-	135
6th - Circulation 1	-	90	-	67
6th - Toilet 1	-	90	-	170
6th- Stair Core 1	-	90	-	50
6th - Office_Per 8	90	-	-	134
6th - Office_Per 9	90	-	-	238
6th - Office_Per 10	90	-	-	136
6th - Office_Per 11	90	-	-	244

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
6th - Office_Per 12	90	-	-	154
6th - Office_Int 2	90	-	-	75
6th - Circulation 2	-	90	-	74
G - Plant 2	90	-	-	227
G - Office_Pod 1	90	-	-	245
5th - Office_Pod 1	90	-	-	189
5th - Office_Pod 2	90	-	-	203
B - Circulation 2	-	90	-	188
5th - Office_Per 13	90	-	-	154
5th - Office_Per 14	90	-	-	87
5th - Toilet 2	-	90	-	86
5th - Circulation 3	-	90	-	17
5th - Circulation 4	-	90	-	68
6th - Office_Int 3	90	-	-	135
6th - Office_Per 13	90	-	-	87
B - Plant Room 4	90	-	-	1423
B - Plant Room 5	90	-	-	302
B - Circulation 3	-	90	-	122
B - Circulation 4	-	90	-	55
B - Electrical Room 2	90	-	-	66
B - Plant Room 6	90	-	-	465
7th - Stair Core 1	-	90	-	42

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
G - Retail 1	NO (-16%)	NO
G - Office_Int 1	NO (-92%)	NO
1st - Office_Int 1	YES (+193%)	NO
G - Office_Per 1	NO (-18%)	NO
G - Office_Per 2	NO (-77%)	NO
G - Office_Per 3	YES (+38%)	NO
G - Office_Per 4	NO (-17%)	NO
G - Office_Per 5	NO (-74%)	NO
G - Office_Per 6	NO (-33%)	NO
G - Office_Per 7	NO (-9%)	NO
1st - Office_Per 1	NO (-58%)	NO
1st - Office_Per 2	NO (-40%)	NO
1st - Office_Per 3	NO (-38%)	NO
1st - Office_Per 4	NO (-78%)	NO
1st - Office_Per 5	YES (+11%)	NO
1st - Office_Per 6	NO (-29%)	NO
1st - Office_Per 7	NO (-80%)	NO
1st - Office_Per 8	NO (-96%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1st - Office_Per 9	NO (-26%)	NO
1st - Office_Per 10	NO (-55%)	NO
1st - Office_Per 11	NO (-44%)	NO
1st - Office_Per 12	NO (-42%)	NO
1st - Office_Int 2	NO (-97%)	NO
1st - Office_Int 3	NO (-76%)	NO
2nd - Office_Per 1	NO (-58%)	NO
2nd - Office_Int 1	YES (+190%)	NO
2nd - Office_Int 2	NO (-72%)	NO
2nd - Office_Per 2	NO (-40%)	NO
2nd - Office_Per 3	NO (-36%)	NO
2nd - Office_Per 4	NO (-77%)	NO
2nd - Office_Per 5	YES (+15%)	NO
2nd - Office_Per 6	NO (-59%)	NO
2nd - Office_Per 7	NO (-96%)	NO
2nd - Office_Per 8	NO (-26%)	NO
2nd - Office_Per 9	NO (-55%)	NO
2nd - Office_Per 10	NO (-45%)	NO
2nd - Office_Per 11	NO (-40%)	NO
3rd - Office_Per 1	NO (-58%)	NO
3rd - Office_Int 1	YES (+191%)	NO
3rd - Office_Int 2	NO (-68%)	NO
3rd - Office_Per 2	NO (-40%)	NO
3rd - Office_Per 3	NO (-34%)	NO
3rd - Office_Per 4	NO (-77%)	NO
3rd - Office_Per 5	YES (+19%)	NO
3rd - Office_Per 6	NO (-55%)	NO
3rd - Office_Per 7	NO (-96%)	NO
3rd - Office_Per 8	NO (-26%)	NO
3rd - Office_Per 9	NO (-55%)	NO
3rd - Office_Per 10	NO (-45%)	NO
3rd - Office_Per 11	NO (-41%)	NO
4th - Office_Per 1	NO (-58%)	NO
4th - Office_Int 1	YES (+190%)	NO
4th - Office_Int 2	NO (-70%)	NO
4th - Office_Per 2	NO (-39%)	NO
4th - Office_Per 3	NO (-32%)	NO
4th - Office_Per 4	NO (-76%)	NO
4th - Office_Per 5	YES (+24%)	NO
4th - Office_Per 6	NO (-50%)	NO
4th - Office_Per 7	NO (-96%)	NO
4th - Office_Per 8	NO (-26%)	NO
4th - Office_Per 9	NO (-55%)	NO
4th - Office_Per 10	NO (-45%)	NO
4th - Office_Per 11	NO (-40%)	NO
5th - Office_Per 1	YES (+10%)	NO
5th - Office_Int 1	NO (-34%)	NO
5th - Office_Int 2	NO (-88%)	NO
5th - Office_Per 2	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
5th - Office_Per 3	NO (-24%)	NO
5th - Office_Per 5	YES (+67%)	NO
5th - Office_Per 6	YES (+28%)	NO
5th - Office_Per 7	NO (-46%)	NO
5th - Office_Per 8	NO (-16%)	NO
5th - Office_Per 9	NO (-50%)	NO
5th - Office_Per 10	YES (+38%)	NO
5th - Office_Per 11	NO (-36%)	NO
5th - Office_Per 12	YES (+1%)	NO
6th - Office_Per 8	NO (-11%)	NO
6th - Office_Per 9	NO (-22%)	NO
6th - Office_Per 10	NO (-23%)	NO
6th - Office_Per 11	NO (-36%)	NO
6th - Office_Per 12	NO (-47%)	NO
6th - Office_Int 2	NO (-89%)	NO
G - Office_Pod 1	NO (-94%)	NO
5th - Office_Pod 1	NO (-94%)	NO
5th - Office_Pod 2	NO (-94%)	NO
5th - Office_Per 13	NO (-48%)	NO
5th - Office_Per 14	NO (-73%)	NO
6th - Office_Int 3	YES (+17%)	NO
6th - Office_Per 13	NO (-61%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	8131	8131
External area [m²]	8112	8112
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	3391	4094
Average U-value [W/m²K]	0.42	0.5
Alpha value* [%]	7.11	7.11

* 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
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**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
	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: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	4.92	3.78
Cooling	4.93	9.4
Auxiliary	9.89	8.9
Lighting	9.15	18.02
Hot water	14.73	14.65
Equipment*	53.25	53.25
TOTAL**	**43.61**	**54.75**

* Energy used by equipment does not count towards the total for calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	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	Notional
Heating + cooling demand [MJ/m²]	107.93	107.96
Primary energy* [kWh/m²]	96.01	131.14
Total emissions [kg/m²]	16.4	22.4

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

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] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	30.7	0	10.3	0	6.1	0.82	0	0.91	0
	Notional	50.6	0	17.2	0	7.8	0.82	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	32.7	0	11	0	1.1	0.82	0	0.91	0
	Notional	36.8	0	12.5	0	1.1	0.82	0	----	----
[ST] Other local room heater - unfanned, [HS] LTHW boiler, [HFT] Electricity, [CFT] Electricity										
	Actual	119.6	0	33.2	0	0	1	0	1	0
	Notional	229.6	0	77.9	0	0	0.82	0	----	----
[ST] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	13.9	133.1	4.7	7.5	14.4	0.82	4.95	0.91	5.21
	Notional	5.4	138.5	1.8	14.3	12.7	0.82	2.7	----	----

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	0.2	External Wall
Floor	0.2	0.17	Ground Floor
Roof	0.15	0.13	Roof
Windows, roof windows, and rooflights	1.5	1.2	W_Gnd-F1
Personnel doors	1.5	1.08	D_Gnd-L1
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project

$U_{i\text{-}Typ}$ = 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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Regents Wharf - Lean Scheme

As designed

Date: Wed Apr 12 16:38:30 2017

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.4.0"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.4.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Moditha Arangi Wickramaratna

Telephone number: 0193 278 1641

Address: 51 Staines Road West, Sunbury-On-Thames, TW16 7AH

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

The building does not comply with England Building Regulations Part L 2013

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	22.2
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	22.2
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	26.1
Are emissions from the building less than or equal to the target?	BER > TER
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

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	External Wall
Floor	0.25	-	-	No floors in project
Roof	0.25	0.13	0.13	Roof
Windows***, roof windows, and rooflights	2.2	1.2	1.2	W_Gnd-L2x
Personnel doors	2.2	-	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* 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	25

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	>0.95

1- Toilets & Showers (4 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

2- Circulation Spaces

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

3- Office Pods

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

4- Offices (8 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	2.34	-	1.6	0.7
Standard value	2.5*	2.6	N/A	1.6^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Allowed SFP may be increased by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

1- Electric DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0
Standard value	1	N/A

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
4th - Circulation 1	-	90	-	82
4th- Stair Core 2	-	90	-	37

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
5th - Office_Per 1	90	-	-	388
5th - Toilet 1	-	90	-	135
5th - Office_Int 1	90	-	-	390
5th- Stair Core 2	-	90	-	38
5th - Circulation 2	-	90	-	60
5th - Office_Per 2	90	-	-	446
4th - Toilet 2	-	90	-	132
4th- Stair Core 1	-	90	-	44
4th - Office_Per 1	90	-	-	412
4th - Office_Int 1	90	-	-	391
4th - Circulation 2	-	90	-	56
4th - Office_Per 2	90	-	-	432
5th - Circulation 1	-	90	-	89
5th- Stair Core 1	-	90	-	46
5th - Pods 1	90	-	-	178
5th - Pods 2	90	-	-	183
4th - SME Office 1	90	-	-	1137
4th - Mezzanine 1	90	-	-	2270
5th - Pods 3	90	-	-	182
5th - Pods 4	90	-	-	223
B - Showers 1	-	90	-	36
4th - Toilet 1	-	90	-	95
4th - Cleaners Cupboard 1	-	90	-	13
4th - Circulation 3	-	90	-	21
6th- Stair Core 1	-	90	-	38

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
5th - Office_Per 1	YES (+29%)	NO
5th - Office_Int 1	NO (-88%)	NO
5th - Office_Per 2	NO (-1%)	NO
4th - Office_Per 1	NO (-62%)	NO
4th - Office_Int 1	NO (-95%)	NO
4th - Office_Per 2	NO (-10%)	NO
5th - Pods 1	NO (-93%)	NO
5th - Pods 2	NO (-92%)	NO
4th - SME Office 1	NO (-32%)	NO
4th - Mezzanine 1	NO (-35%)	NO
5th - Pods 3	NO (-92%)	NO
5th - Pods 4	NO (-95%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	1185	1185
External area [m^2]	1699	1699
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	25	3
Average conductance [W/K]	575	873
Average U-value [W/m^2K]	0.34	0.51
Alpha value* [%]	12.09	12.09

* 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
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**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
	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: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

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

	Actual	Notional
Heating	16.92	8.52
Cooling	6.46	9.37
Auxiliary	20.48	8.18
Lighting	10.01	19.61
Hot water	2.09	2.41
Equipment*	34.12	34.12
TOTAL**	**55.95**	**48.09**

* Energy used by equipment does not count towards the total for calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

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	Notional
Heating + cooling demand [MJ/m^2]	115.63	122.29
Primary energy* [kWh/m^2]	153.93	123.4
Total emissions [kg/m^2]	26.1	22.2

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

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] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	85	0	23.6	0	15.7	1	0	1	0
	Notional	55.5	0	18.8	0	20.9	0.82	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Electricity, [CFT] Electricity										
	Actual	87.2	0	24.2	0	1.1	1	0	1	0
	Notional	37.2	0	12.6	0	1.1	0.82	0	----	----
[ST] No Heating or Cooling										
	Actual	192.4	0	53.4	0	0	1	0	1	0
	Notional	243.3	0	82.5	0	0	0.82	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	44.3	76.2	13.4	9.5	28.5	0.92	2.22	0.96	2.34
	Notional	6.8	134.2	2.3	13.8	9.5	0.82	2.7	----	----

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

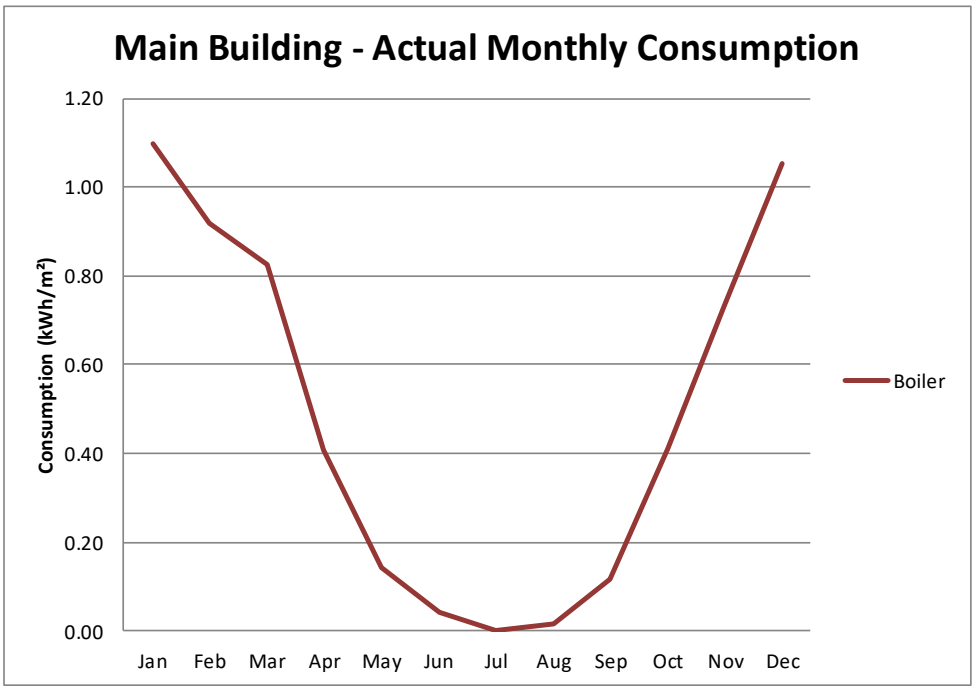
Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.2	External Wall
Floor	0.2	-	No floors in project
Roof	0.15	0.13	Roof
Windows, roof windows, and rooflights	1.5	1.2	W_Gnd-L2x
Personnel doors	1.5	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project

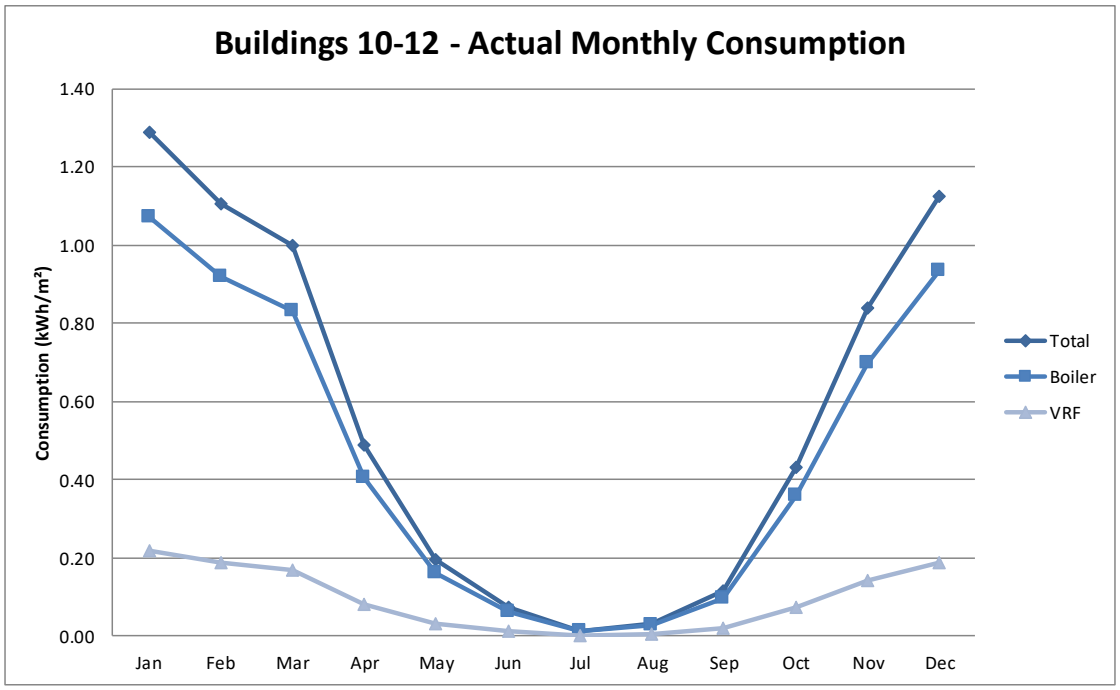
$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* 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	25

Appendix B - Boiler / VRF Heat Comparison





Appendix C – U-Values

U-Values	
Walls	0.20
Roof	0.14
Floor	0.17
Windows – G = 0.3	1.2