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ENERGY STATEMENT

SOLUM REGENERATION PARTNERSHIP

Proposed Mixed-Use Development
Twickenham Station
London

28/04/2011

Revision B

PB/JL/9090

CHB Design Services Ltd T/A
Church House Building Sustainability (CHBS)
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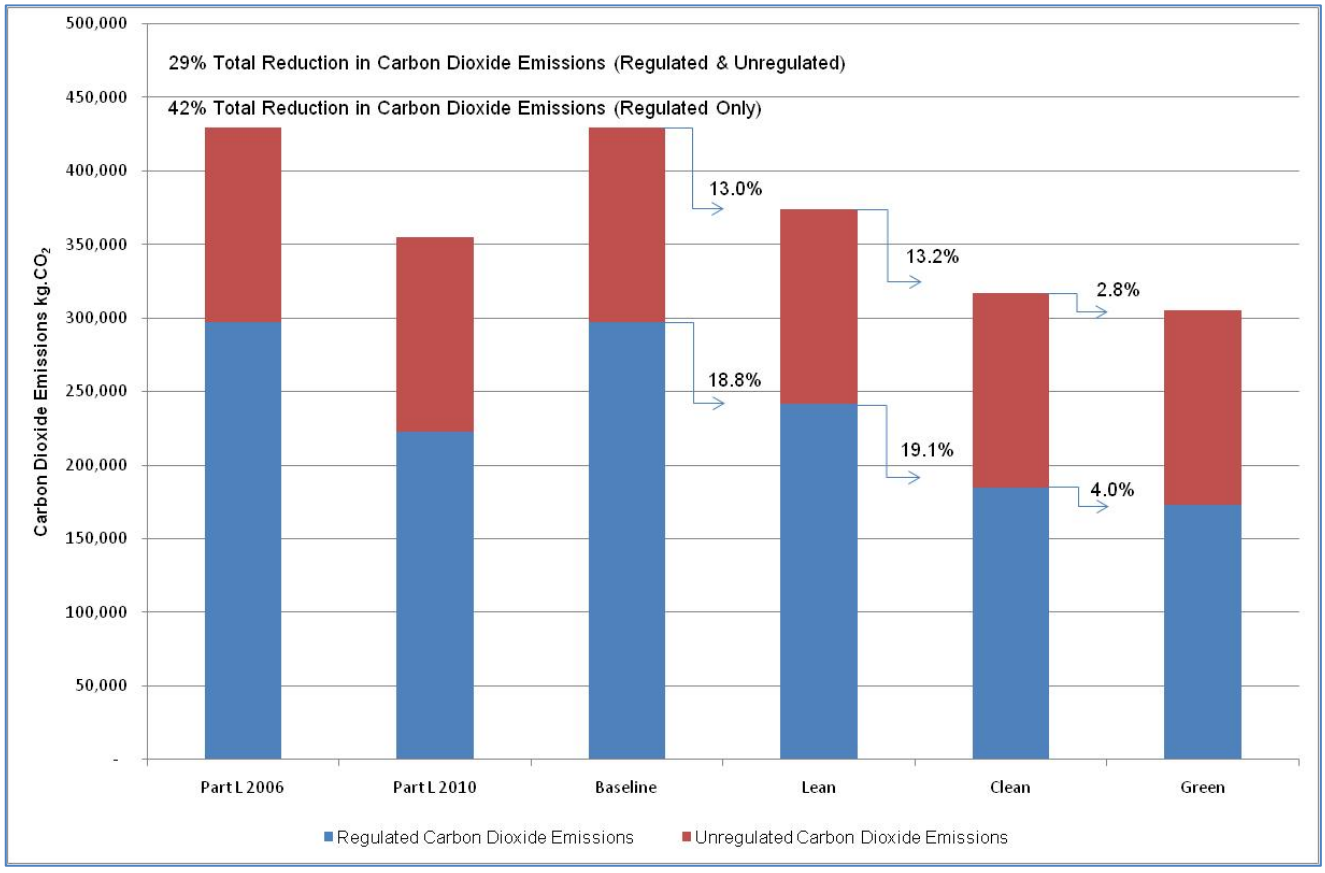
Executive Summary

The proposed mixed-use development at Twickenham Station has an Energy Strategy developed according to the requirements of the London Plan 2008 Energy Hierarchy.



The Energy Strategy proposes to reduce the site-wide total carbon dioxide emissions by a total of **29%** and the regulated emissions by a total of **42%.**

	Tonnes CO_2 per annum		Carbon Dioxide (%)	
	Regulated	**Total Energy**	**Regulated**	**Total Energy**
Baseline Emissions	297.2	429.5		
Savings from Energy Demand Reduction (Lean)	55.9	55.9	18.8	13.0
Savings from CHP (Clean)	56.7	56.7	19.1	13.2
Savings from Renewable Energy (Green)	11.8	11.8	4.0	2.8
Total Savings	124.4	124.4	41.8	29.0

The Energy Strategy includes the following steps of Carbon Dioxide emissions reduction; Lean, Clean and Green:

Lean

Energy efficiency will be designed into the development.

Energy efficiency measures include improvements in the thermal performance of the building fabric to achieve U-values of 20 - 55%, and air permeability of 50%, improvement over the minimum 2006 Building Regulations requirements along with improved detailing to reduce thermal bridging, energy efficient lighting and heating, and whole house ventilation including heat recovery.

Compared to 2010 Building Regulations the improvement in U-values are between 15 – 50%, air permeability remains a 50% improvement.

Clean

Energy, both heating and power, will be delivered efficiently to the whole of the proposed development including all building uses and areas.

This will be achieved through a site-wide heat distribution network and gas-fired Combined Heat and Power (CHP), which will allow connection with a future district heating network if such a scheme develops within the Twickenham area.

Green

A total of 25 kW_p photovoltaic (PV) capacity is proposed. The total PV capacity is made up of roof-top arrays of optimally orientated PV panels located across Block A, Block B and Block C roofs.

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1. Introduction

This energy statement considers the proposed Solum Regeneration mixed use development at Twickenham Station.

The proposed mixed use development comprises of approximately 115 residential units (Class C3), 734 m^2 of retail (A1, A2, A3) and 492.2 m^2 of railway station and associated areas with associated amenity space, access, landscaping and boundary treatment.

It should be noted that the majority of the 492.2 m^2 of railway station is to be unconditioned.

The purpose of the Energy Statement is to demonstrate that climate change mitigation measures are integral to the scheme's design and evolution, and that they are appropriate to the context of the development.

This document will describe the policy context in which the Energy Statement has been developed and demonstrate how it is proposed that the energy, and associated carbon dioxide emissions, will be reduced through energy efficient design, efficient energy supply and onsite renewable energy generation.

Standard Assessment Procedure (SAP) and Simplified Building Energy Model (SBEM) calculations have been performed to ensure that the baseline site emissions and the proposed energy-efficiency measures are modelled in the most accurate and relevant methodology available.

The calculation methods used are SAP 2005 and SBEM V3.5 both designed to demonstrate compliance with 2006 Building Regulations as the proposed development is already registered with Building Control under the 2006 Regulations. A comparison with the 2010 Target Emission Rate is shown on the graphs in the Executive Summary and each section. A site-wide average 25% reduction in emissions rate over 2006 Building Regulations is assumed for this purpose.

The report is based on plans and building layouts provided in the following drawings provided on 21/04/11 by Rolfe Judd;

4674 / T(20)E01 B; 4674 / T(20)E02 B; 4674 / T(20)E03 B; 4674 / T(20)E04 C; 4674 / T(20)E05 B; 4674 / T(20)E06 B

4674 / T(20)P -1 D; 4674 / T(20)P -1M B; 4674 / T(20)P00 B; 4674 / T(20)P0M B; 4674 / T(20)P01 B; 4674 / T(20)P02 B; 4674 / T(20)P03 B; 4674 / T(20)P04 B; 4674 / T(20)P05 B; 4674 / T(20)P06 B; 4674 / T(20)P07 B

4674 / T(20)S01 B; 4674 / T(20)S02 B; 4674 / T(20)S03 B; 4674 / T(20)S04 B

2. Policy Background

The London Plan 2008 is the core policy document to which this Energy Statement responds. The relevant London Plan 2008 policies considered within this statement are summarised as follows;

Policy 4A.4 Energy assessment sets out the minimum requirements for assessing the baseline energy and carbon dioxide emissions of the development and demonstrating how these figures can be reduced through applying the Energy Hierarchy. This particular Energy Statement document is designed to follow the guidance set-out in *Policy 4A.4*.

Policy 4A.1 Tackling Climate Change sets out the overriding strategy of the Energy Hierarchy:

Using less energy	*Be Lean*
Supplying energy efficiently	*Be Clean*
Using renewable energy	*Be Green*

More information on each section of the hierarchy is provided in *Policy 4A.3 Sustainable Design and Construction, Policy 4A.6 Decentralised Energy: Heating, Cooling and Power* and *Policy 4A.7 Renewable Energy*; each is used to inform the relevant sections of this Energy Statement.

The London Plan is due to be replaced; the October 2009 London Plan Consultation draft replacement plan is not an adopted document but will, however, be a material consideration to this Energy Statement.

The London Plan (2009) Draft continues to encourage the Energy Hierarchy, as defined above. However, it also sets quantitative targets for overall reductions in carbon dioxide emissions over a 2006 Building Regulations baseline. The carbon dioxide reduction target for 2010 - 2013 is a 44% reduction over Part L 2006 and for 2013 - 2016 is a 55% reduction over Part L 2006.

3. Baseline Energy Demand and Carbon Dioxide Emissions

Figure 1 demonstrates the results of the SAP and SBEM calculations for the Target Emissions Rate (TER) calculation, which is the worst allowable performance under Building Regulations Approved Document L1A and L2A, in terms of energy and carbon dioxide emissions; these are the baseline energy demand and carbon dioxide emissions for the development.

Not all domestic energy end-uses are accounted for within the SAP methodology; therefore the following equation referred to in the Code for Sustainable Homes Technical Guide (May 2009) and the procedure set out in SAP 2005 Section 14 is used to account for the carbon dioxide emissions due to cooking and appliances (unregulated emissions) within dwellings:

$99.9 \times (TFA \times N)^{0.4717} - (3.267 \times TFA) + (32.23 \times N) + 72.6 = \text{Cooking \& Appliance Emissions}$

Where $N = 2.844 \times (1 - \exp(-0.000391 \times TFA^2))$

The equation above is used over the BREDEM-12 (2001) Model as it has been developed much more recently therefore is expected to have become more accurate.

Non-domestic operational energy consumption due to appliances, including cooking and small power, is calculated within the SBEM method in a separate category entitled equipment; although this is unregulated within ADL2A, for the purposes of determining a more accurate account of the site energy demands these end-uses must be included. The figures provided within the SBEM calculation for equipment energy is based on BRE estimates.

Figure 1 shows the baseline carbon dioxide emissions through regulated emissions, based on the Target Emission Rate (TER) from approved modelling software, and unregulated emissions not assessed within Building Regulations.

Figure 2 shows how the site energy demands which result in the baseline carbon dioxide emissions are divided into heating, cooling and power for the site.

Building	Regulated Carbon Dioxide Emissions ($kg.CO_2$/year)	Non-Regulated Carbon Dioxide Emissions ($kg.CO_2$/year)	Total Carbon Dioxide Emissions ($kg.CO_2$/year)
Residential Block A	61,815	40,106	101,921
Residential Block B	85,108	55,525	140,633
Residential Block C	40,831	26,189	67,020
Retail Unit 1	19,946	1,298	21,244
Retail Unit 2	18,533	1,297	19,830
Retail Unit 3	18,733	1,152	19,885
Retail Unit 4	32,027	2,129	34,155
Conditioned Station + Small Retail Units	20,251	4,517	24,768
Site-wide Total			**429,456**

Figure 1: Baseline Regulated and Non-Regulated Carbon Dioxide Emissions

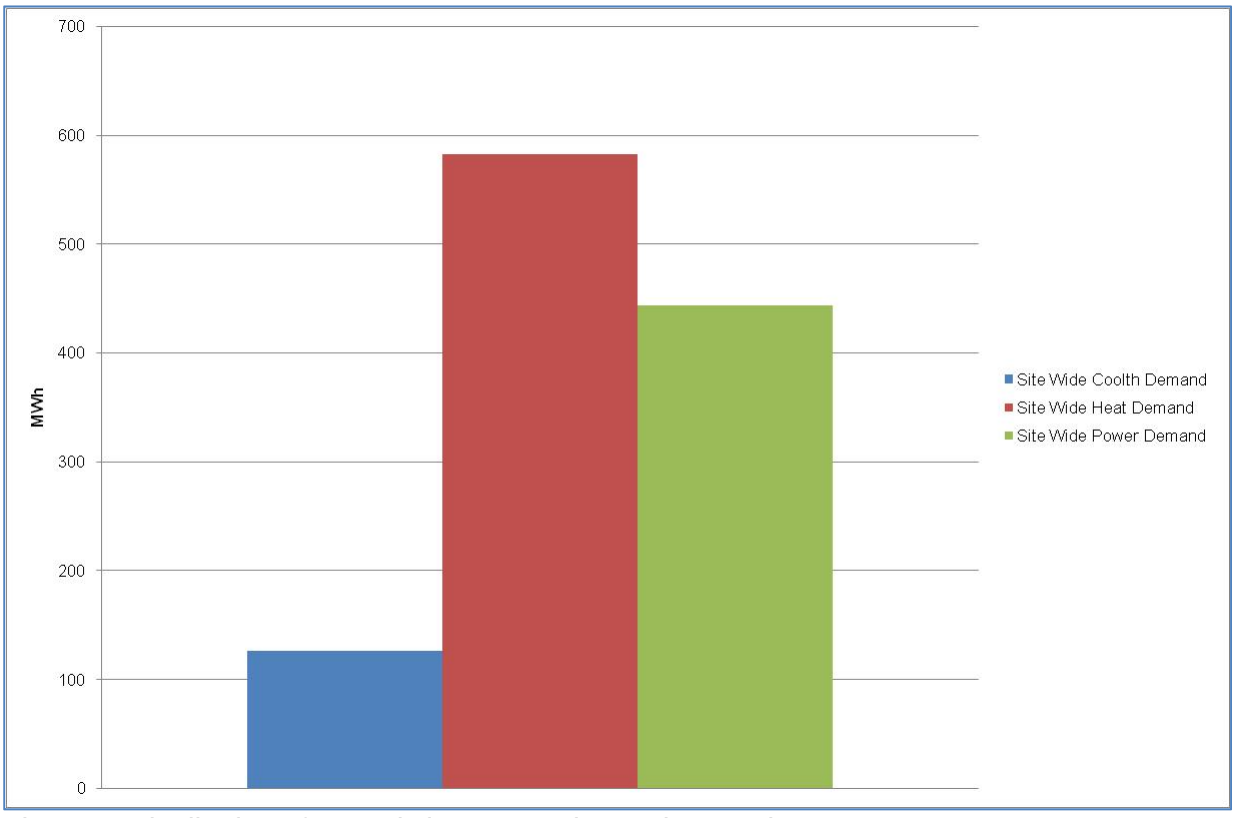

Figure 2: Distribution of annual site energy demands to end-uses.

4. Be Lean: Proposals for Reducing Energy Demand and Carbon Dioxide Emissions

In accordance with good practice environmental design, *Policy 4A. 1* and *Policy 4A.3 Sustainable Design and Construction,* the first priority is to reduce the site baseline emissions through energy efficient design measures.

In order to include all specific measures proposed, each building type will be considered in detail following descriptions of the site-wide improvements in building fabric thermal performance.

The reductions in carbon dioxide emissions against the baseline are shown in figures 4 and 5 at the end of this chapter.

4.1 Site-Wide Energy Efficiency Proposals

a. Layout

The development has been laid out with a compact form to try and reduce the heat loss areas of all building types.

Glazing to the north has been minimised throughout the development as north facing glazing has a high heat loss with negligible beneficial gains. However, some north facing glazing is present, as it is important to provide adequate daylighting to the buildings in order to minimise the use of artificial lighting during daytime hours.

The two retail units with south facing glazing have been designed to have significant overhangs on this façade to provide solar shading and reduce cooling demand. Solar shading is also provided to south west glazing on the retail units through balcony overhangs above the shop front glazing.

A similar strategy has been used throughout the apartments to use balconies as shading devices to reduce summertime solar gains to the apartments below and ensure that energy will not be required for comfort cooling. The design of the balconies will allow beneficial solar gains to penetrate during winter months when the sun is lower in the sky.

b. Building Fabric

It is proposed to make significant improvements to the thermal efficiency of the building fabric throughout all elements of the proposed development. Figure 3 details the proposed building fabric U-values and air infiltration along with comparisons made against the worst allowable Building Regulations Approved Document L1A standards for 2006 and 2010.

The thermal efficiency of the proposed development is intended to be further improved through the specification of Enhanced Construction Details in order to reduce thermal bridging.

For the residential areas of the development it is proposed to achieve a Global Y Value of 0.04 for the specified Enhanced Construction Details; this represents a 50% improvement on New Build Accredited Details which achieve a Global Y Value of 0.08 and has a significant reduction on the heat losses from the dwellings.

Element	Proposed	*Worst Allowable L1A 2006*	Improvement Over L1A 2006	*Worst Allowable L1A 2010*	Improvement Over L1A 2010
Floor U-value (W/m^2.K)	0.20	*0.25*	**20%**	*0.25*	**20%**
Roof U-value (W/m^2.K)	0.13	*0.25*	**48%**	*0.20*	**35%**
Glazing U-value (W/m^2.K)	1.70	*2.20*	**23%**	*2.00*	**15%**
External and Semi Exposed Wall U-value (W/m^2.K)	0.25	*0.35*	**29%**	*0.30*	**17%**
Front Door to Corridor (W/m^2.K)	1.00	*2.20*	**55%**	*2.00*	**50%**
Air Permeability (m^3/(m^2.hr) @50Pa)	5	*10*	**50%**	*10*	**50%**

Figure 3: Proposed improvements in site-wide building fabric specification

c. External lighting

External lighting will be energy efficient and will be controlled through automatic photocells and time switches to ensure that it is not used during daylight hours.

4.2 Sector Specific Energy Efficiency Proposals

a. Residential

Lighting

It is proposed to specify at least 75% of all light fittings within the dwellings with low energy fittings, capable of only accepting lamps with an efficacy of no less than 40 lamp lumens per circuit Watt.

It is further proposed to specify energy efficient lighting in communal areas and exterior areas of the residential development, including controls to ensure that external lighting is only used when required.

Heat Recovery

Mechanical Ventilation with Heat Recovery (MVHR) is proposed to serve each dwelling; these systems ensure the required amount of ventilation is provided to the occupants and building fabric whilst reducing heat loss through ventilation. The heat recovery of the system will be at least 85% efficient at transferring heat from the discharged air into the fresh air supply and the specific fan power will be no more than 1 W/l/s, meeting the Energy Saving Trust Recommended Standard.

Heating

Heating will be supplied by a gas-fired CHP system providing for the heat base load; this is covered in detail within the 'Clean' section. Top-up heating will be provided by a condensing gas-fired boiler system with an efficiency of at least 90%, contributing towards the 'Lean' energy efficiency carbon dioxide savings.

The radiators within the apartments will have individual Thermostatic Radiator Valves (TRV's), along with a thermostat and programmer to enable occupants to control their energy use in providing thermal comfort.

Domestic hot water will be provided via a heat exchanger at each apartment therefore losses through domestic hot water storage will be minimised.

Individual heat meters will also be provided to each apartment to ensure accurate billing of the energy consumed by the occupants.

Holistic Measures

The apartments are to be designed to meet the requirements of the Code for Sustainable Homes to a standard of Level 4. Some of the holistic measures which will be taken to ensure compliance will have a significant impact on reducing the energy demand of the development, these will include;

- Provision of clothes drying space to reduce use of tumble dryers
- Informing residents about energy efficient white goods
- Ample cycle storage to encourage low carbon transport
- Reduced water consumption to no more than 105 litres per person, hence low-flow fittings and appliances which will reduce domestic hot water consumption.
- Specification of construction materials with a low environmental impact demonstrated by an A or A+ Green Guide Rating
- Provision of household recycling facilities
- Monitoring and targeting to reduce environmental impact of the construction site
- Reduction of construction waste

The main holistic measures proposed which can impact on reducing the unregulated carbon dioxide emissions of the residential aspect of the development are encouraging reduced use of tumble dryers and informing residents about purchasing energy-efficient white goods.

As the impact on unregulated emissions is behaviour dependent hence no reduction will be assumed in this assessment as it could have a high degree of error.

b. Retail Units

The 4 large retail units within the development will be speculative and not fitted out by the developer. This can limit the control of the developer to ensure high standards of energy efficiency within the building fit-out.

However, it is proposed that a Green Lease Agreement and Green Building Guide will be used to ensure that the retail units can achieve a BREEAM Excellent rating.

The Green Lease Agreement and Green Building Guide will specify that the fit out will include only A-rated energy efficient equipment for any comfort cooling to these areas, that the lighting installation will have to meet or exceed 3 W/m^2/100 lux for general lighting and 22 lumens per circuit Watt for display lighting and that the connection provided to the site-wide heat network must be utilised to provide both space heating and hot water efficiently.

It is ensured that a high standard of thermal performance is achieved for all of these areas as described in the *Site-Wide Building Fabric* section above.

c. Conditioned Station and Small Retail Units

Only a relatively small area of the station will be conditioned. As the further retail units adjacent to the station entrance and on the platforms are very small hence it is assumed that any Green Lease Agreement would not be appropriate, however, minimum services of space heating are expected to be provided as part of the tenancy.

It is assumed that space and water heating to these areas are also provided by the site-wide heat distribution network.

It is assumed that the lighting, including display lighting, to these areas has an average efficacy of at least 50 lumens per circuit watt.

It is ensured that a high standard of thermal performance is achieved for all of these areas as described in the *Site-Wide Building Fabric* section above.

4.3 Summary – Be Lean

Building	Baseline Total Emissions kg.CO_2/year	Lean Total Emissions kg.CO_2/year	Improvement Over Baseline %
Residential Block A	101,921	91,260	10
Residential Block B	140,633	126,553	10
Residential Block C	67,020	60,713	9
Retail Unit 1	21,244	16,422	23
Retail Unit 2	19,830	14,922	25
Retail Unit 3	19,885	15,632	21
Retail Unit 4	34,155	23,747	30
Conditioned Station + Small Retail Units	24,768	24,338	2
Site-wide Total	**429,456**	**373,586**	**13**

Figure 4: Summary of total (regulated and non-regulated) carbon dioxide emissions reduction through energy efficiency measures

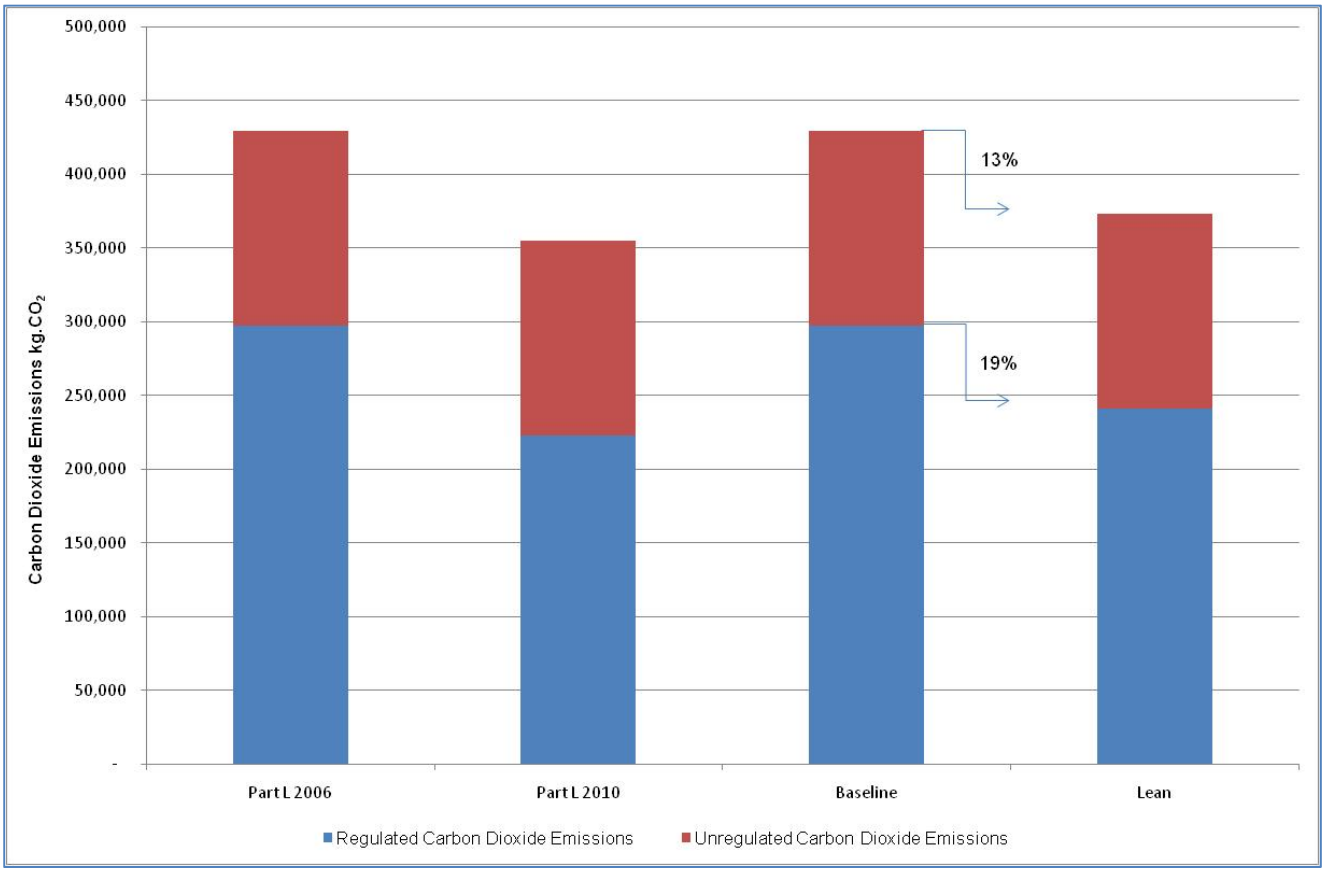

Figure 5: Summary of reduction in total and regulated emissions over the baseline through energy efficiency

5. Be Clean: Proposals for Supplying Energy Efficiently

In accordance with *Policy 4A. 1* and *Policy 4A. 6 Decentralised Energy: Heating, Cooling and Power* once the baseline emissions have been reduced the provision of decentralised energy systems are considered.

The energy demands of the site were considered and it was found that a significant heat base load was present in the form of hot water demand for the residential units. It was also found that active cooling requirements are predicted to be relatively low, as demonstrated in figure 2, therefore a decentralised energy scheme will be required to provide heat and power only.

5.1 Existing Energy Supply Networks

The online resource www.londonheatmap.org.uk was considered firstly to investigate whether an existing distribution network was in place close to the proposed site.

It was found that there were no existing distribution networks within the vicinity of the site hence this option is not feasible for further consideration.

The Evidence Base for Carbon Emissions Reduction Policies London Borough of Richmond on Thames 3rd November 2008 considers the potential for decentralised energy networks within the Local Housing Availability Assessment Potential Sites. The Twickenham Station site is nominated but no further details are provided.

Another of the sites nominated for such a scheme is the 109 London Road Post Office Sorting Office, which is adjacent to the Twickenham Station site considered within this report. Research has been unable to find evidence of a planning application for development of the Sorting Office site, hence it is assumed that the Twickenham Station development would be the first to establish a site-wide decentralised heat network that any future development on the Sorting Office site could connect and contribute to.

5.2 Renewable Energy CHP

A site-wide renewable energy powered CHP system was considered next. The main renewable fuels available for CHP engines are Woodchip, Liquid Biofuels, and Biogas.

Woodchip CHP is not considered suitable for the proposed site for the following reasons;

- A significant area of the site would be required for fuel storage, a bulk delivery vehicle will supply between 20 – 85 m^3 and it is recommended that fuel storage capacity is at least twice the delivery capacity.
- Deliveries could pose health and safety risks as they would involve access to public areas of the site by a heavy goods vehicle, the delivery vehicle will be a 6 or 8 wheel wagon or an articulated lorry depending on the system size and supply contract.
- The site is within an Air Quality Management Area (AQMA) hence a heating system with high particulate emissions would not be allowable.

Liquid biofuels are not considered suitable for the proposed development for the following reasons;

- There are question marks over the sustainability of first generation biofuels – BREEAM does not consider first generation biofuels such as biodiesel or vegetable oil an acceptable low carbon technology, this is due to uncertainty over the impact on biodiversity, global food production and greenhouse gas savings along with the ease of switching from first generation biofuels to fossil fuels.
- Second and third generation biofuels do not currently have a reliable and established supply chain in the UK hence there is not an established supply chain of biofuels with guaranteed sustainability credentials.
- The site is within an Air Quality Management Area (AQMA) hence a heating system with high particulate emissions would not be allowable.

Biogas is not considered suitable for the proposed development for the following reason:

- No easily accessible source of sewage gas has been found within the vicinity of the proposed site.
- It is not considered practical to have an on-site anaerobic digester producing biogas due to lack of available space and potential issues with health, safety and unpleasant aromas.

As a renewable energy fired CHP system is not considered a feasible or sustainable option for this site then the third priority for efficient delivery of heat and power to the site is the most suitable option.

5.3 Proposed Clean Energy Solution: Gas-Fired CHP

It is proposed that the site is served by a site-wide heating distribution network fed by a gas-fired CHP engine within the lower ground floor plant room in Block B. The proposed location of the Energy Centre and an indicative heat main distribution network is shown in figure 6.

The proposed site-wide heat distribution network will ensure that the infrastructure is in place for the proposed mixed use development to connect to any future district-wide energy schemes.

The centralised CHP unit will be designed to meet the base load heat demand and a high efficiency (min 90%) gas-fired boiler system will contribute to the communal heat distribution network when the site-wide demand exceeds the thermal output of the CHP engine.

It should be noted that the distribution network is proposed to serve both space heating and domestic hot water demand across all proposed building-uses with the development.

The proposed CHP design is based on a CHP engine with a heat efficiency of 58.4% and an electrical efficiency of 24.1. The initial CHP design meets 67% of the site-wide domestic hot water and space heating demand when the CHP engine is operating 24 hrs per day.

The initial design has assumed a modular approach using three CHP engines, each with an output of 5.5 kW power and 13.3 kW heat when operating at an assumed return temperature of 60°C.

The CHP unit will be designed to fully satisfy the requirements of the DEFRA GQCHP Scheme.

Figure 8 shows the monthly site-wide heat demands and the proposed output of the most appropriate gas-fired CHP engine to meet the base load demands.

The reduction in site carbon dioxide emissions over the baseline are shown in figures 9 and 10.

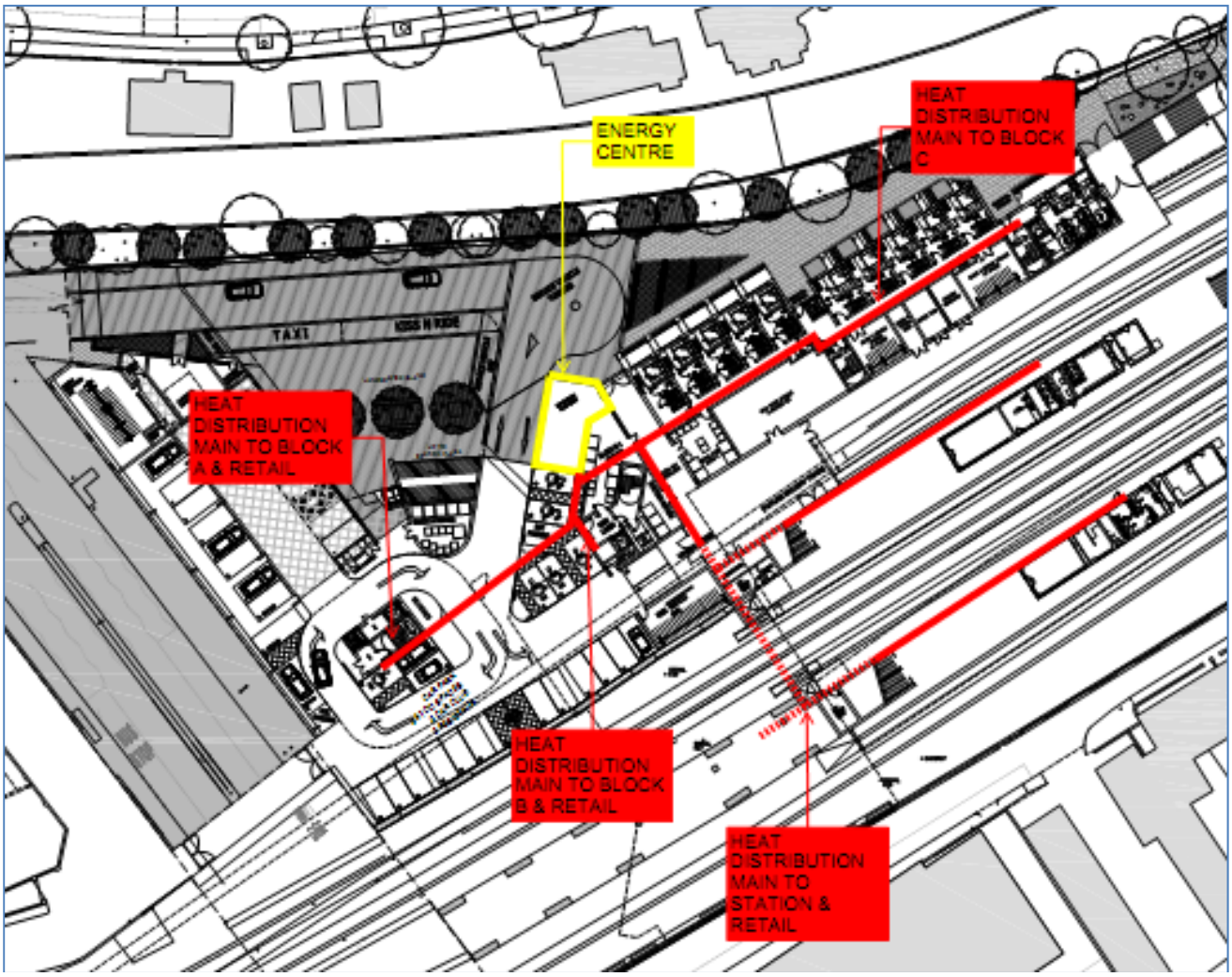

Figure 6: The proposed lower ground floor energy centres and heat distribution network.

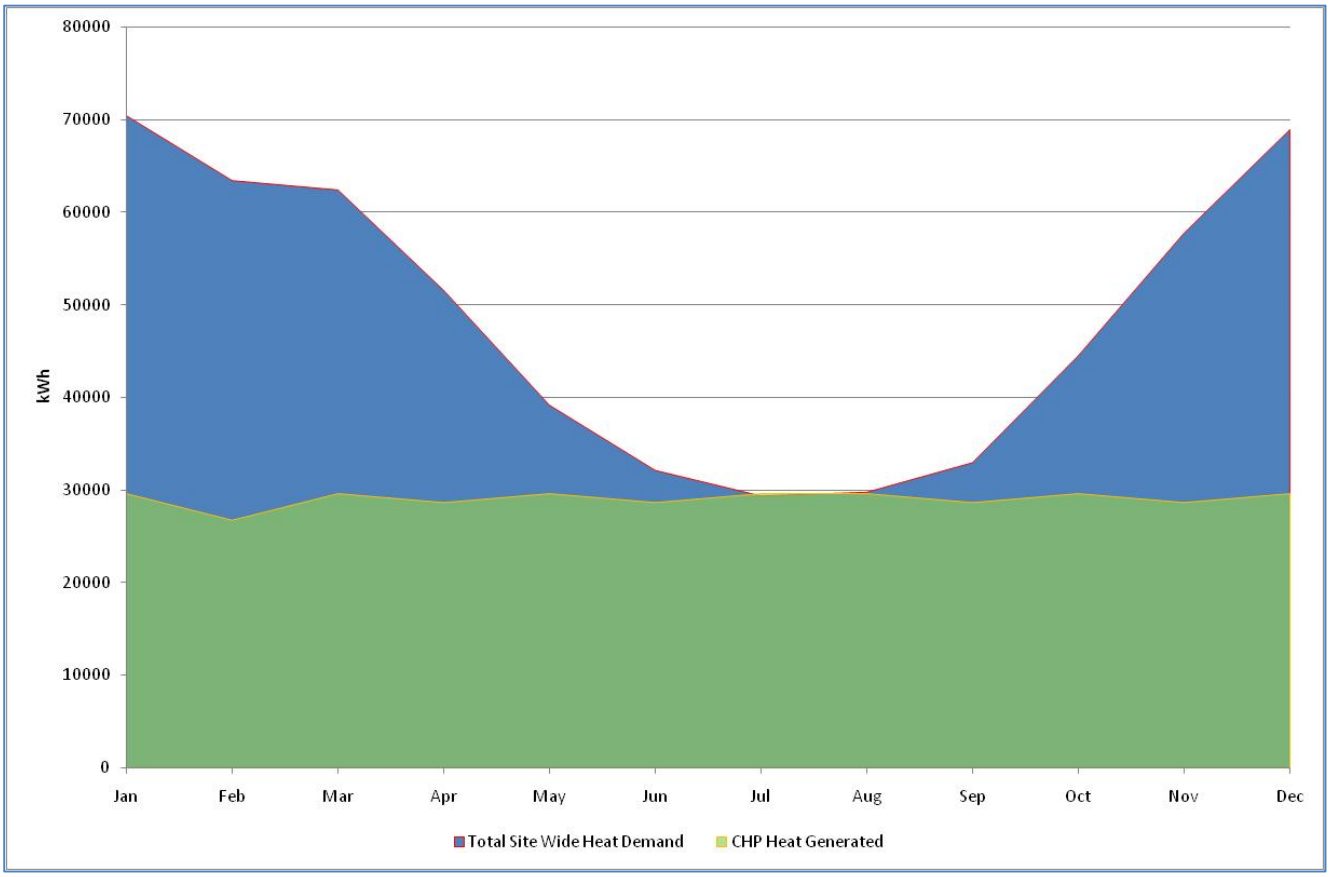

Figure 8: Summary of monthly site-wide heat demands and the proposed gas-CHP output.

5.4 CHP Operation

Initial discussions regarding the use of the ESCO model to operate the site-wide CHP system and heat distribution network have taken place. There are concerns that the scale of the development may not be sufficient for this approach to be viable, however, the feasibility of operating the Energy Centre and distribution network in this way will be assessed further.

5.5 Summary – Be Clean

Building	Lean Total Emissions kg.CO_2/year	Clean Total Emissions kg.CO_2/year	Improvement Over Baseline %
Residential Block A	91,260	76,156	15
Residential Block B	126,553	106,220	14
Residential Block C	60,713	50,532	15
Retail Unit 1	16,422	14,743	8
Retail Unit 2	14,922	14,069	4
Retail Unit 3	15,632	13,681	10
Retail Unit 4	23,747	22,446	4
Conditioned Station + Small Retail Units	24,338	19,089	21
Site-wide Total	**373,586**	**316,936**	**13**

Figure 9: Summary of total (regulated and non-regulated) carbon dioxide emissions reduction through efficient supply of energy

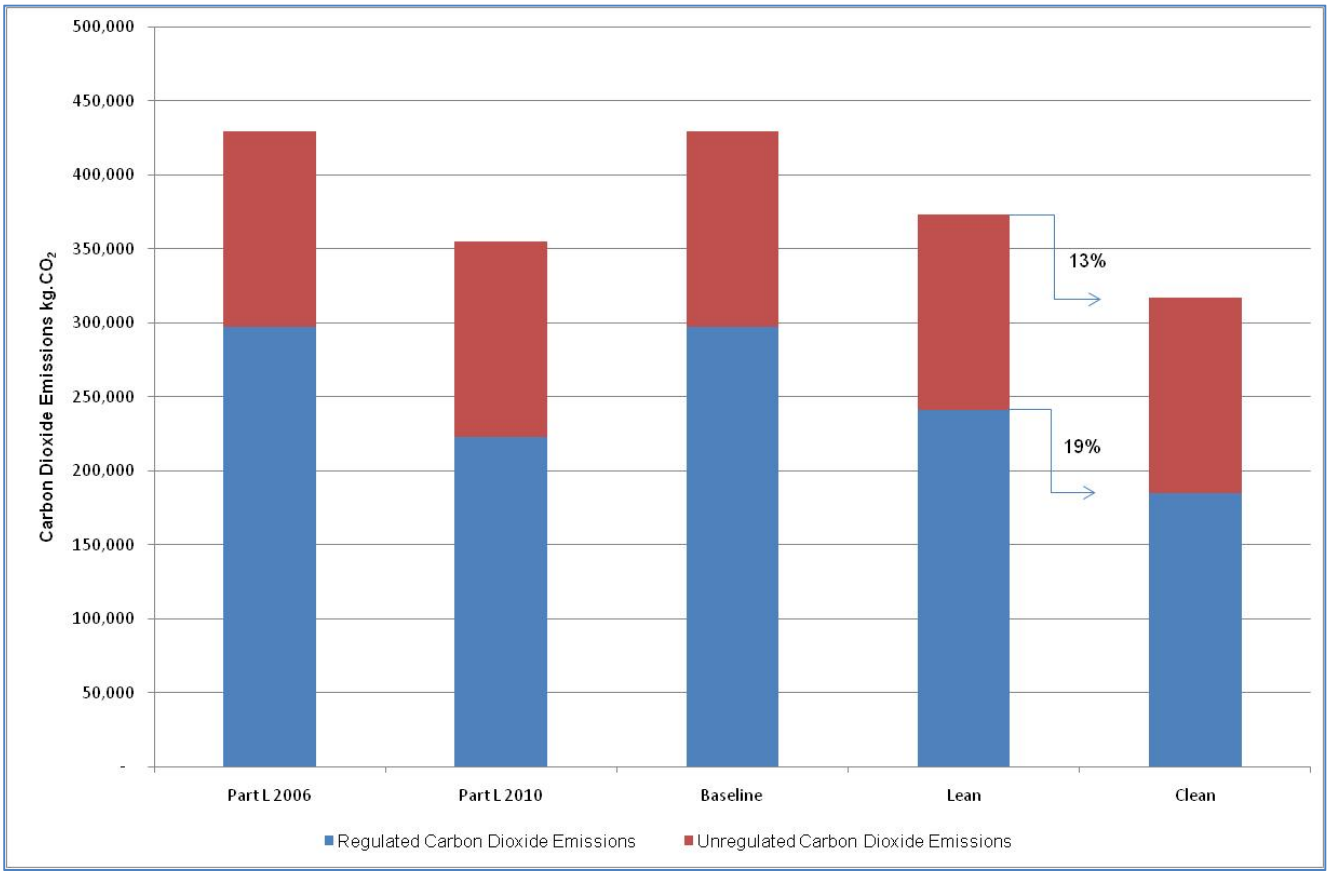

Figure 10: Summary of reduction in total and regulated emissions over the baseline through efficient supply of energy

6. Be Green: Proposals for Renewable Energy Generation

In accordance with *Policy 4A. 1* the site baseline emissions have been reduced through energy efficient design and energy efficient delivery of heat and power, it shall now be considered how the remaining energy demand and associated carbon dioxide emissions can be reduced through the generation of renewable energy.

Policy 4A.7 Renewable Energy states that a 20% reduction in site carbon dioxide emissions should be targeted wherever feasible.

6.1 Feasibility of Renewable Energy Technologies

A renewable energy pre-feasibility study has been performed (*CHBS Report: 9090 Solum Twickenham LZC Pre-Feasibility Study 29-01-10*). The reasons for discounting unfeasible renewable energy technologies are detailed within this report and are summarised below:

Wind Turbines	-	Insufficient predicted wind resource
Biomass	-	Insufficient space for fuel storage Issues of sustainable sourcing Air quality restrictions
Ground Source Heat Pumps	-	High cost of geological survey and limited space
Geothermal	-	Insufficient estimated geothermal heat resource at the site
Hydrogen Fuel Cells	-	Limited supply of hydrogen from renewable sources available

The renewable energy pre-feasibility study found that the most suitable renewable energy technologies for the site are;

Solar Thermal
Mechanical Ventilation with Heat Pump Heat Recovery
Photovoltaics
Air Source Heat Pumps
Water Source Heat Pump
Micro Hydro

Although gas-fired CHP offers significant reductions in carbon dioxide emissions it does however limit the feasible options for renewable heat generation.

It is difficult to integrate a Solar Thermal system with CHP as it would act to reduce the base heat load of the proposed development and could conflict with the CHP during summer months.

Use of Air Source Heat Pumps or Mechanical Ventilation with Heat Pump Heat Recovery to meet the excess heat demand not met by the CHP system is also difficult. Heat pumps cannot efficiently generate the high-grade heat required to feed into a district heating network

It has subsequently been discovered through further investigations that use of the River Crane as an energy resource through the potential energy of its flow or through the heat stored in the water would not be feasible due to issues with ownership of the river bank.

6.2 Proposed Renewable Energy Solution: Photovoltaics

Therefore the most appropriate renewable energy technology to the site is Photovoltaics (PV), which is the only feasible renewable power technology suitable for the site.

Figures 11 shows an indicative layout for an optimally orientated PV array, facing due south at approximately 30° elevation from horizontal. The roof space on Blocks A, B and C are utilised as much as possible although some areas are allocated as dedicated amenity space.

The roof layouts have been configured to ensure that the most un-shaded areas of roof have been made available for the PV panels and the more shaded areas have been allocated for amenity space.

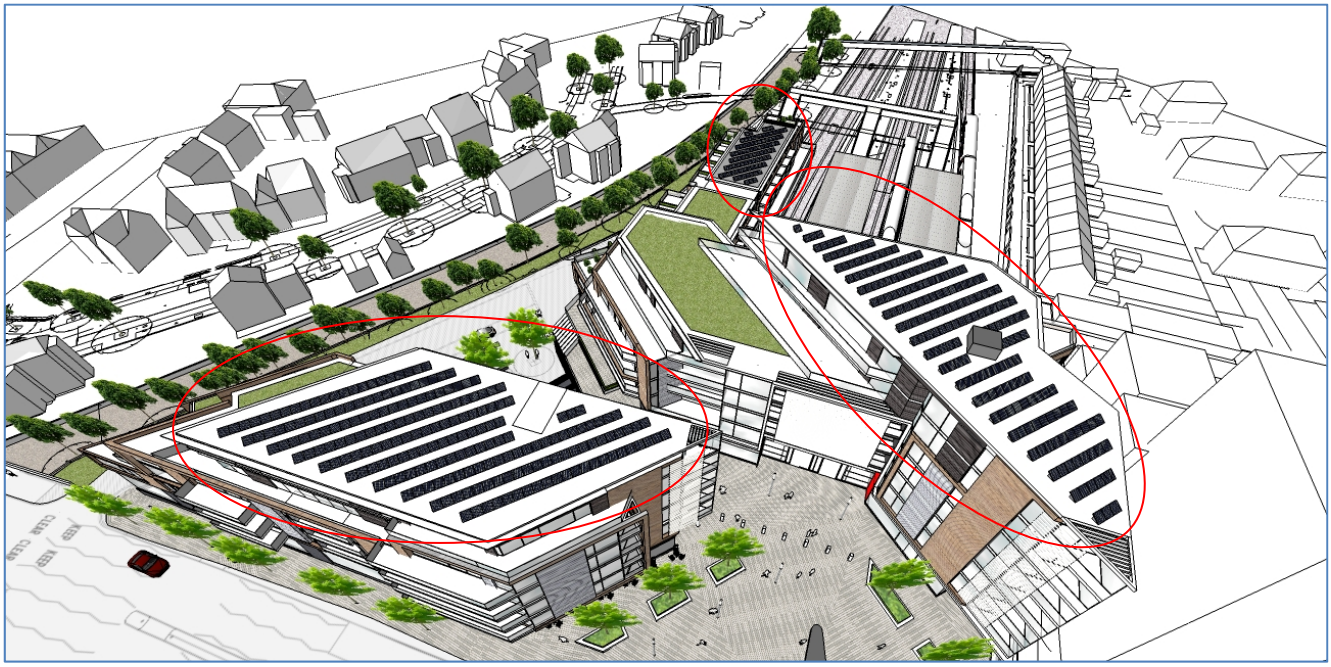

Figure 11: Architects indicative layout of the proposed PV arrays on Blocks A, B & C; optimally orientated PV panels on roof.

An initial assessment of the available roof area has found that there is sufficient space for a total of 25 kW_p PV capacity across the three locations as follows; Block A 10 kW_p, Block B 8 kW_p and Block C 7 kW_p. Maintenance areas and sufficient spacing to avoid panels and roof features causing shading have been considered.

In all proposed PV locations it is proposed that each individual PV panel will be angled at 30°, rather than the individual panels being mounted on a raised frame at 30°, which could increase the available area of solar electricity generation. The reason that a raised frame for mounting the PV array has not been assumed is that there are expected to be planning issues due to the additional height created by this approach and potential negative visual impacts on the architecture of the proposed scheme.

The emissions reductions through the PV arrays are summarised in figures 12 and 13.

6.3 Summary – Be Green

Building	Clean Total Emissions kg.CO_2/year	Green Total Emissions kg.CO_2/year	Improvement Over Baseline %
Residential Block A	76,156	73,329	3
Residential Block B	106,220	103,349	2
Residential Block C	50,532	47,213	5
Retail Unit 1	14,743	14,011	3
Retail Unit 2	14,069	13,428	3
Retail Unit 3	13,681	12,964	4
Retail Unit 4	22,446	21,445	3
Conditioned Station + Small Retail Units	19,089	19,089	0
Site-wide Total	**316,936**	**305,099**	**3**

Figure 12: Summary of total (regulated and non-regulated) carbon dioxide emissions reduction through renewable energy generation

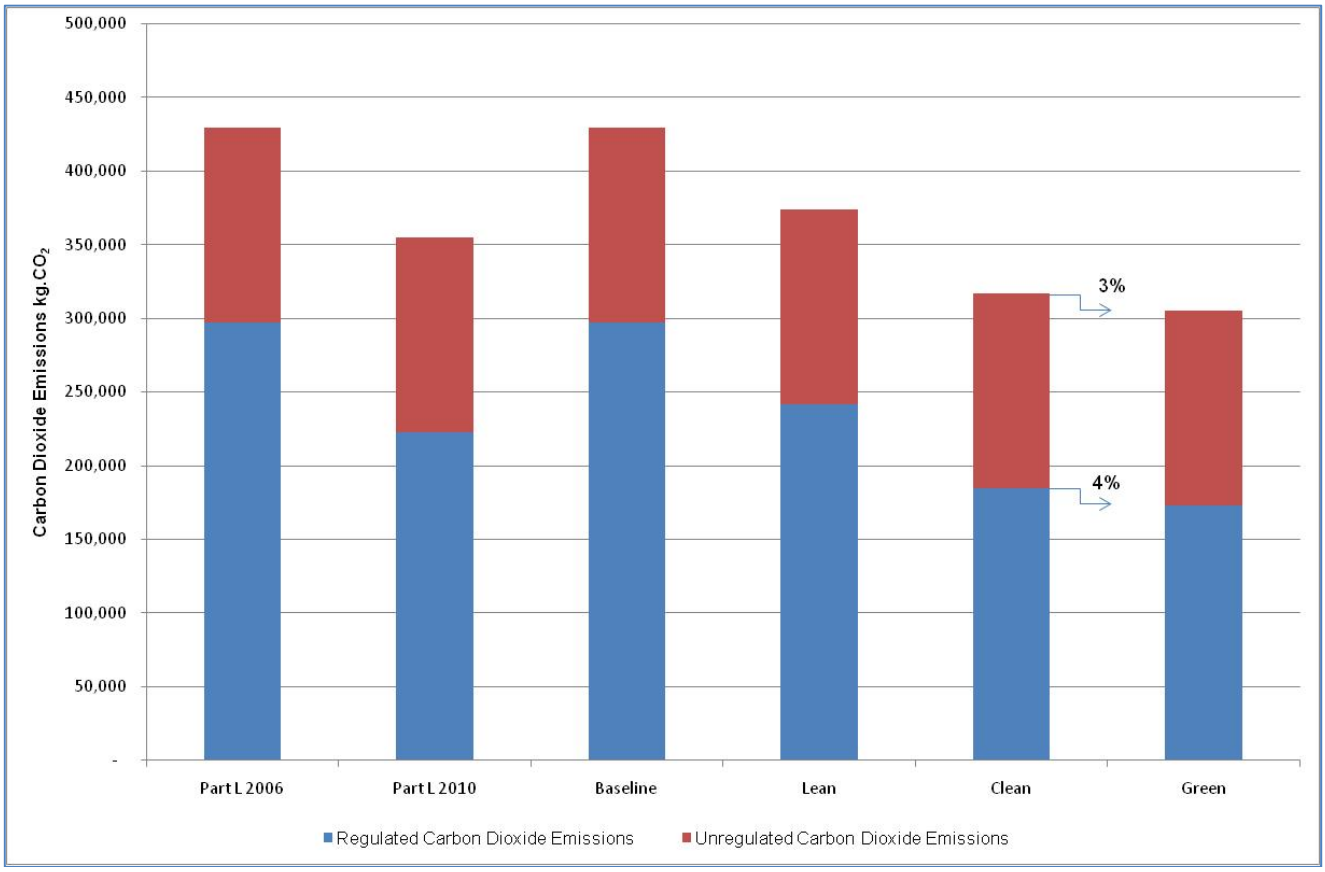

Figure 13: Summary of reduction in total and regulated emissions over the baseline through renewable generation of energy

7. Concluding Summary

This energy statement has been created following the guidance of London Plan Policy 4A.4; it demonstrates the proposed reductions in carbon dioxide emissions through implementation of the Lean / Clean / Green Energy Hierarchy stated in London Plan Policy 4A.1.

It has been shown in this Energy Statement that energy efficiency has been designed into the proposed mixed-use development through significant improvements in the building fabric thermal specification when compared to the minimum requirements of Building Regulations. It has also been demonstrated that building services will be specified with a strong consideration for energy efficiency.

The Energy Statement has described how a site-wide heat distribution network and gas-fired CHP system is proposed in order to supply the whole development with low carbon heat and power.

The Energy Statement has gone on to demonstrate that the site emissions are proposed to be reduced further through the specification of three separate photovoltaic arrays at optimum locations throughout the development in order to generate renewable electricity.

Figure 14 summarises the reductions in the site baseline emissions achieved through implementation of the *London Plan 2008 Policy 4A. 1* as described within this Energy Statement and shows that the Mayor's proposed future carbon reduction targets for new developments between 2010 and 2013 as set out in the draft replacement London Plan (October 2009) of a 44% reduction in regulated emissions over 2006 Building Regulations is almost met.

	Tonnes CO_2 per annum		Carbon Dioxide (%)	
	Regulated	**Total Energy**	**Regulated**	**Total Energy**
Baseline Emissions	297.2	429.5		
Savings from Energy Demand Reduction (Lean)	55.9	55.9	18.8	13.0
Savings from CHP (Clean)	56.7	56.7	19.1	13.2
Savings from Renewable Energy (Green)	11.8	11.8	4.0	2.8
Total Savings	124.4	124.4	41.8	29.0

Figure 14: Summary of carbon dioxide emissions reductions through implementation of energy efficiency, efficient supply of energy and renewable energy generation.

Appendices

Appendix A: Baseline and Lean Modelling Outputs

A1 Residential Baseline and Lean Block Compliance Summary

Block Compliance WorkSheet:
A

User Details

Assessor Name:	Peter Bartley	**Stroma Number:**	STRO001295
Software Name:	Stroma FSAP	**Software Version:**	Version: 1.1.0.214

Calculation Details

Dwelling	DER	TER	TFA
A00-01	23.52	28.47	47.93
A00-02	21.35	27.07	50.42
A00-03	20.23	25.74	66.25
A00-04	19.64	25.73	72.28
A01-05	20.45	25.41	64.09
A01-06	19.86	25.21	50.57
A01-07	17.06	19.77	70.92
A01-08	18.15	22.87	78.02
A01-09	16.86	22.08	77.08
A01-10	17.84	21.68	63.71
A01-11	16.8	22.47	81.35
A01-12	20.54	24.92	50.41
A01-13	17.83	23.41	91.15
A02-14	22.34	28.17	61.33
A02-15	19.56	22.83	64.09
A02-16	19.86	25.21	50.57
A02-17	16.63	18.51	70.92
A02-18	17.4	20.18	78.02
A02-19	16.25	19.36	77.08
A02-20	18	21.38	63.71
A02-21	16.76	19.84	70.64
A02-22	19.95	22.88	74.54
A03-23	19.56	22.83	64.09
A03-24	19.86	25.21	50.57
A03-25	16.73	18.68	70.92
A03-26	17.4	20.18	78.02

Block Compliance WorkSheet:
A Cont...

Dwelling	DER	TER	TFA
A03-27	16.43	19.71	77.08
A03-28	18.83	22.83	63.71
A03-29	17.66	21.6	70.64
A03-30	21.74	25.84	74.54
A04-31	19.56	22.83	64.09
A04-32	20.92	26.7	50.57
A04-33	18.25	20.23	96.83
A04-34	18.25	21.73	60.58
A04-35	18.98	20.64	78.47
A05-36	21.3	25.7	64.09
A05-37	20.99	24.07	83.71
A05-38	22.27	27.48	52.54
A05-39	20.19	25.76	50.89
A05-40	21.61	24.58	65.88

Calculation Summary

Total Floor Area	2692.30
Average TER	22.96
Average DER	19.00
Compliance	Pass

Block Compliance WorkSheet:
B

User Details

Assessor Name:	Peter Bartley	**Stroma Number:**	STRO001295
Software Name:	Stroma FSAP	**Software Version:**	Version: 1.1.0.214

Calculation Details

Dwelling	DER	TER	TFA
B00-01	21.45	27.15	51.75
B00-02	19.18	22.71	73.13
B00-03	17.92	22.68	74.73
B01-04	20.28	25.08	64.9
B01-05	20.08	25.22	54
B01-06	18.19	22.52	82.9
B01-07	21.16	27.6	51.44
B01-08	20.52	24.97	70.18
B01-09	15.7	20.47	101.8
B01-10	19.4	26.09	62.39
B01-11	18.37	23.38	65.03
B01-12	19.57	23.18	50.44
B01-13	17.46	19.98	72.61
B02-14	19.13	22.46	64.9
B02-15	18.52	22.48	54
B02-16	17.32	20.7	70.75
B02-17	18.11	22.39	75.95
B02-18	19.24	22.3	70.18
B02-19	17.69	21.69	79.49
B02-20	14.29	16.61	105.5
B02-21	16.97	20.72	83.88
B02-22	16.66	19.81	76.92
B02-23	17.95	20.14	96.73
B03-24	19.13	22.46	64.9
B03-25	18.52	22.48	54
B03-26	17.32	20.7	70.75

Block Compliance WorkSheet:
B Cont...

Dwelling	DER	TER	TFA
B03-27	17.29	21.17	75.95
B03-28	19.24	22.3	70.18
B03-29	16.23	18.96	79.49
B03-30	14.29	16.61	105.5
B03-31	16.97	20.72	83.88
B03-32	16.66	19.81	76.92
B03-33	17.95	20.14	96.73
B04-34	20.42	24.57	64.9
B04-35	18.55	22.54	54
B04-36	17.33	20.72	70.75
B04-37	17.29	21.17	75.95
B04-38	19.25	22.31	70.18
B04-39	17.18	20.84	79.49
B04-40	15.47	18.93	105.5
B04-41	18.53	23.56	83.88
B04-42	18.23	22.63	76.92
B04-43	19.72	23.06	96.73
B05-44	17.24	19.47	107.2
B05-45	18.2	21.53	79.63
B05-46	16.44	19.53	88.12
B05-47	19.45	20	86.39
B06-48	18.99	22.41	107.2
B06-49	19.95	24.45	79.63
B06-50	18.06	22.34	88.12
B06-51	21.14	22.85	86.39

Block Compliance WorkSheet:
B Cont...

Calculation Summary

Total Floor Area	3932.88
Average TER	21.64
Average DER	18.06
Compliance	Pass

Block Compliance WorkSheet: C

User Details

Assessor Name:	Peter Bartley	**Stroma Number:**	STRO001295
Software Name:	Stroma FSAP	**Software Version:**	Version: 1.1.0.214

Calculation Details

Dwelling	DER	TER	TFA
CLG-01	18.03	21.24	79.27
CLG-02	17.81	20.61	73.15
CLG-03	17.81	20.61	73.15
CLG-04	17.81	20.61	73.15
CLG-05	19.48	23.57	83.79
CLG-06	19.39	23.69	74.99
CLG-07	18.59	21.6	66.54
CLG-08	18.59	21.6	66.54
CLG-09	18.59	21.6	66.54
CLG-10	21.36	24.65	69.07
CLG-11	23.52	29.29	52.25
CLG-12	21.64	25.34	52.25
CLG-13	23.33	28.29	52.25
CUG-14	16.33	19.85	109.12
CUG-15	17.4	20.19	86.9
CUG-16	17.4	20.19	86.9
CUG-17	17.4	20.19	86.9
CUG-18	17.4	20.19	86.9
CUG-19	18.23	22.43	101.34
CUG-20	19.17	23.74	87.17
CUG-21	18.43	21.26	78.26
CUG-22	18.43	21.26	78.26
CUG-23	18.43	21.26	78.26
CUG-24	20.43	24.65	81.26

Block Compliance WorkSheet:
C Cont...

Calculation Summary

Total Floor Area	1844.21
Average TER	22.14
Average DER	18.72
Compliance	Pass

Appendices

Appendix A: Baseline and Lean Modelling Outputs

A2 Retail and Station Baseline and Lean BRUKL Documents

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L

Project name

Retail 1 Lean

As designed

Date: Wed Apr 27 17:01:14 2011

Administrative information

Building Details

Address: Retail Unit, Twickenham Station, London,

Certification tool

Calculation engine: SBEM

Calculation engine version: v3.5.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v2.3.6

BRUKL compliance check version: v3.5.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Julian Leese

Telephone number: 0161 341 0088

Address: Nelson House Park Road Timperley Altrincham, Altrincham, WA14 5BZ

Criterion 1: Predicted CO2 emission from proposed building does not exceed the target

1.1	Calculated CO2 emission rate from notional building	181.5 KgCO2/m2.annum
1.2	Improvement factor	0.2
1.3	LZC benchmark	0.1
1.4	Target CO2 Emission Rate (TER)	130.7 KgCO2/m2.annum
1.5	Building CO2 Emission Rate (BER)	99.1 KgCO2/m2.annum
1.6	Are emissions from building less than or equal to the target?	BER =< TER
1.7	Are as built details the same as used in BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits

2.1 Are the U-values better than the design limits? Better than design limits

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Limit}$	$U_{i\text{-}Calc}$	Surface where this maximum value occurs*
Wall**	0.35	0.25	0.7	0.25	Block A 2011 - Zone 1_W_6
Floor	0.25	0.2	0.7	0.2	Block A 2011 - Zone 1_S_3
Roof	0.25	0	0.35	0	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	0	3.3	0	"No heat loss windows/rooflights"
Personnel doors	2.2	0	3	0	"No heat loss personnel doors"
Vehicle access & similar large doors	1.5	0	4	0	"No heat loss vehicle access doors"
High usage entrance doors	6	0	6	0	"No heat loss high usage entrance doors"

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

* There might be more than one surface exceeding the limiting standards.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standards are similar to those for windows.
*** Display windows and similar glazing are not required to meet the standard given in this table.

2.2 Is air permeability no greater than the worst acceptable standard? No greater than worst acceptable standard

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

2.3 Are all building services standards acceptable?

2.3a-1 Gas Heat AC Coolth HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.9
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	**Limiting Cooling Nominal efficiency**	**This building**
Cooling efficiency	2.4	3.2

2.3b- "No HWS in project, or hot water is provided by HVAC system"

2.4	Does fixed internal lighting comply with England and Wales Building Regulations Part L paragraphs 49 to 61?	Separate submission
2.5	Are energy meters installed in accordance with GIL65?	Separate submission

Criterion 3: The spaces in the building without air-conditioning have appropriate passive control measures to limit the effects of solar gains

3.1	Method of showing compliance with England and Wales Building Regulations Part L in paragraph 64?	Separate submission

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

4.1	Have the key features of the design been included (or bettered) in practice?	Separate submission
4.2	Is the level of thermal bridging acceptable?	Separate submission
4.3	Has satisfactory documentary evidence of site inspection checks been produced?	Separate submission

4.4 Design air permeability

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

4.5	Has evidence been provided that demonstrates that the design air permeability has been achieved satisfactorily?	Separate submission
4.6	Has commissioning been completed satisfactorily?	Separate submission
4.7	Has evidence been provided that demonstrates that the ductwork is sufficiently airtight?	Separate submission

Criterion 5: Providing information

5.1	Has a suitable building log-book been prepared?	Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area (m2)	153	153
External area (m2)	285	285
Weather	LON	LON
Infiltration (m3/hm2 @ 50Pa)	5	10
Average conductance (W/K)	391.69	3531.26
Average U-value (W/m2K)	1.37	12.39
Alpha value (%)	3.13	10

Building Use

% area	Building Type
	Office
	Primary school
	Secondary school
	Further education universities
	Primary health care buildings
	Nursing residential homes and hostels
	Hospital
	Hotel
	Restaurant/public house
	Sports centre/leisure centre
	Sports ground arena
100	**Retail**
	Warehouse and storage
	Theatres/cinemas/music halls and auditoria
	Social clubs
	Community/day centre
	Libraries/museums/galleries
	Prisons
	Emergency services
	Crown and county courts
	Airport terminals
	Bus station/train station/seaport terminal
	Workshops/maintenance depot
	Telephone exchanges
	Industrial process building
	Launderette
	Dwelling
	Retail warehouses
	Miscellaneous 24hr activities

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity										
	Actual	251.3	494.4	83.2	60.4	0	0.84	2.27	0.9	3.2
	Notional	216.5	847.3	72.5	140.9	35.7	0.83	1.67	----	----

Key to terms

Alpha value (%)	= percentage of the building's average heat transfer coefficient which is due to thermal bridging
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
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

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L

Project name

Retail 2 Lean

As designed

Date: Wed Apr 27 17:01:55 2011

Administrative information

Building Details

Address: Retail Unit, Twickenham Station, London,

Certification tool

Calculation engine: SBEM

Calculation engine version: v3.5.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v2.3.6

BRUKL compliance check version: v3.5.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Julian Leese

Telephone number: 0161 341 0088

Address: Nelson House Park Road Timperley Altrincham, Altrincham, WA14 5BZ

Criterion 1: Predicted CO2 emission from proposed building does not exceed the target

1.1	Calculated CO2 emission rate from notional building	168.9 KgCO2/m2.annum
1.2	Improvement factor	0.2
1.3	LZC benchmark	0.1
1.4	Target CO2 Emission Rate (TER)	121.6 KgCO2/m2.annum
1.5	Building CO2 Emission Rate (BER)	89.4 KgCO2/m2.annum
1.6	Are emissions from building less than or equal to the target?	BER =< TER
1.7	Are as built details the same as used in BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits

2.1 Are the U-values better than the design limits? Better than design limits

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Limit}$	$U_{i\text{-}Calc}$	Surface where this maximum value occurs*
Wall**	0.35	0.25	0.7	0.25	Block A 2011 - Zone 2_W_6
Floor	0.25	0.2	0.7	0.2	Block A 2011 - Zone 2_S_3
Roof	0.25	0	0.35	0	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	0	3.3	0	"No heat loss windows/rooflights"
Personnel doors	2.2	0	3	0	"No heat loss personnel doors"
Vehicle access & similar large doors	1.5	0	4	0	"No heat loss vehicle access doors"
High usage entrance doors	6	0	6	0	"No heat loss high usage entrance doors"

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

* There might be more than one surface exceeding the limiting standards.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standards are similar to those for windows.
*** Display windows and similar glazing are not required to meet the standard given in this table.

2.2 Is air permeability no greater than the worst acceptable standard? No greater than worst acceptable standard

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

2.3 Are all building services standards acceptable?

2.3a-1 Gas Heat AC Coolth HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.9
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	**Limiting Cooling Nominal efficiency**	**This building**
Cooling efficiency	2.4	3.2

2.3b- "No HWS in project, or hot water is provided by HVAC system"

2.4	Does fixed internal lighting comply with England and Wales Building Regulations Part L paragraphs 49 to 61?	Separate submission
2.5	Are energy meters installed in accordance with GIL65?	Separate submission

Criterion 3: The spaces in the building without air-conditioning have appropriate passive control measures to limit the effects of solar gains

3.1	Method of showing compliance with England and Wales Building Regulations Part L in paragraph 64?	Separate submission

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

4.1	Have the key features of the design been included (or bettered) in practice?	Separate submission
4.2	Is the level of thermal bridging acceptable?	Separate submission
4.3	Has satisfactory documentary evidence of site inspection checks been produced?	Separate submission

4.4 Design air permeability

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

4.5	Has evidence been provided that demonstrates that the design air permeability has been achieved satisfactorily?	Separate submission
4.6	Has commissioning been completed satisfactorily?	Separate submission
4.7	Has evidence been provided that demonstrates that the ductwork is sufficiently airtight?	Separate submission

Criterion 5: Providing information

5.1	Has a suitable building log-book been prepared?	Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area (m2)	152	152
External area (m2)	226	226
Weather	LON	LON
Infiltration (m3/hm2 @ 50Pa)	5	10
Average conductance (W/K)	226.01	227.68
Average U-value (W/m2K)	1	1.01
Alpha value (%)	3.01	10

Building Use

% area	Building Type
	Office
	Primary school
	Secondary school
	Further education universities
	Primary health care buildings
	Nursing residential homes and hostels
	Hospital
	Hotel
	Restaurant/public house
	Sports centre/leisure centre
	Sports ground arena
100	**Retail**
	Warehouse and storage
	Theatres/cinemas/music halls and auditoria
	Social clubs
	Community/day centre
	Libraries/museums/galleries
	Prisons
	Emergency services
	Crown and county courts
	Airport terminals
	Bus station/train station/seaport terminal
	Workshops/maintenance depot
	Telephone exchanges
	Industrial process building
	Launderette
	Dwelling
	Retail warehouses
	Miscellaneous 24hr activities

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity										
	Actual	126.3	462.1	41.8	56.5	0	0.84	2.27	0.9	3.2
	Notional	101.8	773.8	34.1	128.7	35.7	0.83	1.67	----	----

Key to terms

Alpha value (%)	= percentage of the building's average heat transfer coefficient which is due to thermal bridging
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
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

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L

Project name

Retail 3 Lean

As designed

Date: Wed Apr 27 17:02:53 2011

Administrative information

Building Details

Address: Retail Unit, Twickenham Station, London,

Certification tool

Calculation engine: SBEM

Calculation engine version: v3.5.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v2.3.6

BRUKL compliance check version: v3.5.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Julian Leese

Telephone number: 0161 341 0088

Address: Nelson House Park Road Timperley Altrincham, Altrincham, WA14 5BZ

Criterion 1: Predicted CO2 emission from proposed building does not exceed the target

1.1	Calculated CO2 emission rate from notional building	192 KgCO2/m2.annum
1.2	Improvement factor	0.2
1.3	LZC benchmark	0.1
1.4	Target CO2 Emission Rate (TER)	138.3 KgCO2/m2.annum
1.5	Building CO2 Emission Rate (BER)	106.9 KgCO2/m2.annum
1.6	Are emissions from building less than or equal to the target?	BER =< TER
1.7	Are as built details the same as used in BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits

2.1 Are the U-values better than the design limits? Better than design limits

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Limit}$	$U_{i\text{-}Calc}$	Surface where this maximum value occurs*
Wall**	0.35	0.25	0.7	0.25	Block A 2011 - Zone 3_W_5
Floor	0.25	0.2	0.7	0.2	Block A 2011 - Zone 3_S_3
Roof	0.25	0	0.35	0	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	0	3.3	0	"No heat loss windows/rooflights"
Personnel doors	2.2	0	3	0	"No heat loss personnel doors"
Vehicle access & similar large doors	1.5	0	4	0	"No heat loss vehicle access doors"
High usage entrance doors	6	0	6	0	"No heat loss high usage entrance doors"

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

* There might be more than one surface exceeding the limiting standards.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standards are similar to those for windows.
*** Display windows and similar glazing are not required to meet the standard given in this table.

2.2 Is air permeability no greater than the worst acceptable standard? No greater than worst acceptable standard

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

2.3 Are all building services standards acceptable?

2.3a-1 Gas Heat AC Coolth HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.9
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	**Limiting Cooling Nominal efficiency**	**This building**
Cooling efficiency	2.4	3.2

2.3b- "No HWS in project, or hot water is provided by HVAC system"

2.4	Does fixed internal lighting comply with England and Wales Building Regulations Part L paragraphs 49 to 61?	Separate submission
2.5	Are energy meters installed in accordance with GIL65?	Separate submission

Criterion 3: The spaces in the building without air-conditioning have appropriate passive control measures to limit the effects of solar gains

3.1	Method of showing compliance with England and Wales Building Regulations Part L in paragraph 64?	Separate submission

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

4.1	Have the key features of the design been included (or bettered) in practice?	Separate submission
4.2	Is the level of thermal bridging acceptable?	Separate submission
4.3	Has satisfactory documentary evidence of site inspection checks been produced?	Separate submission

4.4 Design air permeability

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

4.5	Has evidence been provided that demonstrates that the design air permeability has been achieved satisfactorily?	Separate submission
4.6	Has commissioning been completed satisfactorily?	Separate submission
4.7	Has evidence been provided that demonstrates that the ductwork is sufficiently airtight?	Separate submission

Criterion 5: Providing information

5.1	Has a suitable building log-book been prepared?	Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area (m2)	135	135
External area (m2)	270	270
Weather	LON	LON
Infiltration (m3/hm2 @ 50Pa)	5	10
Average conductance (W/K)	455.57	445.07
Average U-value (W/m2K)	1.69	1.65
Alpha value (%)	3.02	10

Building Use

% area	Building Type
	Office
	Primary school
	Secondary school
	Further education universities
	Primary health care buildings
	Nursing residential homes and hostels
	Hospital
	Hotel
	Restaurant/public house
	Sports centre/leisure centre
	Sports ground arena
100	**Retail**
	Warehouse and storage
	Theatres/cinemas/music halls and auditoria
	Social clubs
	Community/day centre
	Libraries/museums/galleries
	Prisons
	Emergency services
	Crown and county courts
	Airport terminals
	Bus station/train station/seaport terminal
	Workshops/maintenance depot
	Telephone exchanges
	Industrial process building
	Launderette
	Dwelling
	Retail warehouses
	Miscellaneous 24hr activities

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity										
	Actual	329.9	547.1	109.2	66.9	0	0.84	2.27	0.9	3.2
	Notional	276.9	940.6	92.7	156.4	35.7	0.83	1.67	----	----

Key to terms

Alpha value (%)	= percentage of the building's average heat transfer coefficient which is due to thermal bridging
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
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

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L

Project name

Retail 4 Lean

As designed

Date: Wed Apr 27 17:03:38 2011

Administrative information

Building Details

Address: Retail Unit, Twickenham Station, London,

Certification tool

Calculation engine: SBEM

Calculation engine version: v3.5.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v2.3.6

BRUKL compliance check version: v3.5.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Julian Leese

Telephone number: 0161 341 0088

Address: Nelson House Park Road Timperley Altrincham, Altrincham, WA14 5BZ

Criterion 1: Predicted CO2 emission from proposed building does not exceed the target

1.1	Calculated CO2 emission rate from notional building	177.8 KgCO2/m2.annum
1.2	Improvement factor	0.2
1.3	LZC benchmark	0.1
1.4	Target CO2 Emission Rate (TER)	128 KgCO2/m2.annum
1.5	Building CO2 Emission Rate (BER)	86.4 KgCO2/m2.annum
1.6	Are emissions from building less than or equal to the target?	BER =< TER
1.7	Are as built details the same as used in BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits

2.1 Are the U-values better than the design limits? Better than design limits

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Limit}$	$U_{i\text{-}Calc}$	Surface where this maximum value occurs*
Wall**	0.35	0.25	0.7	0.25	Block B - Retail 4_W_6
Floor	0.25	0.2	0.7	0.2	Block B - Retail 4_S_3
Roof	0.25	0.13	0.35	0.13	Block B - Retail 4_R_5
Windows***, roof windows, and rooflights	2.2	0	3.3	0	"No heat loss windows/rooflights"
Personnel doors	2.2	0	3	0	"No heat loss personnel doors"
Vehicle access & similar large doors	1.5	0	4	0	"No heat loss vehicle access doors"
High usage entrance doors	6	0	6	0	"No heat loss high usage entrance doors"

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

* There might be more than one surface exceeding the limiting standards.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standards are similar to those for windows.
*** Display windows and similar glazing are not required to meet the standard given in this table.

2.2 Is air permeability no greater than the worst acceptable standard? No greater than worst acceptable standard

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

2.3 Are all building services standards acceptable?

2.3a-1 Gas Heat AC Coolth HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.9
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	**Limiting Cooling Nominal efficiency**	**This building**
Cooling efficiency	2.4	3.2

2.3b- "No HWS in project, or hot water is provided by HVAC system"

2.4	Does fixed internal lighting comply with England and Wales Building Regulations Part L paragraphs 49 to 61?	Separate submission
2.5	Are energy meters installed in accordance with GIL65?	Separate submission

Criterion 3: The spaces in the building without air-conditioning have appropriate passive control measures to limit the effects of solar gains

3.1	Method of showing compliance with England and Wales Building Regulations Part L in paragraph 64?	Separate submission

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

4.1	Have the key features of the design been included (or bettered) in practice?	Separate submission
4.2	Is the level of thermal bridging acceptable?	Separate submission
4.3	Has satisfactory documentary evidence of site inspection checks been produced?	Separate submission

4.4 Design air permeability

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

4.5	Has evidence been provided that demonstrates that the design air permeability has been achieved satisfactorily?	Separate submission
4.6	Has commissioning been completed satisfactorily?	Separate submission
4.7	Has evidence been provided that demonstrates that the ductwork is sufficiently airtight?	Separate submission

Criterion 5: Providing information

5.1	Has a suitable building log-book been prepared?	Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area (m2)	250	250
External area (m2)	493	493
Weather	LON	LON
Infiltration (m3/hm2 @ 50Pa)	5	10
Average conductance (W/K)	300.26	957.48
Average U-value (W/m2K)	0.61	1.94
Alpha value (%)	5.6	10

Building Use

% area	Building Type
	Office
	Primary school
	Secondary school
	Further education universities
	Primary health care buildings
	Nursing residential homes and hostels
	Hospital
	Hotel
	Restaurant/public house
	Sports centre/leisure centre
	Sports ground arena
100	**Retail**
	Warehouse and storage
	Theatres/cinemas/music halls and auditoria
	Social clubs
	Community/day centre
	Libraries/museums/galleries
	Prisons
	Emergency services
	Crown and county courts
	Airport terminals
	Bus station/train station/seaport terminal
	Workshops/maintenance depot
	Telephone exchanges
	Industrial process building
	Launderette
	Dwelling
	Retail warehouses
	Miscellaneous 24hr activities

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity										
	Actual	117.6	414.1	38.9	50.6	0	0.84	2.27	0.9	3.2
	Notional	124.7	878.4	41.7	146.1	35.7	0.83	1.67	----	----

Key to terms

Alpha value (%)	= percentage of the building's average heat transfer coefficient which is due to thermal bridging
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
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

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L

Project name

Station Inc Ret 5 6

As designed

Date: Wed Apr 27 17:07:32 2011

Administrative information

Building Details

Address: Retail Unit, Twickenham Station, London,

Certification tool

Calculation engine: SBEM

Calculation engine version: v3.5.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v2.3.6

BRUKL compliance check version: v3.5.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Julian Leese

Telephone number: 0161 341 0088

Address: Nelson House Park Road Timperley Altrincham, Altrincham, WA14 5BZ

Criterion 1: Predicted CO2 emission from proposed building does not exceed the target

1.1	Calculated CO2 emission rate from notional building	92.3 KgCO2/m2.annum
1.2	Improvement factor	0.15
1.3	LZC benchmark	0.1
1.4	Target CO2 Emission Rate (TER)	70.6 KgCO2/m2.annum
1.5	Building CO2 Emission Rate (BER)	69.1 KgCO2/m2.annum
1.6	Are emissions from building less than or equal to the target?	BER =< TER
1.7	Are as built details the same as used in BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits

2.1 Are the U-values better than the design limits? Better than design limits

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Limit}$	$U_{i\text{-}Calc}$	Surface where this maximum value occurs*
Wall**	0.35	0.25	0.7	0.25	Main Station Building - Managers Office_W_5
Floor	0.25	0.2	0.7	0.2	Main Station Building - Managers Office_S_3
Roof	0.25	0.13	0.35	0.13	Platform 2 A - WC 1_R_4
Windows***, roof windows, and rooflights	2.2	0	3.3	0	"No heat loss windows/rooflights"
Personnel doors	2.2	1	3	1	Main Station Building - Circulation_D_6
Vehicle access & similar large doors	1.5	0	4	0	"No heat loss vehicle access doors"
High usage entrance doors	6	0	6	0	"No heat loss high usage entrance doors"

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

* There might be more than one surface exceeding the limiting standards.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standards are similar to those for windows.
*** Display windows and similar glazing are not required to meet the standard given in this table.

2.2 Is air permeability no greater than the worst acceptable standard? No greater than worst acceptable standard

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

2.3 Are all building services standards acceptable?

2.3a-1 Gas Heat Only HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.9
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		

2.3b- "No HWS in project, or hot water is provided by HVAC system"

2.4	Does fixed internal lighting comply with England and Wales Building Regulations Part L paragraphs 49 to 61?	Separate submission
2.5	Are energy meters installed in accordance with GIL65?	Separate submission

Criterion 3: The spaces in the building without air-conditioning have appropriate passive control measures to limit the effects of solar gains

3.1	Method of showing compliance with England and Wales Building Regulations Part L in paragraph 64?	Separate submission

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

4.1	Have the key features of the design been included (or bettered) in practice?	Separate submission
4.2	Is the level of thermal bridging acceptable?	Separate submission
4.3	Has satisfactory documentary evidence of site inspection checks been produced?	Separate submission

4.4 Design air permeability

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

4.5	Has evidence been provided that demonstrates that the design air permeability has been achieved satisfactorily?	Separate submission
4.6	Has commissioning been completed satisfactorily?	Separate submission
4.7	Has evidence been provided that demonstrates that the ductwork is sufficiently airtight?	Separate submission

Criterion 5: Providing information

5.1	Has a suitable building log-book been prepared?	Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area (m2)	287	287
External area (m2)	1123	1123
Weather	LON	LON
Infiltration (m3/hm2 @ 50Pa)	5	10
Average conductance (W/K)	931.73	1629.84
Average U-value (W/m2K)	0.83	1.45
Alpha value (%)	8.38	10

Building Use

% area	Building Type
	Office
	Primary school
	Secondary school
	Further education universities
	Primary health care buildings
	Nursing residential homes and hostels
	Hospital
	Hotel
	Restaurant/public house
	Sports centre/leisure centre
	Sports ground arena
39	**Retail**
	Warehouse and storage
	Theatres/cinemas/music halls and auditoria
	Social clubs
	Community/day centre
	Libraries/museums/galleries
	Prisons
	Emergency services
	Crown and county courts
	Airport terminals
61	**Bus station/train station/seaport terminal**
	Workshops/maintenance depot
	Telephone exchanges
	Industrial process building
	Launderette
	Dwelling
	Retail warehouses
	Miscellaneous 24hr activities

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] Natural Gas										
	Actual	398.9	551.3	138	0	6.8	0.8	0	0.9	0
	Notional	606.2	976	230.7	0	3.7	0.73	0	----	----

Key to terms

Alpha value (%)	= percentage of the building's average heat transfer coefficient which is due to thermal bridging
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
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

Appendices

Appendix B: Clean Modelling Outputs

B1 Residential Clean Block Compliance Summary

Block Compliance WorkSheet:
A

User Details

Assessor Name:	Peter Bartley	**Stroma Number:**	STRO001295
Software Name:	Stroma FSAP	**Software Version:**	Version: 1.1.0.214

Calculation Details

Dwelling	DER	TER	TFA
A00-01	16.19	28.47	47.93
A00-02	14.96	27.07	50.42
A00-03	14.05	25.74	66.25
A00-04	13.68	25.73	72.28
A01-05	14.17	25.41	64.09
A01-06	14.19	25.21	50.57
A01-07	12.25	19.77	70.92
A01-08	12.74	22.87	78.02
A01-09	12.03	22.08	77.08
A01-10	12.72	21.68	63.71
A01-11	11.98	22.47	81.35
A01-12	14.56	24.92	50.41
A01-13	12.51	23.41	91.15
A02-14	15.27	28.17	61.33
A02-15	13.74	22.83	64.09
A02-16	14.19	25.21	50.57
A02-17	12.01	18.51	70.92
A02-18	12.38	20.18	78.02
A02-19	11.74	19.36	77.08
A02-20	12.87	21.38	63.71
A02-21	12.1	19.84	70.64
A02-22	13.85	22.88	74.54
A03-23	13.74	22.83	64.09
A03-24	14.19	25.21	50.57
A03-25	12.06	18.68	70.92
A03-26	12.38	20.18	78.02

Block Compliance WorkSheet:
A Cont...

Dwelling	DER	TER	TFA
A03-27	11.84	19.71	77.08
A03-28	13.33	22.83	63.71
A03-29	12.61	21.6	70.64
A03-30	14.88	25.84	74.54
A04-31	13.74	22.83	64.09
A04-32	14.77	26.7	50.57
A04-33	12.78	20.23	96.83
A04-34	13.1	21.73	60.58
A04-35	13.26	20.64	78.47
A05-36	14.71	25.7	64.09
A05-37	14.39	24.07	83.71
A05-38	15.51	27.48	52.54
A05-39	14.37	25.76	50.89
A05-40	14.88	24.58	65.88

Calculation Summary

Total Floor Area	2692.30
Average TER	22.96
Average DER	13.39
Compliance	Pass

Block Compliance WorkSheet:
B

User Details

Assessor Name:	Peter Bartley	**Stroma Number:**	STRO001295
Software Name:	Stroma FSAP	**Software Version:**	Version: 1.1.0.214

Calculation Details

Dwelling	DER	TER	TFA
B00-01	14.99	27.15	51.75
B00-02	13.4	22.71	73.13
B00-03	12.7	22.68	74.73
B01-04	14.08	25.08	64.9
B01-05	14.18	25.22	54
B01-06	12.81	22.52	82.9
B01-07	14.84	27.6	51.44
B01-08	14.18	24.97	70.18
B01-09	11.36	20.47	101.8
B01-10	13.62	26.09	62.39
B01-11	13.02	23.38	65.03
B01-12	14.03	23.18	50.44
B01-13	12.48	19.98	72.61
B02-14	13.49	22.46	64.9
B02-15	13.36	22.48	54
B02-16	12.41	20.7	70.75
B02-17	12.81	22.39	75.95
B02-18	13.52	22.3	70.18
B02-19	12.49	21.69	79.49
B02-20	14.26	16.61	105.5
B02-21	12.13	20.72	83.88
B02-22	11.99	19.81	76.92
B02-23	12.65	20.14	96.73
B03-24	13.49	22.46	64.9
B03-25	13.36	22.48	54
B03-26	12.41	20.7	70.75

Block Compliance WorkSheet:
B Cont...

Dwelling	DER	TER	TFA
B03-27	12.35	21.17	75.95
B03-28	13.52	22.3	70.18
B03-29	11.77	18.96	79.49
B03-30	10.56	16.61	105.5
B03-31	12.13	20.72	83.88
B03-32	11.99	19.81	76.92
B03-33	12.65	20.14	96.73
B04-34	14.22	24.57	64.9
B04-35	13.38	22.54	54
B04-36	12.41	20.72	70.75
B04-37	12.35	21.17	75.95
B04-38	13.52	22.31	70.18
B04-39	12.26	20.84	79.49
B04-40	11.23	18.93	105.5
B04-41	13.01	23.56	83.88
B04-42	12.88	22.63	76.92
B04-43	13.66	23.06	96.73
B05-44	12.25	19.47	107.2
B05-45	12.83	21.53	79.63
B05-46	11.81	19.53	88.12
B05-47	13.5	20	86.39
B06-48	13.25	22.41	107.2
B06-49	13.82	24.45	79.63
B06-50	12.72	22.34	88.12
B06-51	14.44	22.85	86.39

Block Compliance WorkSheet:
B Cont...

Calculation Summary

Total Floor Area	3932.88
Average TER	21.64
Average DER	12.89
Compliance	Pass

Block Compliance WorkSheet: C

User Details

Assessor Name: Peter Bartley
Stroma Number: STRO001295
Software Name: Stroma FSAP
Software Version: Version: 1.1.0.214

Calculation Details

Dwelling	DER	TER	TFA
CLG-01	12.75	21.24	79.27
CLG-02	12.68	20.61	73.15
CLG-03	12.68	20.61	73.15
CLG-04	12.68	20.61	73.15
CLG-05	13.59	23.57	83.79
CLG-06	13.57	23.69	74.99
CLG-07	13.19	21.6	66.54
CLG-08	13.19	21.6	66.54
CLG-09	13.19	21.6	66.54
CLG-10	14.7	24.65	69.07
CLG-11	16.14	29.29	52.25
CLG-12	15.08	25.34	52.25
CLG-13	16.03	28.29	52.25
CUG-14	11.75	19.85	109.12
CUG-15	12.42	20.19	86.9
CUG-16	12.42	20.19	86.9
CUG-17	12.42	20.19	86.9
CUG-18	12.42	20.19	86.9
CUG-19	12.84	22.43	101.34
CUG-20	13.4	23.74	87.17
CUG-21	13.02	21.26	78.26
CUG-22	13.02	21.26	78.26
CUG-23	13.02	21.26	78.26
CUG-24	14.13	24.65	81.26

Block Compliance WorkSheet:
C Cont...

Calculation Summary

Total Floor Area	1844.21
Average TER	22.14
Average DER	13.20
Compliance	Pass

Appendices

Appendix B: Clean Modelling Outputs

B2 Retail and Station Clean BRUKL Documents

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L

Project name

Retail 1 Clean

As designed

Date: Wed Apr 27 16:52:36 2011

Administrative information

Building Details

Address: Retail Unit, Twickenham Station, London,

Certification tool

Calculation engine: SBEM

Calculation engine version: v3.5.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v2.3.6

BRUKL compliance check version: v3.5.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Julian Leese

Telephone number: 0161 341 0088

Address: Nelson House Park Road Timperley Altrincham, Altrincham, WA14 5BZ

Criterion 1: Predicted CO2 emission from proposed building does not exceed the target

1.1	Calculated CO2 emission rate from notional building	181.5 KgCO2/m2.annum
1.2	Improvement factor	0.2
1.3	LZC benchmark	0.1
1.4	Target CO2 Emission Rate (TER)	130.7 KgCO2/m2.annum
1.5	Building CO2 Emission Rate (BER)	88.1 KgCO2/m2.annum
1.6	Are emissions from building less than or equal to the target?	BER =< TER
1.7	Are as built details the same as used in BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits

2.1 Are the U-values better than the design limits? Better than design limits

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Limit}$	$U_{i\text{-}Calc}$	Surface where this maximum value occurs*
Wall**	0.35	0.25	0.7	0.25	Block A 2011 - Zone 1_W_6
Floor	0.25	0.2	0.7	0.2	Block A 2011 - Zone 1_S_3
Roof	0.25	0	0.35	0	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	0	3.3	0	"No heat loss windows/rooflights"
Personnel doors	2.2	0	3	0	"No heat loss personnel doors"
Vehicle access & similar large doors	1.5	0	4	0	"No heat loss vehicle access doors"
High usage entrance doors	6	0	6	0	"No heat loss high usage entrance doors"

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

* There might be more than one surface exceeding the limiting standards.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standards are similar to those for windows.
*** Display windows and similar glazing are not required to meet the standard given in this table.

2.2 Is air permeability no greater than the worst acceptable standard? No greater than worst acceptable standard

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

2.3 Are all building services standards acceptable?

2.3a-1 Gas Heat AC Coolth HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.9
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	**Limiting Cooling Nominal efficiency**	**This building**
Cooling efficiency	2.4	3.2

2.3b- "No HWS in project, or hot water is provided by HVAC system"

2.4	Does fixed internal lighting comply with England and Wales Building Regulations Part L paragraphs 49 to 61?	Separate submission
2.5	Are energy meters installed in accordance with GIL65?	Separate submission

Criterion 3: The spaces in the building without air-conditioning have appropriate passive control measures to limit the effects of solar gains

3.1	Method of showing compliance with England and Wales Building Regulations Part L in paragraph 64?	Separate submission

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

4.1	Have the key features of the design been included (or bettered) in practice?	Separate submission
4.2	Is the level of thermal bridging acceptable?	Separate submission
4.3	Has satisfactory documentary evidence of site inspection checks been produced?	Separate submission

4.4 Design air permeability

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

4.5	Has evidence been provided that demonstrates that the design air permeability has been achieved satisfactorily?	Separate submission
4.6	Has commissioning been completed satisfactorily?	Separate submission
4.7	Has evidence been provided that demonstrates that the ductwork is sufficiently airtight?	Separate submission

Criterion 5: Providing information

5.1	Has a suitable building log-book been prepared?	Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area (m2)	153	153
External area (m2)	285	285
Weather	LON	LON
Infiltration (m3/hm2 @ 50Pa)	5	10
Average conductance (W/K)	391.69	3531.26
Average U-value (W/m2K)	1.37	12.39
Alpha value (%)	3.13	10

Building Use

% area	Building Type
	Office
	Primary school
	Secondary school
	Further education universities
	Primary health care buildings
	Nursing residential homes and hostels
	Hospital
	Hotel
	Restaurant/public house
	Sports centre/leisure centre
	Sports ground arena
100	**Retail**
	Warehouse and storage
	Theatres/cinemas/music halls and auditoria
	Social clubs
	Community/day centre
	Libraries/museums/galleries
	Prisons
	Emergency services
	Crown and county courts
	Airport terminals
	Bus station/train station/seaport terminal
	Workshops/maintenance depot
	Telephone exchanges
	Industrial process building
	Launderette
	Dwelling
	Retail warehouses
	Miscellaneous 24hr activities

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity										
	Actual	82.9	494.4	27.5	60.4	0	0.84	2.27	0.9	3.2
	Notional	216.5	847.3	72.5	140.9	35.7	0.83	1.67	----	----

Key to terms

Alpha value (%)	= percentage of the building's average heat transfer coefficient which is due to thermal bridging
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
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

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L

Project name

Retail 2 Clean

As designed

Date: Wed Apr 27 16:50:23 2011

Administrative information

Building Details

Address: Retail Unit, Twickenham Station, London,

Certification tool

Calculation engine: SBEM

Calculation engine version: v3.5.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v2.3.6

BRUKL compliance check version: v3.5.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Julian Leese

Telephone number: 0161 341 0088

Address: Nelson House Park Road Timperley Altrincham, Altrincham, WA14 5BZ

Criterion 1: Predicted CO2 emission from proposed building does not exceed the target

1.1	Calculated CO2 emission rate from notional building	168.9 KgCO2/m2.annum
1.2	Improvement factor	0.2
1.3	LZC benchmark	0.1
1.4	Target CO2 Emission Rate (TER)	121.6 KgCO2/m2.annum
1.5	Building CO2 Emission Rate (BER)	83.8 KgCO2/m2.annum
1.6	Are emissions from building less than or equal to the target?	BER =< TER
1.7	Are as built details the same as used in BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits

2.1 Are the U-values better than the design limits? Better than design limits

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Limit}$	$U_{i\text{-}Calc}$	Surface where this maximum value occurs*
Wall**	0.35	0.25	0.7	0.25	Block A 2011 - Zone 2_W_6
Floor	0.25	0.2	0.7	0.2	Block A 2011 - Zone 2_S_3
Roof	0.25	0	0.35	0	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	0	3.3	0	"No heat loss windows/rooflights"
Personnel doors	2.2	0	3	0	"No heat loss personnel doors"
Vehicle access & similar large doors	1.5	0	4	0	"No heat loss vehicle access doors"
High usage entrance doors	6	0	6	0	"No heat loss high usage entrance doors"

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

* There might be more than one surface exceeding the limiting standards.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standards are similar to those for windows.
*** Display windows and similar glazing are not required to meet the standard given in this table.

2.2 Is air permeability no greater than the worst acceptable standard? No greater than worst acceptable standard

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

2.3 Are all building services standards acceptable?

2.3a-1 Gas Heat AC Coolth HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.9
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	**Limiting Cooling Nominal efficiency**	**This building**
Cooling efficiency	2.4	3.2

2.3b- "No HWS in project, or hot water is provided by HVAC system"

2.4	Does fixed internal lighting comply with England and Wales Building Regulations Part L paragraphs 49 to 61?	Separate submission
2.5	Are energy meters installed in accordance with GIL65?	Separate submission

Criterion 3: The spaces in the building without air-conditioning have appropriate passive control measures to limit the effects of solar gains

3.1	Method of showing compliance with England and Wales Building Regulations Part L in paragraph 64?	Separate submission

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

4.1	Have the key features of the design been included (or bettered) in practice?	Separate submission
4.2	Is the level of thermal bridging acceptable?	Separate submission
4.3	Has satisfactory documentary evidence of site inspection checks been produced?	Separate submission

4.4 Design air permeability

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

4.5	Has evidence been provided that demonstrates that the design air permeability has been achieved satisfactorily?	Separate submission
4.6	Has commissioning been completed satisfactorily?	Separate submission
4.7	Has evidence been provided that demonstrates that the ductwork is sufficiently airtight?	Separate submission

Criterion 5: Providing information

5.1	Has a suitable building log-book been prepared?	Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area (m2)	152	152
External area (m2)	226	226
Weather	LON	LON
Infiltration (m3/hm2 @ 50Pa)	5	10
Average conductance (W/K)	226.01	227.68
Average U-value (W/m2K)	1	1.01
Alpha value (%)	3.01	10

Building Use

% area	Building Type
	Office
	Primary school
	Secondary school
	Further education universities
	Primary health care buildings
	Nursing residential homes and hostels
	Hospital
	Hotel
	Restaurant/public house
	Sports centre/leisure centre
	Sports ground arena
100	**Retail**
	Warehouse and storage
	Theatres/cinemas/music halls and auditoria
	Social clubs
	Community/day centre
	Libraries/museums/galleries
	Prisons
	Emergency services
	Crown and county courts
	Airport terminals
	Bus station/train station/seaport terminal
	Workshops/maintenance depot
	Telephone exchanges
	Industrial process building
	Launderette
	Dwelling
	Retail warehouses
	Miscellaneous 24hr activities

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity										
	Actual	41.7	462.1	13.8	56.5	0	0.84	2.27	0.9	3.2
	Notional	101.8	773.8	34.1	128.7	35.7	0.83	1.67	----	----

Key to terms

Alpha value (%)	= percentage of the building's average heat transfer coefficient which is due to thermal bridging
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
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

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L

Project name

Retail 3 Clean

As designed

Date: Wed Apr 27 16:48:55 2011

Administrative information

Building Details

Address: Retail Unit, Twickenham Station, London,

Certification tool

Calculation engine: SBEM

Calculation engine version: v3.5.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v2.3.6

BRUKL compliance check version: v3.5.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Julian Leese

Telephone number: 0161 341 0088

Address: Nelson House Park Road Timperley Altrincham, Altrincham, WA14 5BZ

Criterion 1: Predicted CO2 emission from proposed building does not exceed the target

1.1	Calculated CO2 emission rate from notional building	192 KgCO2/m2.annum
1.2	Improvement factor	0.2
1.3	LZC benchmark	0.1
1.4	Target CO2 Emission Rate (TER)	138.3 KgCO2/m2.annum
1.5	Building CO2 Emission Rate (BER)	92.5 KgCO2/m2.annum
1.6	Are emissions from building less than or equal to the target?	BER =< TER
1.7	Are as built details the same as used in BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits

2.1 Are the U-values better than the design limits? Better than design limits

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Limit}$	$U_{i\text{-}Calc}$	Surface where this maximum value occurs*
Wall**	0.35	0.25	0.7	0.25	Block A 2011 - Zone 3_W_5
Floor	0.25	0.2	0.7	0.2	Block A 2011 - Zone 3_S_3
Roof	0.25	0	0.35	0	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	0	3.3	0	"No heat loss windows/rooflights"
Personnel doors	2.2	0	3	0	"No heat loss personnel doors"
Vehicle access & similar large doors	1.5	0	4	0	"No heat loss vehicle access doors"
High usage entrance doors	6	0	6	0	"No heat loss high usage entrance doors"

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

* There might be more than one surface exceeding the limiting standards.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standards are similar to those for windows.
*** Display windows and similar glazing are not required to meet the standard given in this table.

2.2 Is air permeability no greater than the worst acceptable standard? No greater than worst acceptable standard

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

2.3 Are all building services standards acceptable?

2.3a-1 Gas Heat AC Coolth HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.9
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	**Limiting Cooling Nominal efficiency**	**This building**
Cooling efficiency	2.4	3.2

2.3b- "No HWS in project, or hot water is provided by HVAC system"

2.4	Does fixed internal lighting comply with England and Wales Building Regulations Part L paragraphs 49 to 61?	Separate submission
2.5	Are energy meters installed in accordance with GIL65?	Separate submission

Criterion 3: The spaces in the building without air-conditioning have appropriate passive control measures to limit the effects of solar gains

3.1	Method of showing compliance with England and Wales Building Regulations Part L in paragraph 64?	Separate submission

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

4.1	Have the key features of the design been included (or bettered) in practice?	Separate submission
4.2	Is the level of thermal bridging acceptable?	Separate submission
4.3	Has satisfactory documentary evidence of site inspection checks been produced?	Separate submission

4.4 Design air permeability

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

4.5	Has evidence been provided that demonstrates that the design air permeability has been achieved satisfactorily?	Separate submission
4.6	Has commissioning been completed satisfactorily?	Separate submission
4.7	Has evidence been provided that demonstrates that the ductwork is sufficiently airtight?	Separate submission

Criterion 5: Providing information

5.1	Has a suitable building log-book been prepared?	Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area (m2)	135	135
External area (m2)	270	270
Weather	LON	LON
Infiltration (m3/hm2 @ 50Pa)	5	10
Average conductance (W/K)	455.57	445.07
Average U-value (W/m2K)	1.69	1.65
Alpha value (%)	3.02	10

Building Use

% area	Building Type
	Office
	Primary school
	Secondary school
	Further education universities
	Primary health care buildings
	Nursing residential homes and hostels
	Hospital
	Hotel
	Restaurant/public house
	Sports centre/leisure centre
	Sports ground arena
100	**Retail**
	Warehouse and storage
	Theatres/cinemas/music halls and auditoria
	Social clubs
	Community/day centre
	Libraries/museums/galleries
	Prisons
	Emergency services
	Crown and county courts
	Airport terminals
	Bus station/train station/seaport terminal
	Workshops/maintenance depot
	Telephone exchanges
	Industrial process building
	Launderette
	Dwelling
	Retail warehouses
	Miscellaneous 24hr activities

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity										
	Actual	108.9	547.1	36	66.9	0	0.84	2.27	0.9	3.2
	Notional	276.9	940.6	92.7	156.4	35.7	0.83	1.67	----	----

Key to terms

Alpha value (%)	= percentage of the building's average heat transfer coefficient which is due to thermal bridging
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
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

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L

Project name

Retail 4 Clean

As designed

Date: Wed Apr 27 16:44:18 2011

Administrative information

Building Details

Address: Retail Unit, Twickenham Station, London,

Certification tool

Calculation engine: SBEM

Calculation engine version: v3.5.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v2.3.6

BRUKL compliance check version: v3.5.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Julian Leese

Telephone number: 0161 341 0088

Address: Nelson House Park Road Timperley Altrincham, Altrincham, WA14 5BZ

Criterion 1: Predicted CO2 emission from proposed building does not exceed the target

1.1	Calculated CO2 emission rate from notional building	177.8 KgCO2/m2.annum
1.2	Improvement factor	0.2
1.3	LZC benchmark	0.1
1.4	Target CO2 Emission Rate (TER)	128 KgCO2/m2.annum
1.5	Building CO2 Emission Rate (BER)	81.2 KgCO2/m2.annum
1.6	Are emissions from building less than or equal to the target?	BER =< TER
1.7	Are as built details the same as used in BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits

2.1 Are the U-values better than the design limits? Better than design limits

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Limit}$	$U_{i\text{-}Calc}$	Surface where this maximum value occurs*
Wall**	0.35	0.25	0.7	0.25	Block B - Retail 4_W_6
Floor	0.25	0.2	0.7	0.2	Block B - Retail 4_S_3
Roof	0.25	0.13	0.35	0.13	Block B - Retail 4_R_5
Windows***, roof windows, and rooflights	2.2	0	3.3	0	"No heat loss windows/rooflights"
Personnel doors	2.2	0	3	0	"No heat loss personnel doors"
Vehicle access & similar large doors	1.5	0	4	0	"No heat loss vehicle access doors"
High usage entrance doors	6	0	6	0	"No heat loss high usage entrance doors"

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

* There might be more than one surface exceeding the limiting standards.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standards are similar to those for windows.
*** Display windows and similar glazing are not required to meet the standard given in this table.

2.2 Is air permeability no greater than the worst acceptable standard? No greater than worst acceptable standard

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

2.3 Are all building services standards acceptable?

2.3a-1 Gas Heat AC Coolth HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.9
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	**Limiting Cooling Nominal efficiency**	**This building**
Cooling efficiency	2.4	3.2

2.3b- "No HWS in project, or hot water is provided by HVAC system"

2.4	Does fixed internal lighting comply with England and Wales Building Regulations Part L paragraphs 49 to 61?	Separate submission
2.5	Are energy meters installed in accordance with GIL65?	Separate submission

Criterion 3: The spaces in the building without air-conditioning have appropriate passive control measures to limit the effects of solar gains

3.1	Method of showing compliance with England and Wales Building Regulations Part L in paragraph 64?	Separate submission

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

4.1	Have the key features of the design been included (or bettered) in practice?	Separate submission
4.2	Is the level of thermal bridging acceptable?	Separate submission
4.3	Has satisfactory documentary evidence of site inspection checks been produced?	Separate submission

4.4 Design air permeability

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

4.5	Has evidence been provided that demonstrates that the design air permeability has been achieved satisfactorily?	Separate submission
4.6	Has commissioning been completed satisfactorily?	Separate submission
4.7	Has evidence been provided that demonstrates that the ductwork is sufficiently airtight?	Separate submission

Criterion 5: Providing information

5.1	Has a suitable building log-book been prepared?	Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area (m2)	250	250
External area (m2)	493	493
Weather	LON	LON
Infiltration (m3/hm2 @ 50Pa)	5	10
Average conductance (W/K)	300.26	957.48
Average U-value (W/m2K)	0.61	1.94
Alpha value (%)	5.6	10

Building Use

% area	Building Type
	Office
	Primary school
	Secondary school
	Further education universities
	Primary health care buildings
	Nursing residential homes and hostels
	Hospital
	Hotel
	Restaurant/public house
	Sports centre/leisure centre
	Sports ground arena
100	**Retail**
	Warehouse and storage
	Theatres/cinemas/music halls and auditoria
	Social clubs
	Community/day centre
	Libraries/museums/galleries
	Prisons
	Emergency services
	Crown and county courts
	Airport terminals
	Bus station/train station/seaport terminal
	Workshops/maintenance depot
	Telephone exchanges
	Industrial process building
	Launderette
	Dwelling
	Retail warehouses
	Miscellaneous 24hr activities

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity										
	Actual	38.8	414.1	12.9	50.6	0	0.84	2.27	0.9	3.2
	Notional	124.7	878.4	41.7	146.1	35.7	0.83	1.67	----	----

Key to terms

Alpha value (%)	= percentage of the building's average heat transfer coefficient which is due to thermal bridging
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
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

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L

Project name

Station Inc Ret 5 6

As designed

Date: Wed Apr 27 17:05:54 2011

Administrative information

Building Details

Address: Retail Unit, Twickenham Station, London,

Certification tool

Calculation engine: SBEM

Calculation engine version: v3.5.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v2.3.6

BRUKL compliance check version: v3.5.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Julian Leese

Telephone number: 0161 341 0088

Address: Nelson House Park Road Timperley Altrincham, Altrincham, WA14 5BZ

Criterion 1: Predicted CO2 emission from proposed building does not exceed the target

1.1	Calculated CO2 emission rate from notional building	92.3 KgCO2/m2.annum
1.2	Improvement factor	0.15
1.3	LZC benchmark	0.1
1.4	Target CO2 Emission Rate (TER)	70.6 KgCO2/m2.annum
1.5	Building CO2 Emission Rate (BER)	50.8 KgCO2/m2.annum
1.6	Are emissions from building less than or equal to the target?	BER =< TER
1.7	Are as built details the same as used in BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits

2.1 Are the U-values better than the design limits? Better than design limits

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Limit}$	$U_{i\text{-}Calc}$	Surface where this maximum value occurs*
Wall**	0.35	0.25	0.7	0.25	Main Station Building - Managers Office_W_5
Floor	0.25	0.2	0.7	0.2	Main Station Building - Managers Office_S_3
Roof	0.25	0.13	0.35	0.13	Platform 2 A - WC 1_R_4
Windows***, roof windows, and rooflights	2.2	0	3.3	0	"No heat loss windows/rooflights"
Personnel doors	2.2	1	3	1	Main Station Building - Circulation_D_6
Vehicle access & similar large doors	1.5	0	4	0	"No heat loss vehicle access doors"
High usage entrance doors	6	0	6	0	"No heat loss high usage entrance doors"

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

* There might be more than one surface exceeding the limiting standards.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standards are similar to those for windows.
*** Display windows and similar glazing are not required to meet the standard given in this table.

2.2 Is air permeability no greater than the worst acceptable standard? No greater than worst acceptable standard

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

2.3 Are all building services standards acceptable?

2.3a-1 Gas Heat Only HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.9
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		

2.3b- "No HWS in project, or hot water is provided by HVAC system"

2.4	Does fixed internal lighting comply with England and Wales Building Regulations Part L paragraphs 49 to 61?	Separate submission
2.5	Are energy meters installed in accordance with GIL65?	Separate submission

Criterion 3: The spaces in the building without air-conditioning have appropriate passive control measures to limit the effects of solar gains

3.1	Method of showing compliance with England and Wales Building Regulations Part L in paragraph 64?	Separate submission

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

4.1	Have the key features of the design been included (or bettered) in practice?	Separate submission
4.2	Is the level of thermal bridging acceptable?	Separate submission
4.3	Has satisfactory documentary evidence of site inspection checks been produced?	Separate submission

4.4 Design air permeability

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

4.5	Has evidence been provided that demonstrates that the design air permeability has been achieved satisfactorily?	Separate submission
4.6	Has commissioning been completed satisfactorily?	Separate submission
4.7	Has evidence been provided that demonstrates that the ductwork is sufficiently airtight?	Separate submission

Criterion 5: Providing information

5.1	Has a suitable building log-book been prepared?	Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area (m2)	287	287
External area (m2)	1123	1123
Weather	LON	LON
Infiltration (m3/hm2 @ 50Pa)	5	10
Average conductance (W/K)	931.73	1629.84
Average U-value (W/m2K)	0.83	1.45
Alpha value (%)	8.38	10

Building Use

% area	Building Type
	Office
	Primary school
	Secondary school
	Further education universities
	Primary health care buildings
	Nursing residential homes and hostels
	Hospital
	Hotel
	Restaurant/public house
	Sports centre/leisure centre
	Sports ground arena
39	**Retail**
	Warehouse and storage
	Theatres/cinemas/music halls and auditoria
	Social clubs
	Community/day centre
	Libraries/museums/galleries
	Prisons
	Emergency services
	Crown and county courts
	Airport terminals
61	**Bus station/train station/seaport terminal**
	Workshops/maintenance depot
	Telephone exchanges
	Industrial process building
	Launderette
	Dwelling
	Retail warehouses
	Miscellaneous 24hr activities

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] Natural Gas										
	Actual	131.7	551.3	45.5	0	6.8	0.8	0	0.9	0
	Notional	606.2	976	230.7	0	3.7	0.73	0	----	----

Key to terms

Alpha value (%)	= percentage of the building's average heat transfer coefficient which is due to thermal bridging
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
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

Appendices

Appendix C: Green Modelling Outputs

C1 Residential Green Block Compliance Summary

Block Compliance WorkSheet:
A

User Details

Assessor Name:	Peter Bartley	**Stroma Number:**	STRO001295
Software Name:	Stroma FSAP	**Software Version:**	Version: 1.1.0.214

Calculation Details

Dwelling	DER	TER	TFA
A00-01	15.1	28.47	47.93
A00-02	13.93	27.07	50.42
A00-03	12.98	25.74	66.25
A00-04	12.63	25.73	72.28
A01-05	13.14	25.41	64.09
A01-06	13.16	25.21	50.57
A01-07	11.18	19.77	70.92
A01-08	11.71	22.87	78.02
A01-09	10.99	22.08	77.08
A01-10	11.68	21.68	63.71
A01-11	10.93	22.47	81.35
A01-12	13.53	24.92	50.41
A01-13	11.47	23.41	91.15
A02-14	14.19	28.17	61.33
A02-15	12.7	22.83	64.09
A02-16	13.16	25.21	50.57
A02-17	10.94	18.51	70.92
A02-18	11.35	20.18	78.02
A02-19	10.7	19.36	77.08
A02-20	11.83	21.38	63.71
A02-21	11.03	19.84	70.64
A02-22	12.77	22.88	74.54
A03-23	12.7	22.83	64.09
A03-24	13.16	25.21	50.57
A03-25	10.99	18.68	70.92
A03-26	11.35	20.18	78.02

Block Compliance WorkSheet:
A Cont...

Dwelling	DER	TER	TFA
A03-27	10.8	19.71	77.08
A03-28	12.29	22.83	63.71
A03-29	11.54	21.6	70.64
A03-30	13.8	25.84	74.54
A04-31	12.7	22.83	64.09
A04-32	13.74	26.7	50.57
A04-33	11.75	20.23	96.83
A04-34	12.08	21.73	60.58
A04-35	12.23	20.64	78.47
A05-36	13.68	25.7	64.09
A05-37	13.32	24.07	83.71
A05-38	14.43	27.48	52.54
A05-39	13.35	25.76	50.89
A05-40	13.8	24.58	65.88

Calculation Summary

Total Floor Area	2692.30
Average TER	22.96
Average DER	12.34
Compliance	Pass

Block Compliance WorkSheet:
B

User Details

Assessor Name:	Peter Bartley	**Stroma Number:**	STRO001295
Software Name:	Stroma FSAP	**Software Version:**	Version: 1.1.0.214

Calculation Details

Dwelling	DER	TER	TFA
B00-01	14.25	27.15	51.75
B00-02	12.69	22.71	73.13
B00-03	11.94	22.68	74.73
B01-04	13.35	25.08	64.9
B01-05	13.48	25.22	54
B01-06	12.07	22.52	82.9
B01-07	14.1	27.6	51.44
B01-08	13.44	24.97	70.18
B01-09	10.62	20.47	101.8
B01-10	12.86	26.09	62.39
B01-11	12.29	23.38	65.03
B01-12	13.28	23.18	50.44
B01-13	11.76	19.98	72.61
B02-14	12.76	22.46	64.9
B02-15	12.66	22.48	54
B02-16	11.67	20.7	70.75
B02-17	12.07	22.39	75.95
B02-18	12.77	22.3	70.18
B02-19	11.78	21.69	79.49
B02-20	13.54	16.61	105.5
B02-21	11.39	20.72	83.88
B02-22	11.25	19.81	76.92
B02-23	11.92	20.14	96.73
B03-24	12.76	22.46	64.9
B03-25	12.66	22.48	54
B03-26	11.67	20.7	70.75

Block Compliance WorkSheet:
B Cont...

Dwelling	DER	TER	TFA
B03-27	11.6	21.17	75.95
B03-28	12.77	22.3	70.18
B03-29	11.01	18.96	79.49
B03-30	9.84	16.61	105.5
B03-31	11.39	20.72	83.88
B03-32	11.25	19.81	76.92
B03-33	11.92	20.14	96.73
B04-34	13.49	24.57	64.9
B04-35	12.68	22.54	54
B04-36	11.68	20.72	70.75
B04-37	11.6	21.17	75.95
B04-38	12.77	22.31	70.18
B04-39	11.55	20.84	79.49
B04-40	10.51	18.93	105.5
B04-41	12.27	23.56	83.88
B04-42	12.14	22.63	76.92
B04-43	12.92	23.06	96.73
B05-44	11.5	19.47	107.2
B05-45	12.12	21.53	79.63
B05-46	11.06	19.53	88.12
B05-47	12.78	20	86.39
B06-48	12.5	22.41	107.2
B06-49	13.11	24.45	79.63
B06-50	11.97	22.34	88.12
B06-51	13.73	22.85	86.39

Block Compliance WorkSheet:
B Cont...

Calculation Summary

Total Floor Area	3932.88
Average TER	21.64
Average DER	12.16
Compliance	Pass

Block Compliance WorkSheet:
C

User Details

Assessor Name:	Peter Bartley	**Stroma Number:**	STRO001295
Software Name:	Stroma FSAP	**Software Version:**	Version: 1.1.0.214

Calculation Details

Dwelling	DER	TER	TFA
CLG-01	10.96	21.24	79.27
CLG-02	10.87	20.61	73.15
CLG-03	10.87	20.61	73.15
CLG-04	10.87	20.61	73.15
CLG-05	11.78	23.57	83.79
CLG-06	11.8	23.69	74.99
CLG-07	11.41	21.6	66.54
CLG-08	11.41	21.6	66.54
CLG-09	11.41	21.6	66.54
CLG-10	12.91	24.65	69.07
CLG-11	14.33	29.29	52.25
CLG-12	13.26	25.34	52.25
CLG-13	14.22	28.29	52.25
CUG-14	9.97	19.85	109.12
CUG-15	10.62	20.19	86.9
CUG-16	10.62	20.19	86.9
CUG-17	10.62	20.19	86.9
CUG-18	10.62	20.19	86.9
CUG-19	11.06	22.43	101.34
CUG-20	11.6	23.74	87.17
CUG-21	11.2	21.26	78.26
CUG-22	11.2	21.26	78.26
CUG-23	11.2	21.26	78.26
CUG-24	12.33	24.65	81.26

Block Compliance WorkSheet:
C Cont...

Calculation Summary

Total Floor Area	1844.21
Average TER	22.14
Average DER	11.40
Compliance	Pass

Appendices

Appendix C: Green Modelling Outputs

C2 Retail and Station Green BRUKL Documents

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L

Project name

Retail 1 Green

As designed

Date: Wed Apr 27 16:59:15 2011

Administrative information

Building Details

Address: Retail Unit, Twickenham Station, London,

Certification tool

Calculation engine: SBEM

Calculation engine version: v3.5.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v2.3.6

BRUKL compliance check version: v3.5.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Julian Leese

Telephone number: 0161 341 0088

Address: Nelson House Park Road Timperley Altrincham, Altrincham, WA14 5BZ

Criterion 1: Predicted CO2 emission from proposed building does not exceed the target

1.1	Calculated CO2 emission rate from notional building	181.5 KgCO2/m2.annum
1.2	Improvement factor	0.2
1.3	LZC benchmark	0.1
1.4	Target CO2 Emission Rate (TER)	130.7 KgCO2/m2.annum
1.5	Building CO2 Emission Rate (BER)	83.3 KgCO2/m2.annum
1.6	Are emissions from building less than or equal to the target?	BER =< TER
1.7	Are as built details the same as used in BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits

2.1 Are the U-values better than the design limits? Better than design limits

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Limit}$	$U_{i\text{-}Calc}$	Surface where this maximum value occurs*
Wall**	0.35	0.25	0.7	0.25	Block A 2011 - Zone 1_W_6
Floor	0.25	0.2	0.7	0.2	Block A 2011 - Zone 1_S_3
Roof	0.25	0	0.35	0	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	0	3.3	0	"No heat loss windows/rooflights"
Personnel doors	2.2	0	3	0	"No heat loss personnel doors"
Vehicle access & similar large doors	1.5	0	4	0	"No heat loss vehicle access doors"
High usage entrance doors	6	0	6	0	"No heat loss high usage entrance doors"

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

* There might be more than one surface exceeding the limiting standards.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standards are similar to those for windows.
*** Display windows and similar glazing are not required to meet the standard given in this table.

2.2 Is air permeability no greater than the worst acceptable standard? No greater than worst acceptable standard

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

2.3 Are all building services standards acceptable?

2.3a-1 Gas Heat AC Coolth HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.9
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	**Limiting Cooling Nominal efficiency**	**This building**
Cooling efficiency	2.4	3.2

2.3b- "No HWS in project, or hot water is provided by HVAC system"

2.4	Does fixed internal lighting comply with England and Wales Building Regulations Part L paragraphs 49 to 61?	Separate submission
2.5	Are energy meters installed in accordance with GIL65?	Separate submission

Criterion 3: The spaces in the building without air-conditioning have appropriate passive control measures to limit the effects of solar gains

3.1	Method of showing compliance with England and Wales Building Regulations Part L in paragraph 64?	Separate submission

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

4.1	Have the key features of the design been included (or bettered) in practice?	Separate submission
4.2	Is the level of thermal bridging acceptable?	Separate submission
4.3	Has satisfactory documentary evidence of site inspection checks been produced?	Separate submission

4.4 Design air permeability

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

4.5	Has evidence been provided that demonstrates that the design air permeability has been achieved satisfactorily?	Separate submission
4.6	Has commissioning been completed satisfactorily?	Separate submission
4.7	Has evidence been provided that demonstrates that the ductwork is sufficiently airtight?	Separate submission

Criterion 5: Providing information

5.1	Has a suitable building log-book been prepared?	Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area (m2)	153	153
External area (m2)	285	285
Weather	LON	LON
Infiltration (m3/hm2 @ 50Pa)	5	10
Average conductance (W/K)	391.69	3531.26
Average U-value (W/m2K)	1.37	12.39
Alpha value (%)	3.13	10

Building Use

% area	Building Type
	Office
	Primary school
	Secondary school
	Further education universities
	Primary health care buildings
	Nursing residential homes and hostels
	Hospital
	Hotel
	Restaurant/public house
	Sports centre/leisure centre
	Sports ground arena
100	**Retail**
	Warehouse and storage
	Theatres/cinemas/music halls and auditoria
	Social clubs
	Community/day centre
	Libraries/museums/galleries
	Prisons
	Emergency services
	Crown and county courts
	Airport terminals
	Bus station/train station/seaport terminal
	Workshops/maintenance depot
	Telephone exchanges
	Industrial process building
	Launderette
	Dwelling
	Retail warehouses
	Miscellaneous 24hr activities

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity										
	Actual	82.9	494.4	27.5	60.4	0	0.84	2.27	0.9	3.2
	Notional	216.5	847.3	72.5	140.9	35.7	0.83	1.67	----	----

Key to terms

Alpha value (%)	= percentage of the building's average heat transfer coefficient which is due to thermal bridging
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
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

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L

Project name

Retail 2 Green

As designed

Date: Wed Apr 27 16:57:53 2011

Administrative information

Building Details

Address: Retail Unit, Twickenham Station, London,

Certification tool

Calculation engine: SBEM

Calculation engine version: v3.5.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v2.3.6

BRUKL compliance check version: v3.5.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Julian Leese

Telephone number: 0161 341 0088

Address: Nelson House Park Road Timperley Altrincham, Altrincham, WA14 5BZ

Criterion 1: Predicted CO2 emission from proposed building does not exceed the target

1.1	Calculated CO2 emission rate from notional building	168.9 KgCO2/m2.annum
1.2	Improvement factor	0.2
1.3	LZC benchmark	0.1
1.4	Target CO2 Emission Rate (TER)	121.6 KgCO2/m2.annum
1.5	Building CO2 Emission Rate (BER)	79.6 KgCO2/m2.annum
1.6	Are emissions from building less than or equal to the target?	BER =< TER
1.7	Are as built details the same as used in BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits

2.1 Are the U-values better than the design limits? Better than design limits

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Limit}$	$U_{i\text{-}Calc}$	Surface where this maximum value occurs*
Wall**	0.35	0.25	0.7	0.25	Block A 2011 - Zone 2_W_6
Floor	0.25	0.2	0.7	0.2	Block A 2011 - Zone 2_S_3
Roof	0.25	0	0.35	0	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	0	3.3	0	"No heat loss windows/rooflights"
Personnel doors	2.2	0	3	0	"No heat loss personnel doors"
Vehicle access & similar large doors	1.5	0	4	0	"No heat loss vehicle access doors"
High usage entrance doors	6	0	6	0	"No heat loss high usage entrance doors"

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

* There might be more than one surface exceeding the limiting standards.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standards are similar to those for windows.
*** Display windows and similar glazing are not required to meet the standard given in this table.

2.2 Is air permeability no greater than the worst acceptable standard? No greater than worst acceptable standard

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

2.3 Are all building services standards acceptable?

2.3a-1 Gas Heat AC Coolth HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.9
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	**Limiting Cooling Nominal efficiency**	**This building**
Cooling efficiency	2.4	3.2

2.3b- "No HWS in project, or hot water is provided by HVAC system"

2.4	Does fixed internal lighting comply with England and Wales Building Regulations Part L paragraphs 49 to 61?	Separate submission
2.5	Are energy meters installed in accordance with GIL65?	Separate submission

Criterion 3: The spaces in the building without air-conditioning have appropriate passive control measures to limit the effects of solar gains

3.1	Method of showing compliance with England and Wales Building Regulations Part L in paragraph 64?	Separate submission

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

4.1	Have the key features of the design been included (or bettered) in practice?	Separate submission
4.2	Is the level of thermal bridging acceptable?	Separate submission
4.3	Has satisfactory documentary evidence of site inspection checks been produced?	Separate submission

4.4 Design air permeability

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

4.5	Has evidence been provided that demonstrates that the design air permeability has been achieved satisfactorily?	Separate submission
4.6	Has commissioning been completed satisfactorily?	Separate submission
4.7	Has evidence been provided that demonstrates that the ductwork is sufficiently airtight?	Separate submission

Criterion 5: Providing information

5.1	Has a suitable building log-book been prepared?	Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area (m2)	152	152
External area (m2)	226	226
Weather	LON	LON
Infiltration (m3/hm2 @ 50Pa)	5	10
Average conductance (W/K)	226.01	227.68
Average U-value (W/m2K)	1	1.01
Alpha value (%)	3.01	10

Building Use

% area	Building Type
	Office
	Primary school
	Secondary school
	Further education universities
	Primary health care buildings
	Nursing residential homes and hostels
	Hospital
	Hotel
	Restaurant/public house
	Sports centre/leisure centre
	Sports ground arena
100	**Retail**
	Warehouse and storage
	Theatres/cinemas/music halls and auditoria
	Social clubs
	Community/day centre
	Libraries/museums/galleries
	Prisons
	Emergency services
	Crown and county courts
	Airport terminals
	Bus station/train station/seaport terminal
	Workshops/maintenance depot
	Telephone exchanges
	Industrial process building
	Launderette
	Dwelling
	Retail warehouses
	Miscellaneous 24hr activities

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity										
	Actual	41.7	462.1	13.8	56.5	0	0.84	2.27	0.9	3.2
	Notional	101.8	773.8	34.1	128.7	35.7	0.83	1.67	----	----

Key to terms

Alpha value (%)	= percentage of the building's average heat transfer coefficient which is due to thermal bridging
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
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

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L

Project name

Retail 3 Green

As designed

Date: Wed Apr 27 16:56:14 2011

Administrative information

Building Details

Address: Retail Unit, Twickenham Station, London,

Certification tool

Calculation engine: SBEM

Calculation engine version: v3.5.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v2.3.6

BRUKL compliance check version: v3.5.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Julian Leese

Telephone number: 0161 341 0088

Address: Nelson House Park Road Timperley Altrincham, Altrincham, WA14 5BZ

Criterion 1: Predicted CO2 emission from proposed building does not exceed the target

1.1	Calculated CO2 emission rate from notional building	192 KgCO2/m2.annum
1.2	Improvement factor	0.2
1.3	LZC benchmark	0.1
1.4	Target CO2 Emission Rate (TER)	138.3 KgCO2/m2.annum
1.5	Building CO2 Emission Rate (BER)	87.2 KgCO2/m2.annum
1.6	Are emissions from building less than or equal to the target?	BER =< TER
1.7	Are as built details the same as used in BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits

2.1 Are the U-values better than the design limits? Better than design limits

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Limit}$	$U_{i\text{-}Calc}$	Surface where this maximum value occurs*
Wall**	0.35	0.25	0.7	0.25	Block A 2011 - Zone 3_W_5
Floor	0.25	0.2	0.7	0.2	Block A 2011 - Zone 3_S_3
Roof	0.25	0	0.35	0	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	0	3.3	0	"No heat loss windows/rooflights"
Personnel doors	2.2	0	3	0	"No heat loss personnel doors"
Vehicle access & similar large doors	1.5	0	4	0	"No heat loss vehicle access doors"
High usage entrance doors	6	0	6	0	"No heat loss high usage entrance doors"

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

* There might be more than one surface exceeding the limiting standards.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standards are similar to those for windows.
*** Display windows and similar glazing are not required to meet the standard given in this table.

2.2 Is air permeability no greater than the worst acceptable standard? No greater than worst acceptable standard

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

2.3 Are all building services standards acceptable?

2.3a-1 Gas Heat AC Coolth HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.9
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	**Limiting Cooling Nominal efficiency**	**This building**
Cooling efficiency	2.4	3.2

2.3b- "No HWS in project, or hot water is provided by HVAC system"

2.4	Does fixed internal lighting comply with England and Wales Building Regulations Part L paragraphs 49 to 61?	Separate submission
2.5	Are energy meters installed in accordance with GIL65?	Separate submission

Criterion 3: The spaces in the building without air-conditioning have appropriate passive control measures to limit the effects of solar gains

3.1	Method of showing compliance with England and Wales Building Regulations Part L in paragraph 64?	Separate submission

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

4.1	Have the key features of the design been included (or bettered) in practice?	Separate submission
4.2	Is the level of thermal bridging acceptable?	Separate submission
4.3	Has satisfactory documentary evidence of site inspection checks been produced?	Separate submission

4.4 Design air permeability

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

4.5	Has evidence been provided that demonstrates that the design air permeability has been achieved satisfactorily?	Separate submission
4.6	Has commissioning been completed satisfactorily?	Separate submission
4.7	Has evidence been provided that demonstrates that the ductwork is sufficiently airtight?	Separate submission

Criterion 5: Providing information

5.1	Has a suitable building log-book been prepared?	Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area (m2)	135	135
External area (m2)	270	270
Weather	LON	LON
Infiltration (m3/hm2 @ 50Pa)	5	10
Average conductance (W/K)	455.57	445.07
Average U-value (W/m2K)	1.69	1.65
Alpha value (%)	3.02	10

Building Use

% area	Building Type
	Office
	Primary school
	Secondary school
	Further education universities
	Primary health care buildings
	Nursing residential homes and hostels
	Hospital
	Hotel
	Restaurant/public house
	Sports centre/leisure centre
	Sports ground arena
100	**Retail**
	Warehouse and storage
	Theatres/cinemas/music halls and auditoria
	Social clubs
	Community/day centre
	Libraries/museums/galleries
	Prisons
	Emergency services
	Crown and county courts
	Airport terminals
	Bus station/train station/seaport terminal
	Workshops/maintenance depot
	Telephone exchanges
	Industrial process building
	Launderette
	Dwelling
	Retail warehouses
	Miscellaneous 24hr activities

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity										
	Actual	108.9	547.1	36	66.9	0	0.84	2.27	0.9	3.2
	Notional	276.9	940.6	92.7	156.4	35.7	0.83	1.67	----	----

Key to terms

Alpha value (%)	= percentage of the building's average heat transfer coefficient which is due to thermal bridging
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
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

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L

Project name

Retail 4 Green

As designed

Date: Wed Apr 27 16:54:54 2011

Administrative information

Building Details

Address: Retail Unit, Twickenham Station, London,

Certification tool

Calculation engine: SBEM

Calculation engine version: v3.5.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v2.3.6

BRUKL compliance check version: v3.5.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Julian Leese

Telephone number: 0161 341 0088

Address: Nelson House Park Road Timperley Altrincham, Altrincham, WA14 5BZ

Criterion 1: Predicted CO2 emission from proposed building does not exceed the target

1.1	Calculated CO2 emission rate from notional building	177.8 KgCO2/m2.annum
1.2	Improvement factor	0.2
1.3	LZC benchmark	0.1
1.4	Target CO2 Emission Rate (TER)	128 KgCO2/m2.annum
1.5	Building CO2 Emission Rate (BER)	77.2 KgCO2/m2.annum
1.6	Are emissions from building less than or equal to the target?	BER =< TER
1.7	Are as built details the same as used in BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits

2.1 Are the U-values better than the design limits? Better than design limits

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Limit}$	$U_{i\text{-}Calc}$	Surface where this maximum value occurs*
Wall**	0.35	0.25	0.7	0.25	Block B - Retail 4_W_6
Floor	0.25	0.2	0.7	0.2	Block B - Retail 4_S_3
Roof	0.25	0.13	0.35	0.13	Block B - Retail 4_R_5
Windows***, roof windows, and rooflights	2.2	0	3.3	0	"No heat loss windows/rooflights"
Personnel doors	2.2	0	3	0	"No heat loss personnel doors"
Vehicle access & similar large doors	1.5	0	4	0	"No heat loss vehicle access doors"
High usage entrance doors	6	0	6	0	"No heat loss high usage entrance doors"

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

* There might be more than one surface exceeding the limiting standards.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standards are similar to those for windows.
*** Display windows and similar glazing are not required to meet the standard given in this table.

2.2 Is air permeability no greater than the worst acceptable standard? No greater than worst acceptable standard

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

2.3 Are all building services standards acceptable?

2.3a-1 Gas Heat AC Coolth HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.9
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	**Limiting Cooling Nominal efficiency**	**This building**
Cooling efficiency	2.4	3.2

2.3b- "No HWS in project, or hot water is provided by HVAC system"

2.4	Does fixed internal lighting comply with England and Wales Building Regulations Part L paragraphs 49 to 61?	Separate submission
2.5	Are energy meters installed in accordance with GIL65?	Separate submission

Criterion 3: The spaces in the building without air-conditioning have appropriate passive control measures to limit the effects of solar gains

3.1	Method of showing compliance with England and Wales Building Regulations Part L in paragraph 64?	Separate submission

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

4.1	Have the key features of the design been included (or bettered) in practice?	Separate submission
4.2	Is the level of thermal bridging acceptable?	Separate submission
4.3	Has satisfactory documentary evidence of site inspection checks been produced?	Separate submission

4.4 Design air permeability

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

4.5	Has evidence been provided that demonstrates that the design air permeability has been achieved satisfactorily?	Separate submission
4.6	Has commissioning been completed satisfactorily?	Separate submission
4.7	Has evidence been provided that demonstrates that the ductwork is sufficiently airtight?	Separate submission

Criterion 5: Providing information

5.1	Has a suitable building log-book been prepared?	Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area (m2)	250	250
External area (m2)	493	493
Weather	LON	LON
Infiltration (m3/hm2 @ 50Pa)	5	10
Average conductance (W/K)	300.26	957.48
Average U-value (W/m2K)	0.61	1.94
Alpha value (%)	5.6	10

Building Use

% area	Building Type
	Office
	Primary school
	Secondary school
	Further education universities
	Primary health care buildings
	Nursing residential homes and hostels
	Hospital
	Hotel
	Restaurant/public house
	Sports centre/leisure centre
	Sports ground arena
100	**Retail**
	Warehouse and storage
	Theatres/cinemas/music halls and auditoria
	Social clubs
	Community/day centre
	Libraries/museums/galleries
	Prisons
	Emergency services
	Crown and county courts
	Airport terminals
	Bus station/train station/seaport terminal
	Workshops/maintenance depot
	Telephone exchanges
	Industrial process building
	Launderette
	Dwelling
	Retail warehouses
	Miscellaneous 24hr activities

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity										
	Actual	38.8	414.1	12.9	50.6	0	0.84	2.27	0.9	3.2
	Notional	124.7	878.4	41.7	146.1	35.7	0.83	1.67	----	----

Key to terms

Alpha value (%)	= percentage of the building's average heat transfer coefficient which is due to thermal bridging
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
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