

Energy Statement

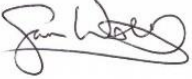
43 & 43a London Street, Reading, RG1 4PS

Prepared for Rose Hill Commercial Estates Ltd
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envision

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CONTENTS

EXECUTIVE SUMMARY	4
1 INTRODUCTION	7
2 CONTEXT AND PROPOSALS	8
Location & Existing Situation	8
The Proposed Development	9
3 ENERGY POLICY CONTEXT	10
National Planning Policy Framework	10
Reading Borough Council Planning	11
Policy Advice surrounding CO ₂ reduction	12
4 ENERGY STATEMENT	13
Methodology	13
Establishing the Target Emission Rate (TER) – Refurbished Building	15
Establishing the Target Emission Rate (TER) – New Build Residential	17
Applying the Energy Hierarchy: Stage 1 – Be Lean	19
Applying the Energy Hierarchy: Stage 2 – Be Clean	24
Applying the Energy Hierarchy: Stage 3 – Be Green	25
5 CONCLUSION	28
APPENDIX I – LOW/ZERO CARBON/RENEWABLE ANALYSIS	
APPENDIX II – EXISTING BUILDING BRUKL	
APPENDIX III– REFURBISHED BUILDING BRUKL	
APPENDIX IV – REFURBISHED BUILDING SAP SUMMARY	
APPENDIX V – NEW BUILD SAP SUMMARY	
APPENDIX VI – CARBON EMISSION FIGURES	

EXECUTIVE SUMMARY

1. This Energy Statement has been prepared by Envision on behalf of Rose Hill Commercial Estates Ltd (the applicant), and is submitted to support a planning application for the refurbishment and re-development of 43 and 43A London Street, Reading to consist of the part-demolition of the existing London Street facade and internal works to building alongside demolition of two storey building to rear to enable residential-led mixed-use development comprising 48 sqm community use (Class D1) and 21 no residential units (2 x studio, 7 x 1 bed, 9 x 2 two bed and 3 x 3 bed units) together with associated services enclosures, parking and landscaping.
2. The primary purpose of this document to explain how the scheme can meet with Reading Borough Council's energy policies, along with the requirements of Part L1a, L1b, L2a and L2b of Building Regulations 2013 (with 2016 amendments).
3. Envision have undertaken a review of the relevant policies and worked with the design team to determine and agree the relevance and approach that should be taken to fulfil each policy.
4. This report additionally illustrates how the scheme complies with the nationally recognised "Energy Hierarchy" and follows passive and efficiency improvements before the application of any Low or Zero Carbon (LZC) sources.
5. Envision has produced a Part L1a/L1b 2013 compliant SAP calculations, and L2b compliant SBEM calculations through the DesignBuilder Dynamic Simulation Model (DSM) engine, in order to determine the energy and CO₂ emissions for the proposed development in both the refurbished and new-build portion.
6. To reduce the energy consumption of the development, the following design measures are recommended and will need to be incorporated into the detailed design;
 - Building fabric construction U-values significantly improved compared with standard Building Regulations U-values in the new-build portion;
 - Upgrade to fabric performance in refurbished portion where appropriate;
 - In the new-build portion, reduced Air Permeability, lower than standard Buildings Regulations;
 - Upgrade to heating systems in the refurbished portion of the development;
 - On-site efficient energy generation through the use of a Photovoltaic (PV) array on the uppermost roof for the new-build portion;
 - HVAC system controls ensure installed equipment will be operating efficiently and to include automatic monitoring and targeting with alarms for out of range values;
 - Application of Mechanical Ventilation Heat Recovery (MVHR) systems in the new-build apartments;

- High efficiency LED lighting utilizing low-energy control systems such as occupancy sensing.
- 7. The figures used as the basis for this assessment are discussed further in Section 4 of this report.

Carbon Savings Predicted – Refurbished Building

8. The existing building baseline (43 Reading Street) for the development has been calculated as being **12,826.58 kg.CO₂/year**. This is the baseline from which the proposed refurbished building must show an improvement.
9. Through the energy-efficient design measures proposed in the refurbishment, the CO₂ reductions at the ‘Be-Lean’ Stage, i.e. energy-efficient stage, have been calculated at **6,698.34 kg.CO₂/year**. This represents a **47.78%** reduction in CO₂ emissions for the refurbished building over the existing building baseline.

Carbon Savings Predicted – New-Build Portion

10. The regulated baseline for the new-build portion (Part L1A 2013 compliant) has been calculated as being **21,523.28 kg.CO₂/year**.
11. The CO₂ reductions at the ‘Be-Lean’ Stage, i.e. energy-efficient stage, have been calculated at **1,378.33 kg.CO₂/year**. This represents a **6.40%** reduction in carbon emissions over the Part L1A 2013 compliant baseline.
12. At the ‘Be-Clean’ stage, district heating and CHP units were assessed for their viability on site. Analysis showed that owing to the development’s location, size and servicing strategy, neither were viable for inclusion. Therefore, there are no CO₂ or Energy Demand savings to be shown at this stage.
13. The ‘Be-Green’ stage, i.e. on-site renewables/low carbon technology accounted for the proposed installation of;
 - A 7,260 kWh/annum Photovoltaic (PV) array on the uppermost roof. A PV array of this output will have an estimated area of 46 m²;
14. The CO₂ reductions at the ‘Be-Green’ Stage, i.e. on-site renewables/low carbon technology, have been calculated at **5,104.44 kg.CO₂/year**.
15. Therefore, in total the new-build portion reduces CO₂ emissions by **23.72%** over the Part L 2013 baseline, thereby complying with RBC polices for residential development.

1 INTRODUCTION

- 1.1 Envision is a dynamic building services, energy and sustainability consultancy, dedicated to providing strategic and technical advice to clients through all phases of planning and development.
- 1.2 We have been appointed by Rose Hill Commercial Estates Ltd Ltd (the applicant), to prepare an Energy Statement to support a planning application for the part-demolition of the existing London Street facade and internal works to building alongside demolition of two storey building to rear to enable residential-led mixed-use development comprising 48 sqm community use (Class D1) and 21no residential units (2 x studio, 7 x 1 bed, 9 x 2 two bed and 3 x 3 bed units) together with associated services enclosures, parking and landscaping.

Scope

- 1.3 This Energy Statement provides information on the predicted carbon emissions of the development and includes an analysis of the potential contribution that renewable and low carbon technologies could contribute towards reducing the energy and associated CO₂ emissions for the scheme.
- 1.4 This Energy Statement sets the parameters of detailed design, but remains at a strategic level. The calculations in this document are an indication of system size and carbon emissions based on guidance documents, approved software and practical experience. They are not design calculations but establish the viability and feasibility of various technologies for the proposed development.
- 1.5 This statement is structured as follows:
- Section 2 provides a description of the site and the development proposals;
 - Section 3 provides a description of the main energy policies relevant to the application;
 - Section 4 provides an energy assessment, structured against the requirements of the policies examined in Section 3;
 - Section 5 provides a concluding summary.

2 CONTEXT AND PROPOSALS

Location & Existing Situation

- 2.1 The site, which has a total area of about 750m², is located within Reading Central Area Action Plan and Market Place/London Street Conservation Area.
- 2.2 No. 43 London Street is a two storey building with taller properties on either side, both of which are Grade II Listed. Together with Nos. 45 to 47 it is designated as a Building of Townscape Merit, however it is in poor condition and has been much altered from its original form as 'The Eagle Tavern'. The interior of the building is arranged on several different levels and the difficult access makes it unsuitable for community use. The building was last used as a dental surgery and has been vacant since 2016.
- 2.3 No. 43a is a three storey infill building at the rear of 43 London Street, which consists of separately accessed office areas together with treatment rooms and ancillary space for the former dental practice.

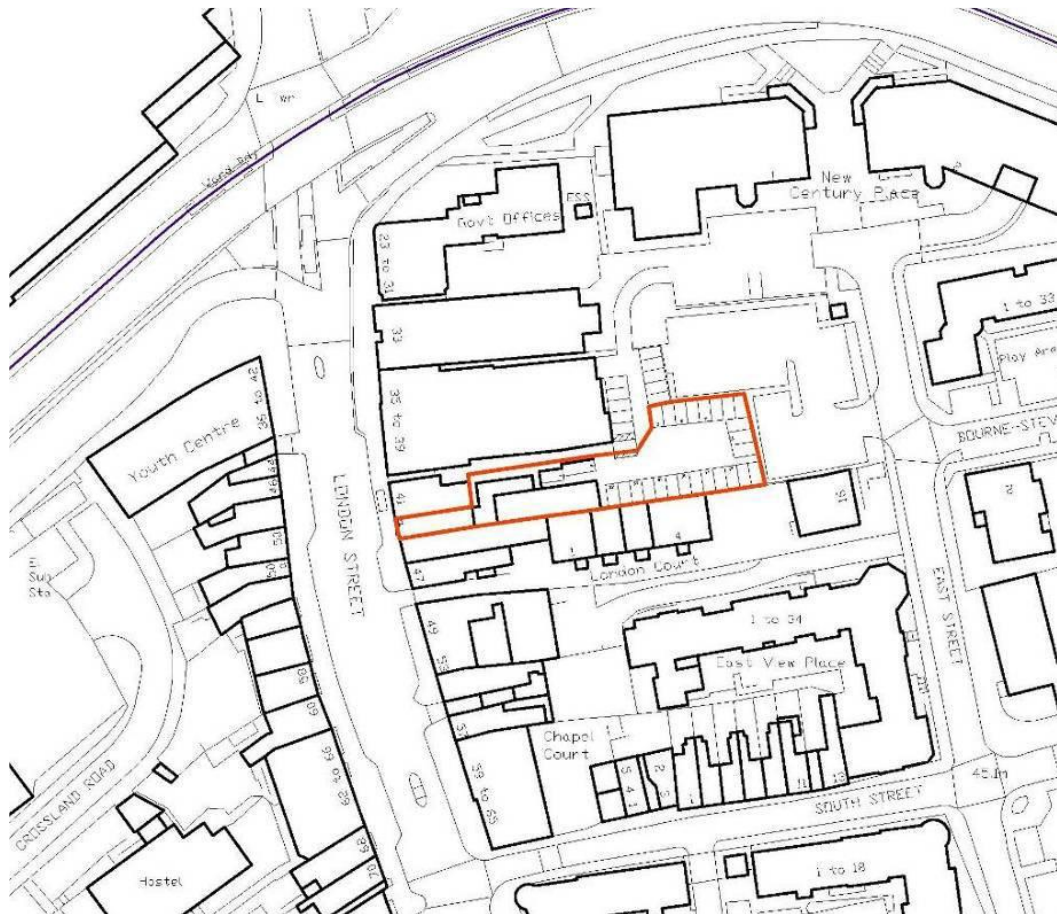


Figure 2.1 – Site Location (image courtesy of DSP Architecture)

The Proposed Development

- 2.4 The proposed development will consist of the the refurbishment and re-development of 43 and 43A London Street, Reading to consist of the part-demolition of the existing London Street facade and internal works to building alongside demolition of two storey building to rear to enable residential-led mixed-use development comprising 48 sqm community use (Class D1) and 21 no residential units (2 x studio, 7 x 1 bed, 9 x 2 two bed and 3 x 3 bed units) together with associated services enclosures, parking and landscaping.



Figure 2.2 – Birds eye view from London Street (Image courtesy of DSP Architecture)

3 ENERGY POLICY CONTEXT

- 3.1 A key mechanism for delivering the principles of low-carbon development lies within the UK planning system, which is implemented through national guidance along with regional and local planning policies. A review of all the relevant policy documents was undertaken in order to gain an understanding of the guiding policies for energy and CO₂ reduction.

National Planning Policy Framework

- 3.2 The revised National Planning Policy Framework (NPPF) was published on 24th July 2018 and updated in February 2019. It sets out the framework for all planning policy in England and how these are expected to be applied. The NPPF sets out a presumption in favour of sustainable development, and the need to support economic growth through the planning system.
- 3.3 Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives:
- an economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;
 - a social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and
 - an environmental objective – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.
- 3.4 Planning plays a key role in helping shape places to radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impacts of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure. This is central to the economic, social and environmental dimensions of sustainable development. The NPPF does not include detailed measures on sustainable design codes and standards to apply, although expects that when setting any local requirement for a building's sustainability, local planning authorities should do so in a way consistent with the national technical standards.

Reading Borough Council Planning

3.5 The most relevant policies which need to be considered when assessing the scheme's compliance to sustainability policy are those provided within local development documents. Reading Borough Council (RBC) is currently working to 3 primary adopted documents referencing energy and CO₂ reduction:

1. Core Strategy (adopted 2006, altered 2015);
2. Site & Detailed Policies Document (adopted 2012, altered 2015);
3. Sustainable Design & Construction SPD (Adopted July 2011)

3.6 In addition to the adopted documents listed above, RBC is working on producing a new Local Plan, which will replace the current development plans (the Core Strategy, Reading Central Area Action Plan and Sites and Detailed Policies Document) with a new plan setting out how Reading will develop up to 2036.

3.7 Given the Local Plan is due for adoption late 2018/early 2019, potentially during the determination period for this application, consideration has been given towards the policies in this document as well.

Policy CS1: Sustainable Construction and Design (Core Strategy)

3.8 This policy requires proposals for new development, including the construction of new buildings to comply with the following;

1. All new developments maximise the use of energy efficiency and energy conservation measures in their design, layout and orientation to reduce overall energy demand;
2. All developments of more than 10 dwellings or 1000m² floorspace incorporate on-site generation of energy from renewable sources and energy efficient design measures (including the use of CHP where appropriate) to off-set at least 20% of predicted carbon dioxide emissions from the estimated energy usage of the completed and occupied development.

Policy CC2: Sustainable Construction and Design (Emerging Local Plan)

3.9 This policy requires proposals for new development, including the construction of new buildings to comply with the following;

1. The design of buildings and site layouts must use energy, water, minerals, materials and other natural resources appropriately, efficiently and with care and take account of the effects of climate change.

Policy CC3: Adaptation to Climate Change (Emerging Local Plan)

3.10 This policy requires proposals for new development to incorporate measures to adapt to climate change including;

1. New buildings shall be orientated to maximise the opportunities for both natural heating and ventilation and reducing exposure to wind and other elements;
2. Proposals involving both new and existing buildings shall demonstrate how they have been designed to maximise resistance and resilience to climate change for example

by including measures such as solar shading, heating and ventilation of the building and appropriately coloured materials in areas exposed to direct sunlight, green and brown roofs, etc.

Policy CC4: Decentralised Energy

- 3.11 This policy requires proposals for new development to demonstrate how consideration has been given to securing energy for the development from a decentralised energy source (including various renewable technologies) and CHP.

Policy Advice surrounding CO₂ reduction

- 3.12 Reading Borough Council is in the process of producing a new Local Plan. The Local Plan and Proposals Map were submitted to the Secretary of State for Communities and Local Government on 29th March 2018. This marked the beginning of a public examination process, where an independent Inspector considers the Local Plan and Proposals Map, and determines whether they are sound, legally compliant and fulfil the duty to co-operate.
- 3.13 Whilst the current Core Strategy is still the adopted Development Plan, the new Local Plan may be a material consideration in planning decisions. The significance given to it is a matter for the decision maker, but it gains more weight as it moves through the process to adoption.
- 3.14 Emerging Policy H5 (Standards for new housing) is relevant for this scheme, which requires; *“all other new build housing to achieve a minimum 19% improvement in the dwelling emission rate over the TER as defined in 2013 Building Regs”*.
- 3.15 Following the policy advice provided, the CO₂ reduction requirement to be followed by the development is 19%.

4 ENERGY STATEMENT

- 4.1 An Energy Statement considers a multitude of factors. These factors help shape the efficacy of an energy statement at planning and through the design and construction phase. The bare minimum is that it achieves the Part L Building Regulations 2013 baseline (for new-build), follows the energy hierarchy, is appropriate to its setting and adheres to the local authority's planning policies and management plans.
- 4.2 An effective energy strategy should follow the *Energy Hierarchy*, that is;
1. 'Be-Lean' (minimise energy demand through passive and active measures);
 2. 'Be-Clean' (select the most energy-efficient heating and cooling infrastructure) and;
 3. 'Be Green' (show intelligent use of renewable energy and technologies).
- 4.3 An Energy Statement should also clearly identify the operational carbon footprint of the development after each stage of the energy hierarchy, including both regulated emissions and those emissions associated with uses not covered by Building Regulations.

Methodology

- 4.4 The developer proposals consist of 2 primary portions that must have their energy performance addressed separately:
1. The refurbishment of 43 London Street to create;
 - (a) 1 no. ground floor commercial unit
 - (b) 3 no refurbished apartments.
 2. Construction of 18 no. new-build apartments
- 4.5 In accordance with NCM guidance, the appropriate methodology for calculating the energy performance of the refurbished and new-build apartments is "The Government's Standard Assessment Procedure for Energy Rating of Dwellings". This procedure was undertaken using Stroma FSAP 2012 version 1.0.4.18 which is a Department of Communities and Local Government (DCLG) approved methodology and software for undertaking SAP assessments.
- 4.6 The appropriate methodology for calculating the energy performance of the non-domestic refurbished commercial unit is through a Simplified Building Energy Model (SBEM). The SBEM was produced using DesignBuilder software version 6.1.0.006, which is a DCLG approved software and methodology for undertaking SBEM.

- 4.7 For the purposes of the energy assessment for the new-build portion of the development, the following apartment typologies were selected for analysis which were based on apartment size, and location (either in the north-facing Simms Court block or the east facing block)

Table 4.1 – Apartment Typologies

Unit	Orientation	Reference for SAP Calculations
Ground Floor 3-Bed Maisonette	North	M-GF-3B
Ground Floor 2-Bed Flat	North	F-GF-2B (North)
Ground Floor 2-Bed Flat	East	F-GF-2B (East)
Ground Floor 3-Bed Flat	East	F-GF-3B (East)
Mid Floor 1-Bed Flat	North	F-MF-1B (North)
Mid Floor 1-Bed Flat	East	F-MF-1B (East)
Mid Floor 2-Bed Flat	North	F-MF-2B (North)
Mid Floor 2-Bed Flat	East	F-MF-2B (East)
Top Floor 1-Bed Flat	North	F-TF-1B (North)
Top Floor 1-Bed Flat	East	F-TF-1B (East)
Top Floor 3-Bed Flat	East	F-TF-3B (East)

Establishing the Target Emission Rate (TER) – Refurbished Building

- 4.8 In order to calculate the CO₂ emissions for the existing building(s) at 43 London Street, best practice guidance has been followed from the BRE Domestic Refurbishment and Non-Domestic Refurbishment methodology, which requires:
1. Where newly constructed thermal elements replace existing elements (e.g. demolition of an existing wall and construction of a new wall), input data to calculate the pre-refurbishment baseline for the element being replaced should be based upon the U-value of the elements prior to replacement as set out in appendix S of SAP 2012 to recognise the improvement achieved from replacing a poorly performing thermal element with one compliant with Part L;
 2. Building dimensions for the pre-refurbishment and post-refurbishment energy performance should be based on the units dimensions post-refurbishment, this is the methodology followed for both the residential and commercial portion of the development.
 3. Where new thermal elements are added during a refurbishment, the U-values of these elements pre-refurbishment should be based upon the baseline U-values given in Building Regulations Approved Document Part L1b & L2b 2010 (amended 2013);
 4. All other assumptions (heating, hot water, infiltration, thermal bridging etc.) should be based on the details set out in SAP appendix S or using actual values where available.
- 4.9 By following the methodology laid out above, an existing DER will be arrived at for each flat and the ground floor commercial unit, which will form the baseline for the refurbished portion of the development.
- 4.10 A planning search on the Reading Borough Council planning database determined that the building underwent no major refurbishment in the recent past. Therefore, existing fabric and M&E performance figures were taken from the following sources:
1. Residential Portion: SAP Appendix S, with the age band assumed to be A/B, the age-band for buildings built up to 1919;
 2. Commercial Portion: DesignBuilder Library data, which contains performance data based on an elements age and construction
 3. M&E Performance: As no existing survey information was available, default figures have been used where appropriate.

- 4.11 Therefore, based on the methodology above, the inputs for the existing building were as follows;

Table 4.2 – Existing Building Inputs

Existing Building Input	Residential Portion	Commercial Portion
External Wall U-Value (W.m ² K)	1.7	1.6 (assumes 300mm solid masonry wall, uninsulated)
Exposed Floor U-Value (W.m ² K)	n/a	0.58 (assumes uninsulated solid ground floor)
Roof U-Value (W.m ² K)	2.3 (assumes no insulation between rafters)	n/a
Window U-Value (W.m ² K)	4.8	5.057 (assumed typical glazing, pre-1995)
Lighting	Non-LED	Lamp efficacy of 90 lm/W with L.O.R of 0.9. Occupancy sensing in BOH zones
Ventilation	Extract Fan to WC	Extract fan to notional WC with default SFP of 1.5 W/l/s
Space & Water Heating	Gas-Fired condensing combi (1998 or later) with SAP assumed winter efficiency of 84% and summer efficiency of 75%	Gas-fired system with default efficiency of 81%
Metering & Controls	None	None

- 4.12 Based in the guidance and inputs based above, the baseline for the development was calculated as follows;

Table 4.3 – Existing Building Baseline Emissions

Unit	Total Floor Area (m ²)	Existing DER	Total Target CO ₂ (kg.CO ₂ .yr)	Target Regulated Energy (kWh.yr)
Flat 2	46	56.48	2,598.08	11,390.31
Flat 3	46	61.45	2,826.70	12,449.00
Flat 4	56	75.48	4,226.88	19,758.15
Commercial Unit	47.6	66.70	3,174.92	8,812.19
		Total =	12,826.58	52,409.65

- 4.13 The site-wide figure of **12,826.58 kg.CO₂.year** is the target that must be reached and improved upon by the refurbished building in this Energy Assessment in order to comply with energy policies contained within Reading Borough Council local policy documents.

- 4.14 This will be achieved through the implementation of fabric efficiency, energy-reduction and carbon-saving measures as outlined in the ensuing sections.

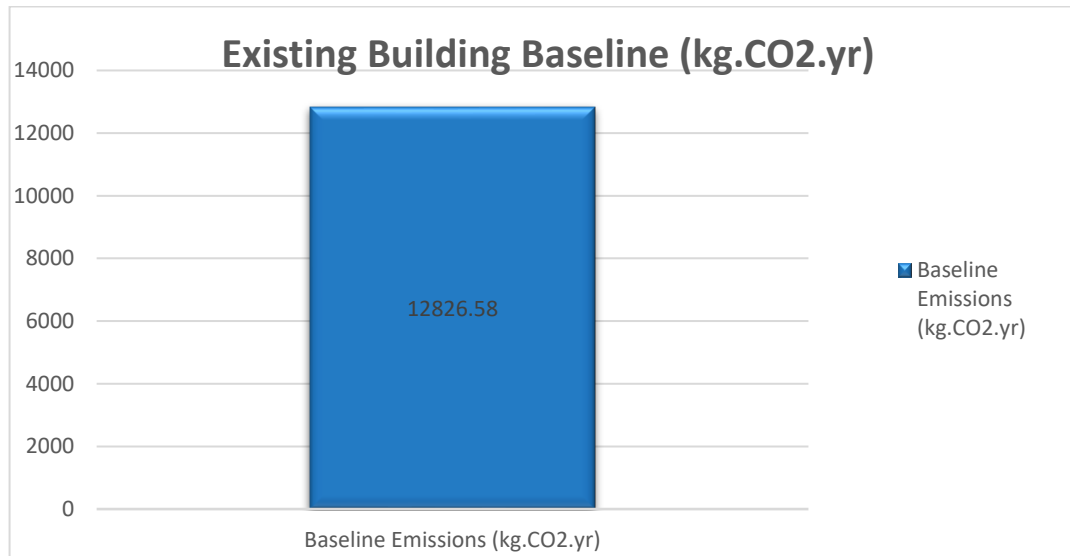


Fig 4.1 – Target CO₂ emissions for Refurbished building

Establishing the Target Emission Rate (TER) – New Build Residential

- 4.15 The total emissions savings calculated in this report for the 18 no new-build flats are expressed against a Building Regulation 2013 Target Emission Rate. This is the Baseline against which the measures implemented must show an improvement.
- 4.16 The Target Emission Rate for the buildings has been established using CLG approved methodology and software.
- 4.17 The calculated carbon emissions and total energy demand for the Target Emission Rate are illustrated below. The calculated figure demonstrates a Building Regulations 2013 compliant model.

Table 4.4 – Target CO₂ emissions for New-Build

Unit	Total Floor Area (m ²)	TER	Total Target CO ₂ (kg.CO ₂ .yr)	Target Regulated Energy (kWh.yr)
M-GF-3B	95	18.14	1,723.30	7,196.66
F-GF-2B (North)	62	19.72	1,222.64	5,143.46
F-GF-2B (East)	79	17.71	1,399.09	5,864.06
F-GF-3B (East)	83	17.61	1,461.63	6,154.45
F-MF-1B (North)	110	17.78	1,955.80	4,060.92
F-MF-1B (East)	109	19.48	2,123.32	4,791.38
F-MF-2B (North)	129	17.37	2,240.73	4,471.00
F-MF-2B (East)	282	15.70	4,427.40	4,700.82
F-TF-1B (North)	111	20.17	2,238.87	4,668.39
F-TF-2B (North)	62	19.95	1,236.90	5,206.13
F-TF-3B (East)	80	18.67	1,493.60	6,280.64
		Total =	21,523.28	58,537.91

- 4.18 The figure of **21,523.28 kg.CO₂.year** is the target that must be reached and improved upon by the new-build proposals in this Energy Assessment in order to comply with Part L1a of Building Regulations, along with energy policies contained within RBC's plans. This will be achieved through the implementation of fabric efficiency, energy-reduction and carbon-saving measures as outlined in the ensuing sections.

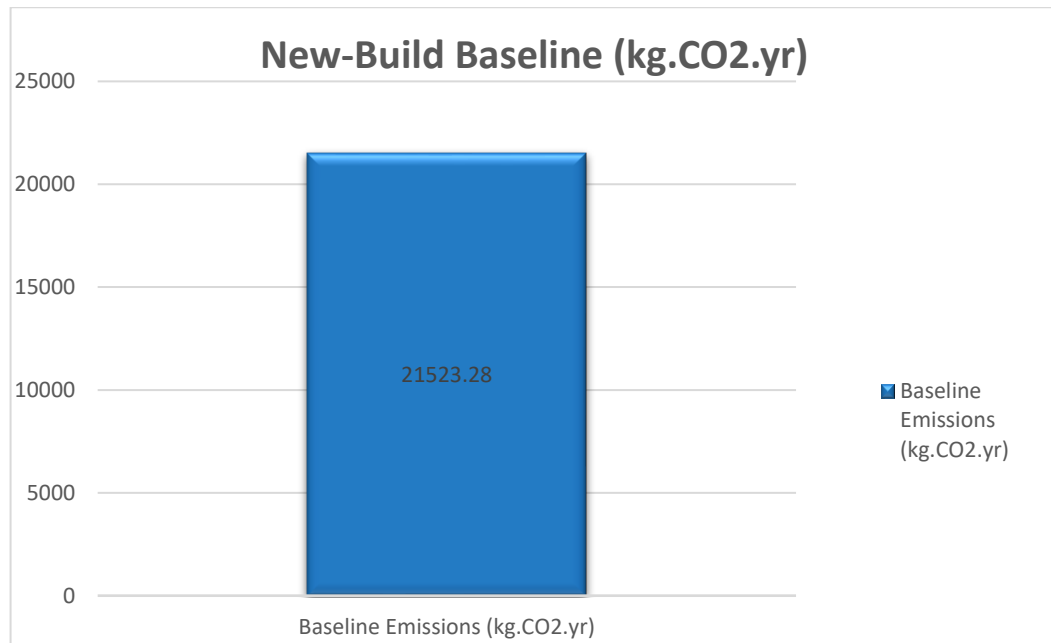


Fig 4.2 – Target CO₂ emissions for New-Build

Applying the Energy Hierarchy: Stage 1 – Be Lean

- 4.19 Best practice low carbon design seeks a ‘fabric first’ approach to reducing the carbon footprint of the built environment. This is achieved through buildings using less energy by improving u-values, air-tightness and lighting efficiency amongst others. This is the first step to consider in reducing a building’s carbon emissions before the efficient delivery of power, heat or renewables are considered by a design-team.

Fabric Efficiency

- 4.20 U-Values are used to measure how effective elements of a building’s fabric are as insulators. That is, how effective they are at preventing heat from transmitting between the inside and the outside of a building. The lower the U-value of an element of a building’s fabric, the more slowly heat is able to transmit through it, and so the better it performs as an insulator. Very broadly, the better (i.e. lower) the U-value of a buildings fabric, the less energy is required to maintain comfortable conditions inside the building.
- 4.21 The table below details the u-values for the new-build apartments, refurbished flats and refurbished commercial unit.

Table 4.5 Proposed U-Values

Elements	New-Build ¹ Thermal Elements: U-Values – W/m ² K	Refurbished ² Thermal Elements for Residential: U-Values – W/m ² K	Refurbished ³ Thermal Elements for Commercial: U-Values – W/m ² K
External Wall⁴	0.16	0.3	Retained
Ground Floor	0.12	n/a	Retained
Pitched/Flat Roof	0.11	0.3	n/a
Standard Window Units	1.1	1.6	2
External Solid Doors	1.8	1.8	1.8

¹ These thermal values apply to the 21 new-build apartments

² These thermal values apply to the 3 refurbished flats

³ These thermal values apply to the ground floor commercial unit

⁴ This includes walls to unheated corridors

Commentary on Glazing Technology

- 4.22 In order to reduce the effects of solar gain and the resultant risk of overheating, low g-values have been specified and must be specified at detail-design.

Air Permeability

- 4.23 The designed Air Permeability Rate (APR) has been set at $3.5 \text{ m}^3/\text{h.m}^2$ @ 50Pa for the new-build residential apartments.
- 4.24 No air testing for the refurbished building is proposed and therefore the air tightness has been assumed at $15 \text{ m}^3.\text{h.m}^2$ @ 50 pa. For the refurbished apartments, it is assumed there will be 100% draught-proof stripping to all windows and doors.

Lighting – Residential

- 4.1 The SAP calculation software used for assessing the development does not allow for the specification of lighting elements. However, it is assumed that the light fittings across all residential apartments (refurbished and new-build) be specified as LED, low-energy with local manual switching and if appropriate, occupancy sensing.

Lighting Strategy: Non-Residential

- 4.25 This energy demand will be limited by the application of more efficient lighting, occupancy control and use of LED lighting throughout. The following lighting design requirements are therefore stipulated;

Table 4.6 – Non-Residential Lighting Datasheet

Lighting zone	Luminaire Lumens / Circuit Watt	Light Output Ratio	Photocell Dimming (Parasitic Power – W/m^2)	Occupancy Sensing – On/Off (Parasitic Power – W/m^2)
Office/Reception Areas	90	0.9	No	No
Office BOH	90	0.9	No	Yes ($0.2 \text{ W}/\text{m}^2$)

Space & Water Heating – Residential

- 4.26 It is proposed that in order to meet the requirements of Building Regulations and local energy policy, all dwellings will be heated via a gas-fired combi boiler with radiator outlets and a minimum efficiency of 89.7% - also providing the domestic hot water.⁵

⁵ This assumes a gas connection is available to site.

- 4.27 It is assumed that all heating systems will be controlled via suitable arrangement of plumbing and electrical services and will use a delayed start thermostat, with boiler interlock.

Space & Water Heating: Non-Residential

- 4.28 It is proposed that in order to improve the energy performance over the existing commercial unit, the new A1/B1 unit will be heated via a gas-fired boiler with radiator outlets and a minimum efficiency of 91% - also providing the domestic hot water.⁶
- 4.29 It is assumed that all heating systems will be metered, controlled via suitable arrangement of plumbing and electrical services and will use a delayed start thermostat, with boiler interlock.

Ventilation Strategy: Residential

- 4.30 The ventilation strategy has been designed to meet with occupant and client requirements across the varied activity zones in the development, whilst maintaining the energy efficiency needed to lower carbon emissions. A balanced whole-house mechanical ventilation system with heat recovery is proposed for every dwelling as follows;

1. 1-Bed Flats: *Nuair MRXBOX95-WM1* (or similar);
2. 2 & 3 Bed Flats: *Nuair MRXBOXAB-ECO2* (or similar);

Ventilation Strategy: Refurbished Commercial Element

- 4.31 The ventilation strategy in the non-residential areas has been designed to meet with occupant and client requirements across the varied activity zones in the development, whilst maintaining the energy efficiency needed to lower carbon emissions. The following strategy is proposed;

Table 4.7 – Summary of Non-Residential Ventilation Strategy

Ventilation Zone	System	Specific Fan Power	Heat Recovery (Efficiency)
Office WCs	Basic Extract Fan (remote from zone)	0.5	No

⁶ This assumes a gas connection is available to site.

Be Lean Stage – CO₂ Reductions for Refurbished Building

- 4.32 The following tables and graphs represent the lean stage improvements for the refurbished building over the existing building baseline

Table 4.8 – Be-Lean CO₂ emissions for Refurbished Building

Unit	Total Floor Area (m ²)	DER	Total CO ₂ (kg.CO ₂ .yr)	Regulated Energy (kWh.yr)
Flat 2	46	28.05	1,290.30	5,549.59
Flat 3	46	29.08	1,337.68	5,769.98
Flat 4	56	44.21	2,475.76	11,259.17
Commercial Unit	47.6	33.50	1,594.60	5,702.48
		Total =	6,698.34	28,281.22
		Difference over Baseline	6128.24	24128.43
		% Difference	47.78%	46.04%

- 4.33 As detailed above, the proposed energy efficient design measures taken at the ‘Be-Lean’ stage will result in a **47.78%** reduction in CO₂ emissions over the existing building baseline CO₂ emissions.

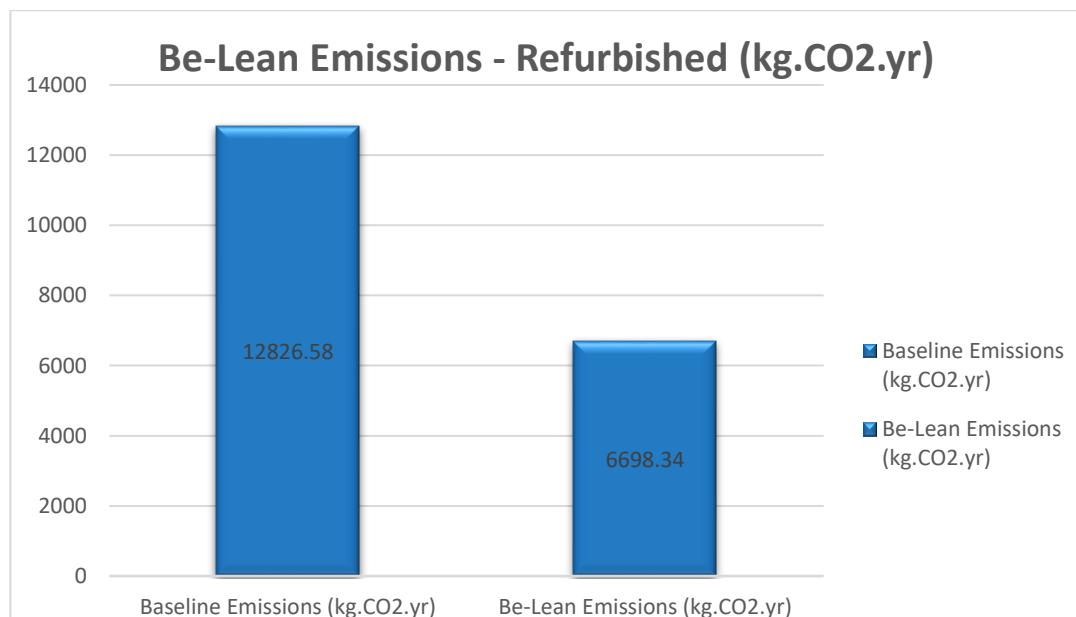


Fig 4.3 – Be-Lean Emissions for Refurbished Building

Be Lean Stage – CO₂ Reductions for New-Build

- 4.34 The following tables and graphs represent the lean stage improvements for the new-build apartments of the development over the Target Emission Rate;

Table 4.9– Be-Lean CO₂ emissions for Non-Domestic Portion

Unit	Total Floor Area (m ²)	DER	Total CO ₂ (kg.CO ₂ .yr)	Regulated Energy (kWh.yr)
M-GF-3B	95	18.22	1,730.90	6,857.18
F-GF-2B (North)	62	19.11	1,184.82	4,783.12
F-GF-2B (East)	79	16.89	1,334.31	5,330.99
F-GF-3B (East)	83	16.68	1,384.44	5,551.93
F-MF-1B (North)	110	16.45	1,809.50	3,520.63
F-MF-1B (East)	109	18.45	2,011.05	4,297.27
F-MF-2B (North)	129	15.85	2,044.65	3,851.90
F-MF-2B (East)	282	13.87	3,911.34	3,868.99
F-TF-1B (North)	111	19.40	2,153.40	4,269.25
F-TF-2B (North)	62	19.17	1,188.54	4,801.40
F-TF-3B (East)	80	17.40	1,392.00	5,571.74
		Total =	20,144.95	52,704.40
		Difference over Baseline	1378.33	5833.51
		% Difference	6.40%	9.97%

- 4.35 As detailed above, the measures as taken at 'Be-Lean' stage would result in a **6.40%** reduction in regulated CO₂ emissions and a 9.97% reduction in regulated energy demand over the Part L 2013 Target Emission Rate.

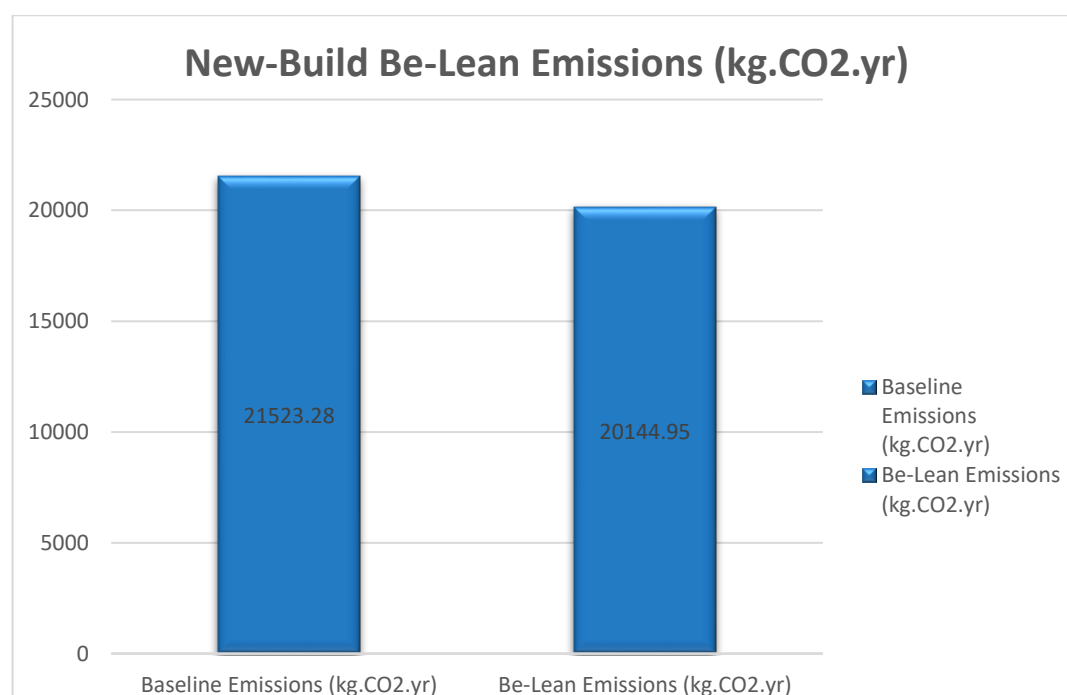


Fig 4.4– Be-Lean Emissions for New-Build

Applying the Energy Hierarchy: Stage 2 – Be Clean

- 4.36 Policy CS1 Of the Reading Borough Council Core Strategy and Policy DM2 of the Site & Detailed Policies Document requires any development of more than 20 dwellings and/ or non-residential development of over 1,000 sq m shall consider the inclusion of a CHP plant, or biomass-fueled heating scheme, or other form of decentralised energy provision, within the site, unless it can be demonstrated that the scheme is not suitable or feasible for this form of energy provision. Where there is existing decentralised energy provision, including a CHP plant or a district energy network present within the vicinity of an application site, further developments of over 10 dwellings or non-residential development of 1,000 sq m will be expected to link into the existing decentralised energy network or demonstrate why this is not feasible.

Connection to existing heating or cooling networks

- 4.37 A desktop study undertaken on the area surrounding the site at 43 London Street shows there are no existing nor planned heat networks within vicinity of the site.
- 4.38 As the proposed system includes a wet system to serve the LTHW installation it is may be possible to include isolation valves on the LTHW header for connection to any district heating infrastructure, added in the future to the area. This will be further examined at detail-design stage.

Site wide CHP network

- 4.39 The development proposals consist of 3 refurbished apartments, and 18 new-build apartments. Taken in isolation the 18 new-build apartments do not meet the threshold for Policy CS1 or DM2.
- 4.40 Small-medium residential-led developments (e.g. containing fewer than 500 apartments) are generally not viable for CHP installation. At this scale, it is generally not economic to install CHP in residential led, mixed use developments (and where CHP is installed it tends to have lower electrical efficiencies). Due to the small landlord electricity demand, CHP installed to meet the base heat load would require the export of electricity to the grid.
- 4.41 In addition, the administrative burden of managing CHP electricity sales at this small scale where energy service companies (ESCOs) are generally not active, and the low unit price available for small volumes of exported CHP electricity, means it is generally uneconomic for developers to pursue. This can lead to CHP being installed but not operated. For these reasons the use of CHP is discounted for this application, instead the installation of high-efficiency gas-fired boilers is being pursued.

Applying the Energy Hierarchy: Stage 3 – Be Green

- 4.42 An analysis of low carbon/renewable technologies was undertaken to determine which would be suitable for application in a development of this size and nature. This analysis has been appended to this document in Appendix I.
- 4.43 During the design-development period for this scheme, multiple low carbon/renewable systems were examined for both their feasibility and ability to lower carbon emissions insofar as possible. As per the analysis contained in Appendix 1, Photovoltaics (PV) were deemed to be the most viable solution for the new-build portion of the development.

Renewable Technology for Refurbished Building

- 4.44 As detailed in the 'Be-Lean' section, the proposed energy efficient design will result in a 47.68% reduction in CO₂ emissions over the existing building baseline CO₂ emissions.
- 4.45 Therefore, it is not proposed to specify any additional renewable technology at the 'Be-Green' stage for the refurbished portion of the development.

Low-Carbon/Renewable Technology System 1 – Photovoltaic Array

- 4.46 The first low-carbon/renewable energy proposed for the development is a Photovoltaic (PV) array. The proposed PV will be mounted at the uppermost roof level, both on the south facing slope of the Simms Court block and the flat roof of the eastern building block. The building design will provide service riser accommodation to allow the roof mounted inverter to be wired back to a distribution board and G59 intake meter arrangement.
- 4.47 The carbon offset from the installation will contribute towards the overall developments CO₂ reduction. In order to achieve the necessary carbon reduction to achieve compliance, a 46m² array of mono-crystalline PV panels will be provided for the development with a calculated annual generation of 7,260 kWh. Included in the table below is a break-down of the PV;

Table 4.10 – PV Array Details

Area	PV Area	PV Peak Power (kWp)	PV Energy Generation (kWh.annum)
Simms Court roof and East Block Roof	46m ² (approx.)	8.4 kWp	7,260 kWh/annum

- 4.48 The energy assessment assumed 28 no. 300 Watt PV panels, each measuring 1640mm (l) x 1000mm (w).

Be Green Stage –CO₂ Reductions for New-Build portion

- 4.49 The following tables and graphs represent the lean stage improvements for the development over the Target Emission Rate;

Table 4.11 – Green Stage CO₂ Reductions over Baseline

Unit	Total Floor Area (m ²)	DER	Total CO ₂ (kg.CO ₂ .yr)	Regulated Energy (kWh.yr)
M-GF-3B	95	16.79	1,595.05	6,598.09
F-GF-2B (North)	62	16.93	1,049.66	4,524.03
F-GF-2B (East)	79	15.19	1,200.01	5,071.90
F-GF-3B (East)	83	15.06	1,249.98	5,292.84
F-MF-1B (North)	110	11.56	1,271.60	3,002.46
F-MF-1B (East)	109	13.85	1,509.65	3,779.10
F-MF-2B (North)	129	11.50	1,483.50	3,333.73
F-MF-2B (East)	282	10.17	2,867.94	3,350.82
F-TF-1B (North)	111	16.95	1,881.45	4,010.16
F-TF-2B (North)	62	17.00	1,054.00	4,542.31
F-TF-3B (East)	80	15.70	1,256.00	5,312.65
		Total =	16,418.84	48,818.09
		Difference over Be-Lean	3726.11	3886.31
		% Difference	18.50%	7.37%
		Difference over Baseline	5104.44	9719.82
		% Difference	23.72%	16.60%

- 4.50 As detailed above, the 18 new-build apartments are expected to reduce CO₂ emissions by 23.72% over the Part L1a baseline, therefore in compliance with relevant energy policies contained within the RBC local development documents.

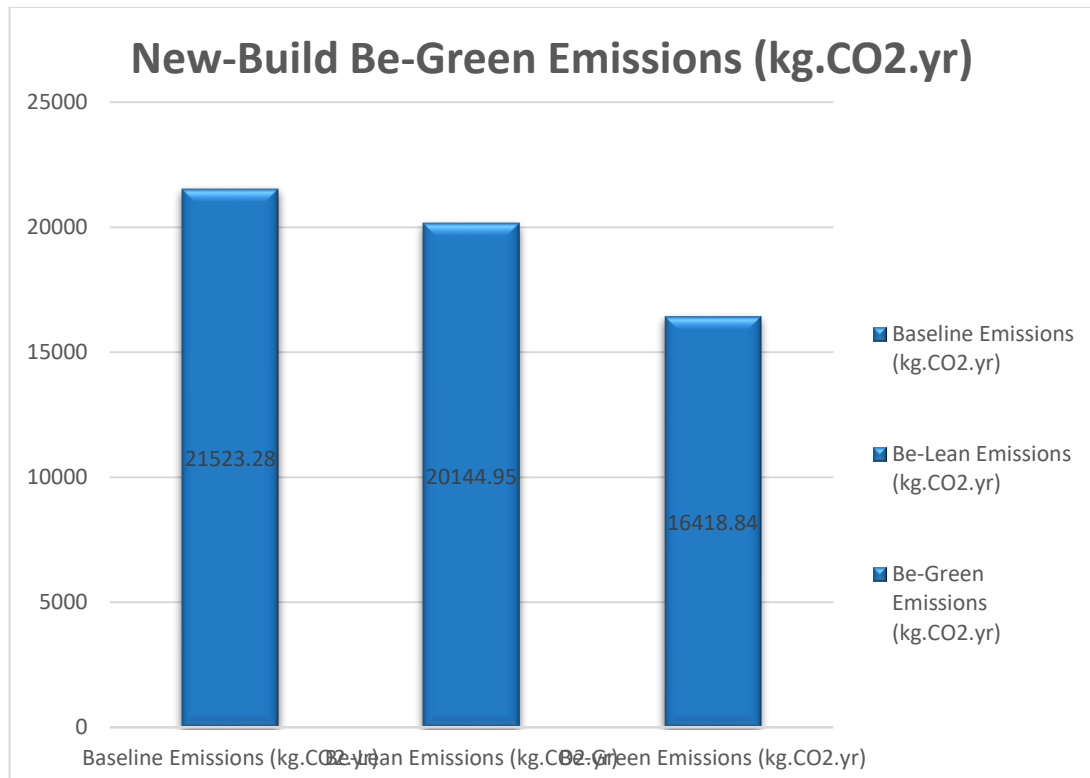


Fig 4.5– Be-Green Emissions for New-Build

5 CONCLUSION

- 5.1 At this stage of the project timeline, the solutions proposed are considered to be technically and financially viable and will deliver the carbon emission reductions in accordance with policy.
- 5.2 Further optimising of the gas-fired boilers and Photovoltaic (PV) will be assessed at the detail-design phase. For this Energy Statement, the solutions have been optimised to suit the predicted energy consumption and carbon emissions as per Envision's calculations.
- 5.3 Analysis of the outline design using accepted approaches and the energy hierarchy have indicated the new-build apartments can exceed the minimum performance requirement of 19% lower carbon emissions over 2013 Building Regulations.
- 5.4 The strategy proposed follows the three-step 'Energy Hierarchy' and meets all policies as outlined in Section 3 of the report.
- 5.5 The refurbished building is expected to reduce CO₂ emissions by **47.78%** over the existing building baseline.
- 5.6 The 18 new-build apartments overall reduction in carbon emissions over the Part L1a 2013 baseline is **23.72%** therefore complying with RBC policy on CO₂ reductions.
- 5.7 To minimise energy consumption by the development and to assist in achieving a Building Regulation Part L 2013 compliant development, the following design measures are recommended and will need to be incorporated into detailed designs:
- Building fabric construction U-values significantly improved compared with standard Building Regulations U-values in the new-build portion;
 - Upgrade to fabric performance in refurbished portion where appropriate;
 - In the new-build portion, reduced Air Permeability, lower than standard Buildings Regulations;
 - Upgrade to heating systems in the refurbished portion of the development;
 - On-site efficient energy generation through the use of a Photovoltaic (PV) array on the uppermost roof for the new-build portion;
 - HVAC system controls ensure installed equipment will be operating efficiently and to include automatic monitoring and targeting with alarms for out of range values;
 - High efficiency LED lighting utilizing low-energy control systems such as occupancy sensing.
- 5.8 This Energy Statement sets the parameters of detailed design, but remains at a strategic level. The calculations in this document are an indication of system size and carbon emissions based on guidance documents, approved software and practical experience.

APPENDIX I – LOW/ZERO CARBON/RENEWABLE ANALYSIS

Renewable Technology	Rating (out of 5)	Comment
Photovoltaics	***	The roof is relatively free from shading and flat which is well suited for PV installation. PV arrays have a long lifespan and have limited maintenance requirements.
Solar Thermal	**	The use of a solar thermal system would not offer significant CO2 savings compared to PV
Wind Turbine	*	The restricted nature of the site, coupled with the noise, aesthetic (planning) and building vibrations arising from their installation means this system is unviable.
Ground Source Heat Pump	**	The site has limited accessible ground to allow the installation of the horizontal ground loops required for this system. Vertical ground loops set within the pile foundations are possible, but come with significant capital cost due to the ground heat exchanger and they add significant complexity to the thermal modelling of the building to ensure they are effectively serving the heating requirements of the building. These would require additional renewable services to achieve RBC targets.
Air Source Heat Pump	**	ASHPs are not viable for the scheme owing to the following issues with the location of the outdoor units; 1. The roof is not a suitable location for the outdoor units as they would be visible from the street which would not be in accordance with the streetscape elevations as agreed through pre-application meetings; 2. There is limited external space for 22 no. outdoor units. In addition, there is noise associated with the operation of outdoor ASHP units, which would be an issue considering the noise-sensitive nature of the surrounding suburban/residential area.
Biomass Communal Boiler	**	The significant plant and in particular, storage space required for a biomass boiler is unsuitable for a development of this size.

APPENDIX II – EXISTING BUILDING BRUKL

Project name

Commercial Unit (Existing)

As designed

Date: Thu Jun 06 09:59:27 2019

Administrative information

Building Details

Address: 43 London Sreet, Reading,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.1

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.0

BRUKL compliance check version: v5.6.a.1

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Ciaran Dorrity

Telephone number: 01908062819

Address: Unit 2 Lodge Farm Business Centre,
Castlethorpe, MK19 7ESCriterion 1: The calculated CO₂ emission rate for the building must not exceed the target

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

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	22
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	22
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	66.7
Are emissions from the building less than or equal to the target?	BER > TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	1.6	1.6	Ground Floor Commercial Unit - Surgery_W_6
Floor	0.25	0.58	0.58	Ground Floor Commercial Unit - Surgery_S_3
Roof	0.25	-	-	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	5.06	5.06	Ground Floor Commercial Unit - Reception_G_8
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	25

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Gas-Fired System

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.81	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- Gas-Fired DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.143
Standard value	N/A	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
Ground Floor Commercial Unit - WC	1.5	-	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
Ground Floor Commercial Unit - Surgery	28	-	-	819
Ground Floor Commercial Unit - BOH	28	-	-	31
Ground Floor Commercial Unit - WC	-	55	-	71
Ground Floor Commercial Unit - Reception	-	55	15	121

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Ground Floor Commercial Unit - Surgery	N/A	N/A
Ground Floor Commercial Unit - Reception	YES (+194.5%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	47.6	47.6
External area [m ²]	69.2	69.2
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	25	5
Average conductance [W/K]	80.39	15.2
Average U-value [W/m ² K]	1.16	0.22
Alpha value* [%]	6.2	22.53

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

Building Use

% Area Building Type

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	70.76	15.08
Cooling	0	0
Auxiliary	4.1	1.61
Lighting	84.17	34.35
Hot water	26.1	2.54
Equipment*	25.89	25.89
TOTAL **	185.13	53.57

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

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

Energy Production by Technology [kWh/m²]

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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	379.52	185.58
Primary energy* [kWh/m ²]	389.17	129.12
Total emissions [kg/m ²]	66.7	22

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

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	184.2	195.3	70.8	0	4.1	0.72	0	0.81	0
	Notional	44.5	141.1	15.1	0	1.6	0.82	0	----	----

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

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	1.6	Ground Floor Commercial Unit - Surgery_W_6
Floor	0.2	0.58	Ground Floor Commercial Unit - Surgery_S_3
Roof	0.15	-	"No heat loss roofs"
Windows, roof windows, and rooflights	1.5	5.06	Ground Floor Commercial Unit - Reception_G_8
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	25

APPENDIX III– REFURBISHED BUILDING BRUKL

Project name

Commercial Unit (Proposed)

As designed

Date: Thu Jun 06 10:17:50 2019

Administrative information

Building Details

Address: 43 London Sreet, Reading,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.1

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.0

BRUKL compliance check version: v5.6.a.1

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Ciaran Dorrity

Telephone number: 01908062819

Address: Unit 2 Lodge Farm Business Centre,
Castlethorpe, MK19 7ESCriterion 1: The calculated CO₂ emission rate for the building must not exceed the target

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

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	17.8
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	17.8
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	33.5
Are emissions from the building less than or equal to the target?	BER > TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	1.6	1.6	Ground Floor Commercial Unit - Office_W_6
Floor	0.25	0.58	0.58	Ground Floor Commercial Unit - Office_S_3
Roof	0.25	-	-	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	2	2	Ground Floor Commercial Unit - Office_G_9
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	25

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Gas-Fired System

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- Gas-Fired DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.143
Standard value	N/A	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
Ground Floor Commercial Unit - WC	0.5	-	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
Ground Floor Commercial Unit - Office	81	-	-	317
Ground Floor Commercial Unit - BOH	81	-	-	10
Ground Floor Commercial Unit - WC	-	90	-	24

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Ground Floor Commercial Unit - Office	YES (+70.3%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	47.6	47.6
External area [m ²]	69.2	69.2
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	25	5
Average conductance [W/K]	64.19	17.23
Average U-value [W/m ² K]	0.93	0.25
Alpha value* [%]	7.77	19.87

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

Building Use

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	70.72	16.28
Cooling	0	0
Auxiliary	2.6	1.4
Lighting	22.68	25.68
Hot water	23.8	2.57
Equipment*	33.37	33.37
TOTAL **	119.79	45.93

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

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

Energy Production by Technology [kWh/m²]

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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	274.9	139.78
Primary energy* [kWh/m ²]	192.9	104.06
Total emissions [kg/m ²]	33.5	17.8

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

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	206.7	68.2	70.7	0	2.6	0.81	0	0.91	0
	Notional	48	91.8	16.3	0	1.4	0.82	0	----	----

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

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	1.6	Ground Floor Commercial Unit - Office_W_6
Floor	0.2	0.58	Ground Floor Commercial Unit - Office_S_3
Roof	0.15	-	"No heat loss roofs"
Windows, roof windows, and rooflights	1.5	2	Ground Floor Commercial Unit - Office_G_9
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	25

APPENDIX IV – REFURBISHED BUILDING SAP SUMMARY

Block Compliance WorkSheet: Refurbished Block - Emissions

User Details

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP

Software Version:

Version: 1.0.4.18

Calculation Details

Dwelling	DER	TER	DFEE	TFEE	TFA
Flat 2 (Existing)	56.48	18.81	142.6	40.6	46
Flat 3 (Existing)	61.45	19.16	158.9	42.4	46
Flat 4 (Existing)	75.48	18.21	211.7	45.3	58.7
Flat 2 (Refurbished)	28.05	18.81	63.1	40.6	46
Flat 3 (Refurbished)	29.08	19.16	66.8	42.4	46
Flat 4 (Refurbished)	44.21	18.21	119	45.3	58.7

Calculation Summary

Total Floor Area	301.40
Average TER	18.68
Average DER	50.03
Average DFEE	130.25
Average TFEE	42.98
Compliance	Fail
% Improvement DER TER	N/A
% Improvement DFEE TFEE	N/A

APPENDIX V – NEW BUILD SAP SUMMARY

Block Compliance WorkSheet: 43 London Street - New Build (Be-Lean)

User Details

Assessor Name: Sam Wallis **Stroma Number:** STRO029754
Software Name: Stroma FSAP **Software Version:** Version: 1.0.4.18

Calculation Details

Dwelling	DER	TER	DFEE	TFEE	TFA
M-GF-3B	18.22	18.14	51.9	53	94.13
F-GF-2B (North)	19.11	19.72	51.4	53	61.8
F-GF-2B (East)	16.89	17.71	45.2	47.4	79
F-GF-3B (East)	16.68	17.61	45.8	48.6	83.12
F-MF-1B (North)	16.45	17.78	37.3	40.6	54.9
F-MF-1B (East)	18.45	19.48	46.9	50.3	58.44
F-MF-2B (North)	15.85	17.37	37	41	61.8
F-MF-2B (East)	13.87	15.7	29.9	34.8	72.75
F-TF-1B (North)	19.4	20.17	49.7	52.8	54.9
F-TF-2B (North)	19.17	19.95	50.7	54.2	61.8
F-TF-3B (East)	17.4	18.67	50.3	53.7	79.46

Calculation Summary

Total Floor Area	762.10
Average TER	18.30
Average DER	17.35
Average DFEE	45.33
Average TFEE	48.28
Compliance	Pass
% Improvement DER TER	5.19
% Improvement DFEE TFEE	6.11

Block Compliance WorkSheet: 43 London Street - New-Build (Be-Green)

User Details

Assessor Name: Sam Wallis
Software Name: Stroma FSAP

Stroma Number: STRO029754
Software Version: Version: 1.0.4.18

Calculation Details

Dwelling	DER	TER	DFEE	TFEE	TFA
M-GF-3B	16.79	18.14	51.9	53	94.13
F-GF-2B (North)	16.93	19.72	51.4	53	61.8
F-GF-2B (East)	15.19	17.71	45.2	47.4	79
F-GF-3B (East)	15.06	17.61	45.8	48.6	83.12
F-MF-1B (North)	11.56	17.78	37.3	40.6	54.9
F-MF-1B (East)	13.85	19.48	46.9	50.3	58.44
F-MF-2B (North)	11.5	17.37	37	41	61.8
F-MF-2B (East)	10.17	15.7	29.9	34.8	72.75
F-TF-1B (North)	16.95	20.17	49.7	52.8	54.9
F-TF-2B (North)	17	19.95	50.7	54.2	61.8
F-TF-3B (East)	15.7	18.67	50.3	53.7	79.46

Calculation Summary

Total Floor Area	762.10
Average TER	18.30
Average DER	14.70
Average DFEE	45.33
Average TFEE	48.28
Compliance	Pass
% Improvement DER TER	19.67
% Improvement DFEE TFEE	6.11

APPENDIX VI – CARBON EMISSION FIGURES

The Building Regulations Part L 2013 Fuel Factors have been used within this report and are summarised below against the previous 2010 Fuel Factors.

FUEL	2013 kgCO ₂ /kWh	2010 kgCO ₂ /kWh
Natural Gas	0.216	0.198
Grid Supplied Electricity	0.519	0.517
Grid Displaced Electricity	0.519	0.529