



Energy Statement

Oxford Road, Reading

September 2020

Energy Statement

Oxford Road, Reading

25/09/2020

Stonegate Homes Ltd

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Contents

1.	Introduction.....	1
2.	Planning Policy	2
3.	3D Compliance Model	4
4.	Baseline	5
5.	Be Lean Assessment	7
6.	'Be Clean' Assessment	9
7.	'Be Green' Assessment.....	10
8.	Conclusion.....	16

1. Introduction

Background

- 1.1 Phlorum Ltd has been commissioned by Stonegate Homes Ltd to undertake an energy statement for the proposed development at Oxford Road, Reading. The scheme involves the construction of a new mixed used development over ground floor and 5no upper floors. The ground floor will provide speculative commercial space in the form of two 'shell only' units. A total of 26no apartments will be provided on the above ground floors, which will comprise 5no 1-bed apartments, 13no 2-bed apartments and 8no 3-bed apartments. The site has a suburban context and is located approximately one mile from the centre of Reading.
- 1.2 Under Reading Borough Council planning policy an assessment of Low and Zero Carbon (LZC) opportunities must be provided with any major planning application. A major residential planning application is defined as any application for ten or more dwellings. This assessment must include a study into the feasibility of connection to existing or provision of new decentralised energy networks.
- 1.3 This report therefore provides a summary of the energy assessment undertaken and the proposed energy strategy in accordance with local policy requirements. The energy strategy has been prepared following the recognised London Plan 2016 energy hierarchy:
 -  Be lean: use less energy;
 -  Be clean: supply energy efficiently; and
 -  Be green: use renewable energy.

2. Planning Policy

- 2.1 The site is located approximately one mile from the centre of Reading in the 'Oxford Road West' district and so is subject to Reading Borough Council's (RBC) planning policy. Within RBC Local Plan (adopted November 2019), policy CC4 address the potential for connection to, or creation of decentralised energy networks. Under this policy, any development of over 20no dwellings must consider the inclusion of decentralised energy provision, unless it can be demonstrated that it is unviable. Where existing energy networks are present within the vicinity of the site it is expected that the development will link to these.

CC4: DECENTRALISED ENERGY

In meeting the sustainability requirements of this plan, developments of the sizes set out below shall demonstrate how consideration has been given to securing energy for the development from a decentralised energy source.

Any development of more than 20 dwellings and/ or non-residential development of over 1,000 sq m shall consider the inclusion of decentralised energy provision, within the site, unless it can be demonstrated that the scheme is not suitable, feasible or viable for this form of energy provision.

Where there is existing decentralised energy provision present within the vicinity of an application site, further developments of 10 dwellings or more or non-residential development of 1,000 sq m or more will be expected to link into the existing decentralised energy network or demonstrate why this is not feasible.

Figure 2.1 RBC Local Plan Policy CC4

- 2.2 Policy H5 within the same document discusses the required standards for new housing. Under this policy, all major new-build residential development should be designed to achieve zero carbon homes. The Sustainable Design and Construction Supplementary Planning Document (adopted December 2019) provides further clarification of this policy. Within this SPD document table 3.1 it is stated that, where zero carbon emissions are not achievable under the development proposals a minimum of 35% improvement in the dwelling emission rate over the target emission rate must be achieved. Section 3.4 of the SPD also confirms that an energy statement must be prepared to demonstrate that the proposed strategy meets these targets.

	Size of Development	Required Standard
New-build residential	Minor (fewer than 10 dwellings)	19% improvement in the dwelling emission rate over the target emission rate, as defined in the 2013 Building Regulations
	Major (10 dwellings or more)	Zero Carbon (or if unachievable, a minimum 35% improvement in the dwelling emission rate over the target emission rate, as defined in the 2013 Building Regulations and planning contribution to offset remaining carbon emissions to zero)
Creation of new residential units through conversion from other uses and/or major refurbishment	Minor (fewer than 10 dwellings)	BREEAM 'Very Good'
	Major (10 dwellings or more)	BREEAM 'Excellent'
Non-residential development (including development for non-C3 residential)	Minor (less than 1,000 sq. m of floorspace)	BREEAM 'Very Good'
	Major (1,000 sq. m of floorspace or more)	BREEAM 'Excellent'
Non-residential refurbishment (including refurbishment for non-C3 residential)	Minor (less than 1,000 sq. m of floorspace)	BREEAM 'Very Good'
	Major (1,000 sq. m of floorspace or more)	BREEAM 'Excellent'

Figure 2.2 Extract from RBC's Sustainable Design & Construction SPD (table 3.1)

- 2.3 Therefore, as the proposed development meets the definition of a 'major development' consideration must be given to decentralised energy provision / connection and a minimum reduction of 35% below the Part L 2013 TER must be demonstrated within this energy statement.

3. 3D Compliance Model

Geometry

- 3.1 A 3D model of the commercial elements of the development has been constructed within IES Virtual Environment software using the ModelIT tool. IES VE is a dynamic simulation modeling software, which has been selected and applied in accordance with CIBSE AM11. Geometry of the apartments has been entered into the residential SAP assessment approved software based upon the following planning issue drawings provided by ECE Architecture Ltd:
-  6906/110/rev F Proposed Ground Floor Plan
 -  6906/111/rev D Proposed First Floor Plan
 -  6906/112/rev C Proposed Second Floor Plan
 -  6906/113/rev D Proposed Third Floor Plan
 -  6906/114/rev D Proposed Fourth Floor Plan
 -  6906/115/rev C Proposed Fifth Floor Plan
 -  6906/142/rev A Proposed Street Elevation Sheet 1
 -  6906/143/rev A Proposed Street Elevation Sheet 2
- 3.2 The energy assessment for the residential accommodation has been completed using Building Regulations Approved Document Part L1A 2013 compliant Standard Assessment procedure (SAP) software, which is approved for use by the Department for Communities and Local Government. AD L1A relates to energy efficiency in new dwellings and seeks to ensure all new residential construction meets a minimum benchmark for regulated energy use.

Climate Data

- 3.3 To complete the energy assessment for the non-residential areas an AD Part L2A assessment has been completed using the VE Compliance tool within IES Virtual Environment software package. This offers full dynamic simulation of the building using default NCM data sets. To complete this analysis a Test Reference Year (TRY) weather file must be selected and applied to the model.
- 3.4 The TRY is composed of 12 separate months of data, each chosen to be the most average month from the collected data. The TRY is used for energy analysis, compliance with the UK Building Regulations (Part L) and to assess winter thermal comfort. The TRY weather file used within the compliance model is the LondonTRY 2016 file.

4. Baseline

Summary

- 4.1 To complete the assessment of the residential areas a total of seven dwelling types were selected and an initial SAP assessment was completed upon each. The unit types assessed were:
-  'Exposed floor corner' – an apartment with an exposed floor and in a corner / end location
 -  'Partial exposed floor centre' – an apartment with a partially exposed floor with adjacent apartments on both sides
 -  'Mid floor corner' – an apartment with no exposed roof or floor and in a corner location
 -  'Mid floor centre' - an apartment with no exposed roof or floor and with adjacent apartments on both sides
 -  'Partial exposed roof corner' – a mid-floor apartment with only a partly exposed roof in a corner / end location
 -  'Exposed roof corner' – an apartment with a fully exposed roof and in a corner location
 -  'Exposed roof centre' – an apartment with a fully exposed roof and with adjacent apartments on both sides
- 4.2 These units were selected for analysis as they broadly represent the different apartments types and levels of external exposure present on the plan drawings provided.
- 4.3 As the SAP process reports regulated CO₂ emissions in kgCO₂/m²/yr one of the above apartment types was allocated to each unit and the total floor area of each apartment type was summed. The SAP results for each sample assessment were then multiplied by the total floor area of each apartment type to obtain an estimate of CO₂ emissions at each stage. The SAP process was then repeated at each stage of the energy hierarchy.
- 4.4 The sample SAP calculations were completed to determine the AD L1A baseline, known as the target Emission rate (TER). This is the benchmark emission rate as calculated by the software that the dwelling must meet or exceed to comply with Building Regulations. The TER is based upon a naturally ventilated property with gas fired heating and hot water and is used as the baseline for this assessment.
- 4.5 The baseline for the commercial spaces is derived from an Approved Document Part L2A 2013 compliance calculation and determining the Target Emission Rate (TER) from an SBEM (Simplified Building Energy Model) or DSM (Dynamic Simulation Model) calculation using NCM (National Calculation Methodology) approved software. In this instance an SBEM model has been prepared to obtain a benchmark.

Baseline Assessment Results

- 4.6 The results of the baseline assessment are shown in table 4.1 below. These demonstrate that the site has baseline CO₂ emissions of 40,428 kg.

Unit Type	Total Area (m ²)	TER (kg/m ² /yr)	CO ₂ (kg/yr)
Exposed floor corner	173	19.26	3,336
Partial exposed floor centre	209	16.95	3,544
Mid floor centre	567	17.1	9,696
Mid floor corner	450	17.42	7,844
Partial exposed roof corner	168	18.22	3,055
Exposed roof corner	282	19.78	5,582
Exposed roof centre	59	19.78	1,165
Commercial	158	39.4	6,206
Site Baseline CO₂ Emissions			40,428

Table 4.1 Annual Baseline CO₂ Emissions

5. Be Lean Assessment

Summary

- 5.1 The first step of the energy hierarchy is to improve a development's energy demand through the specification of thermally efficient building fabric and services. To reduce this energy demand from the building high performance thermal insulation will be specified where possible to reduce existing envelope u-values significantly below what is required for AD L 2013 compliance.
- 5.2 The 'Be Lean' fabric thermal performance is shown in table 5.1 below and is based upon information provided by ECE Architecture and similar project experience.

Building Element	U-Value W/m ² K	Part L2A W/m ² K
External Wall	0.20	0.35
Roof	0.15	0.25
Ground / Exposed Floor	0.15	0.25
Glazing (g=0.4)	1.20	2.20
Doors	1.20	2.20
Air permeability (m ³ /hr.m ²)	5	10

Table 5.1 Building Fabric Constructions

- 5.3 To further reduce the energy demand and associated CO₂ emissions from the development the efficiency of the building services strategy must also be considered. Within residential areas it is proposed that heating and hot water will be delivered to each of the units from high efficiency gas fired condensing combi boilers. Each dwelling will be naturally ventilated, and lighting will be 100% low energy LED.
- 5.4 Within the commercial premises highly efficient VRF heat pumps are specified to meet the heat demand, which can be reversed to provide cooling during the warmer months. Lighting throughout will be low energy LED, which will be automatically controlled where appropriate to ensure lighting is only used when required. Due to the depth of the units the ventilation strategy will be mechanical supply and extract with heat recovery, which further reduces the heat demand. All fans will be selected with a low specific fan power (SFP) in mind. The hot water demand in the 'be lean' commercial units will be met by standalone electric hot water generator with a small amount of storage.
- 5.5 Table 5.2 below provides details of the 'be lean' services strategy within the speculative commercial units. It should be stated that within the speculative unit the proposed HVAC strategy is only indicative as final strategy will be determined by the future tenant's design team / specification.

System	System Details	Delivery Method / Controls
Heating	VRF Heat Pump, C.O.P. = 4.0	Local Fan Coils Units, generally concealed
Cooling	VRF Heat Pump, E.E.R. = 3.5	Local Fan Coils Units, generally concealed
Ventilation	Mechanical supply & extract, SFP=1.50, heat recovery η =70.0%	Dedicated MVHR units, ducted
Hot water	Dedicated point of use electric heaters, η =100.0%	Max 200L storage, 9.4kWh / day losses
Lighting	LED, assumed 100 lms/W	Daylight dimming

5.6 Table 5.2 Building Services Systems & Performance Data for commercial assessment

'Be Lean' Assessment Results

- 5.7 The results of the 'Be Lean' assessment are shown in table 5.3 below. These demonstrate that the site has CO₂ emissions of 40,058 kg per annum. This is a reduction of 0.91% below the baseline figure.

Unit Type	Total Area (m ²)	TER (kg/m ² /yr)	DER (kg/m ² /yr)	CO ₂ (kg/yr)
Exposed floor corner	173	19.26	21.48	3,720
Partial exposed floor centre	209	16.95	17.41	3,640
Mid floor centre	567	17.1	17.65	10,008
Mid floor corner	450	17.42	18.12	8,159
Partial exposed roof corner	168	18.22	19.4	3,253
Exposed roof corner	282	19.78	22.07	6,228
Exposed roof centre	59	19.78	22.08	1,301
Commercial	158	39.4	23.8	3,749
Site 'Be Lean' CO₂ Emissions				40,058
% Reduction below TER baseline				0.91%

Table 5.3 Annual 'Be Lean' Regulated CO₂ Emissions

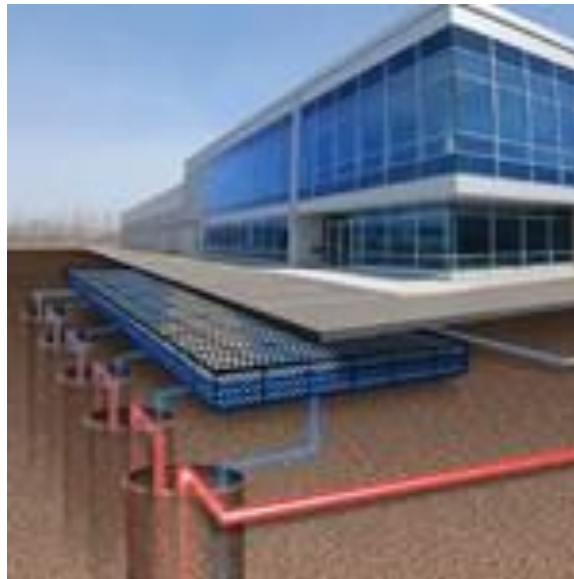
6. 'Be Clean' Assessment

- 6.1 Within RBC's Local Plan policy CC4 the following is applicable:
-  Any development of more than 20 dwellings and/ or non-residential development of over 1,000 sqm shall consider the inclusion of decentralised energy provision, within the site, unless it can be demonstrated that the scheme is not suitable, feasible or viable for this form of energy provision.
 -  Where there is existing decentralised energy provision present within the vicinity of an application site, further developments of 10 dwellings or more or non-residential development of 1,000 sq m or more will be expected to link into the existing decentralised energy network or demonstrate why this is not feasible.
- 6.2 The SBD document (sections 8.7 to 8.8) states that a heat mapping exercise was completed by RBC, with locations that are viable for a heat network scheme listed. However, the area of the proposed site does not fall within one of these heat network 'clusters' and so there is no existing or proposed opportunity for connection.
- 6.3 In order to allow provision for connection to a district heating system in the future the heating system would need to be designed with future connection capability in mind. As the current proposed services strategy for the residential properties comprises individual gas fired boilers this is not compatible with future connection.
- 6.4 The proposed site is located approximately 1 mile from the centre of Reading and the proposed building footprint and parking occupy the whole site. The current design does not include provision of a suitable plant room to locate a communal heating and hot water system. The addition of such a space would result in the loss of either commercial or residential accommodation, which when considered with the increased capital cost of such a system would not make the development commercially viable. Whilst the proposed scheme does technically meet the definition of 'major development', in reality it is only 4 no dwellings above this threshold and as these are all apartments the total floor area of the development is relatively small. A housing development of fewer units, which would be considered 'minor development' under the policy definition would likely have a larger total floor area and heat demand.
- 6.5 Therefore, as the inclusion of a decentralised system is not financially viable for a development of this size no further savings are realized at the 'be clean' stage of the energy hierarchy.

7. 'Be Green' Assessment

- 7.1 The commentary below provides an overview of the potential LZC technologies available for specification within the development and present the associated opportunities and constraints.

Ground Source Heat Pumps



- 7.2 A ground sourced heat pump (GSHP) is a system used to extract heat from the ground to provide space heating and domestic hot water within buildings. At a depth of 2m below the surface the ground remains at a relatively constant temperature throughout the year (approximately 10-12°C in England) and so this can be used as a heat source. A heat transfer fluid is circulated through a closed buried in the ground and passes through a heat exchanger in the heat pump that extracts heat from the fluid through a vapour compression cycle, similar to a refrigerator in reverse.
- 7.3 Both space heating and hot water could be provided to the site through the use of a ground source heat pump. However, as there is insufficient space available on site for a horizontal 'slinky' style system a vertical bore hole would be the only option available. The bore holes would likely need to be located below the ground floor slab, which could interfere with any piling. Due to the site's suburban location and depth of bore hole required it is possible that local infrastructure could be encountered when drilling these. Furthermore, as the system operates using grid supplied electricity with high associated CO₂ emissions the savings in delivered energy requirements would not be realized to the same extent by a corresponding saving in CO₂ emissions. For these reasons, a GSHP system is not considered to be a viable strategy.

Air Source Heat Pumps



- 7.4 In a similar way to GHPs, Air Source Heat Pumps (ASHPs) extract renewable heat from the outside air using an external condenser unit and vapour compression cycle. This is then transferred through refrigeration pipework to an indoor unit, which conveys that heat to the heating emitters and / or hot water cylinder. This system can provide 100% of heating within a building when sized correctly.
- 7.5 As there are 26no proposed residential properties it would not be practical to specify a separate ASHP system to each unit and so this system would form part of an energy centre. The system would require a large electrical load, which may result in an increase in capacity requirements from the substation. Furthermore, a large area would be required to locate the quantities of external condensers required and it is unclear whether sufficient space is available on site other than at roof level. There are also noise pollution implications from the condensers to consider, as this may affect the residents of the units.

Biomass



- 7.6 Within a biomass system waste timber, in the form of wood chips and pellets, can be used as fuel in boilers to provide heating and hot water within buildings. Biomass generation is close to carbon neutral, meaning the CO₂ that is emitted by the combustion is comparable to the CO₂ that is removed from the atmosphere during the life of the tree. Wood chips and pellets present no risk if accidentally released into the environment and there are no harmful by-products. The flue gas is smoke-free and the ash content of between 0.5% and 3% by volume (depending on material), is minimal.
- 7.7 Biomass heating systems are typically sized to meet the majority of the building heating load, with gas condensing boilers providing the additional input required at peak times to reduce the amount of on/off cycling of the biomass boilers. A biomass boiler system would therefore need to be coupled with gas fired boilers to offer a bivalent heating solution.
- 7.8 Storage of the biomass fuel would be required on site, sized to accommodate at least one peak month of heating. On this site there is limited available area to locate the fuel storage and delivery of the fuel could pose an issue to local traffic in an urban context. Furthermore, the flue emissions from the boiler could affect local air quality and would likely not comply with Local Authority policy in this regard. This system could only realistically be used as part of an 'energy centre' strategy, which it has already been confirmed is not possible.
- 7.9 For these reasons, a biomass heating system is not considered to be viable for the development.

Solar Thermal



- 7.10 Solar thermal heating systems use the renewable energy from the sun to heat water, most commonly in the UK for hot water needs. The systems use a heat collector, generally mounted on the roof in which a fluid is heated by the sun. This fluid is passed through a heat exchanger and used to heat up water, which is stored in either a separate hot water cylinder or a twin coil hot water cylinder inside the building. There are two types of collectors used for solar water heating applications - flat plate collectors and evacuated tube collectors. Evacuated tube collectors are generally more expensive due to a more complex manufacturing process (to achieve the vacuum) but offer a higher performance during winter months.

- 7.11 A solar thermal system would need to be installed on the roof as there are no other suitable external areas on site. The roof space available would be better suited to PV, which would offer year round savings with surplus energy exported to the grid. Furthermore, excess thermal energy collected during the summer months must be 'dumped' to avoid the system overheating, whilst PV can continue to generate electricity year-round.
- 7.12 For this reason, whilst viable a solar thermal hot water system is not considered to be appropriate for this development.

Photovoltaics



- 7.13 Solar photovoltaic (PV) technology is a semi-conductor based technology that converts the energy in sunlight into electricity. The term describes a solid-state electronic cell that produces direct current electrical energy from the radiant energy of the sun. When sunlight strikes the surface of a PV cell, this electrical field provides momentum and direction to light-stimulated electrons, resulting in a flow of direct current when the solar cell is connected to an electrical load. The PV systems should be unshaded as shading, even over a small area of the panel, can significantly reduce performance. Excess energy can be exported to the grid; and feed-in tariffs are available.
- 7.14 The proposed development has flat roof space available, which could be well suited to a PV installation. This technology is therefore considered to be viable for inclusion to minimise emissions and meet local planning policy.

'Be Green' Strategy

- 7.15 The above appraisal concludes that PV is the most viable technology for inclusion within this development. Therefore, a PV array will be considered for inclusion at the 'Be Green' stage of the energy hierarchy.

- 7.16 Commercially available PV panels have an area of 1.6sqm and can achieve a peak output of 330Wp each. A sufficient quantity of panels has therefore been included within each of the sample SAP calculations to ensure that at least a 35% reduction in the TER baseline is achieved, whilst ensuring sufficient roof space is available for these. The amount of PV has then been applied to each dwelling and pro-rated to determine a total installed capacity of PV required for compliance with policy H5. Table 7.1 below shows the quantity of PV required across the whole site.

Unit Type	Proposed PV kWp	PV Energy Generated (kWh/yr)
Exposed floor corner	4	3,021
Partial exposed floor centre	4	2,684
Mid floor centre	10	7,536
Mid floor corner	8	6,342
Partial exposed roof corner	3	2,498
Exposed roof centre	1	1,065
Commercial	0	0

Table 7.1 PV proposed per unit type

- 7.17 The total amount of installed peak capacity required has been calculated to be 30 kWp. Whilst the optimum angle of inclination of panels in the South of England is around 30°, on flat roofs this creates a larger shadow, meaning rows of panels must be located further apart. A balance must generally be struck between angle of inclination and output of the panel to find an optimum output per square metre of roof space. An inclination of 10° from horizontal is considered the most appropriate for a dense flat roof installation, as this only reduced the rated output of the panel by 5% (compared to an inclination of 30°), whilst significantly decreasing the spacing required between rows.
- 7.18 A South facing PV array of 30 kWp at an inclination of 10° would comprise 92no 330W panels. This would require a total roof space of 207sqm, allowing for 0.65m spacing between rows. The plan drawings provided indicate that there is approximately 124sqm of South orientated 4th floor roof space available and 306sqm of 5th floor roof space available to locate this PV array.

'Be Green' Results

- 7.19 The results of the 'Be Green' assessment are shown in table 7.2 below. These demonstrate that the site has CO₂ emissions of 25,292 kg per annum. This is a reduction of 37.44% below the baseline figure.

Unit Type	Total Area (m ²)	TER (kg/m ² /yr)	DER (kg/m ² /yr)	TOTALS
				CO ₂ (kg/yr)
Exposed floor corner	173	19.26	12.43	2,153
Partial exposed floor centre	209	16.95	10.74	2,246
Mid floor centre	567	17.1	10.75	6,095
Mid floor corner	450	17.42	10.81	4,868
Partial exposed roof corner	168	18.22	11.67	1,957
Exposed roof corner	282	19.78	12.32	3,477
Exposed roof centre	59	19.78	12.70	748
Commercial	158	39.4	23.80	3,749
Site 'Be Green' CO₂ Emissions				25,292
% Reduction below TER baseline				37.44%

Table 7.2 Annual 'Be Green' Regulated Energy Use & CO₂ Emissions

8. Conclusion

- 8.1 An energy strategy for the proposed development at Oxford Road, Reading has been assessed in accordance with Reading Borough Council Local plan policy following the energy hierarchy:
- 8.2 Be Lean: use less energy
-  Be Clean: supply energy efficiently
 -  Be Green: use renewable energy
- 8.3 Following this approach has resulted in an energy efficient scheme that has minimised CO₂ emissions associated with the use of regulated energy through improvements to the thermal performance of the building envelope and high efficiency building services strategy. These measures have resulted in a reduction in annual CO₂ emissions of 0.91% below the Part L baseline.
- 8.4 Connection to a district heat network is not considered to be a viable option as there are no existing networks in close vicinity of the site. Furthermore, due to the relatively small scale of the proposed scheme a community heating strategy utilising either heat pumps or CHP is not deemed to be commercially viable. Therefore, no further CO₂ savings are reported at the 'Be Clean' stage of the energy hierarchy.
- 8.5 An LZC technology appraisal has been completed, which concludes that a large PV array would be the most suitable option for inclusion. As such a 30 kWp array is proposed, which would offer a further 36.5% reduction in CO₂ emissions below the 'Be Lean' development and a total of 37.4% overall reduction below the baseline from the 'be green' stage of the energy hierarchy. The PV array would comprise approximately 92no panels and would require a total roof space of 207sqm allowing for a spacing of 0.65m between rows of panels.
- 8.6 The results of the energy hierarchy analysis followed within this energy strategy are shown in table 8.1 and figure 8.1 below.

Measure	Site CO ₂ Emissions (kg/yr)	CO ₂ Reduction (kg/yr)	Reduction at each Stage (%)	Reduction from Baseline (%)
Baseline	40,428			
Be Lean	40,058	370	0.9%	0.9%
Be Green	25,292	15,136	36.5%	37.4%

Table 8.1 Results of energy hierarchy analysis using Part L 2013

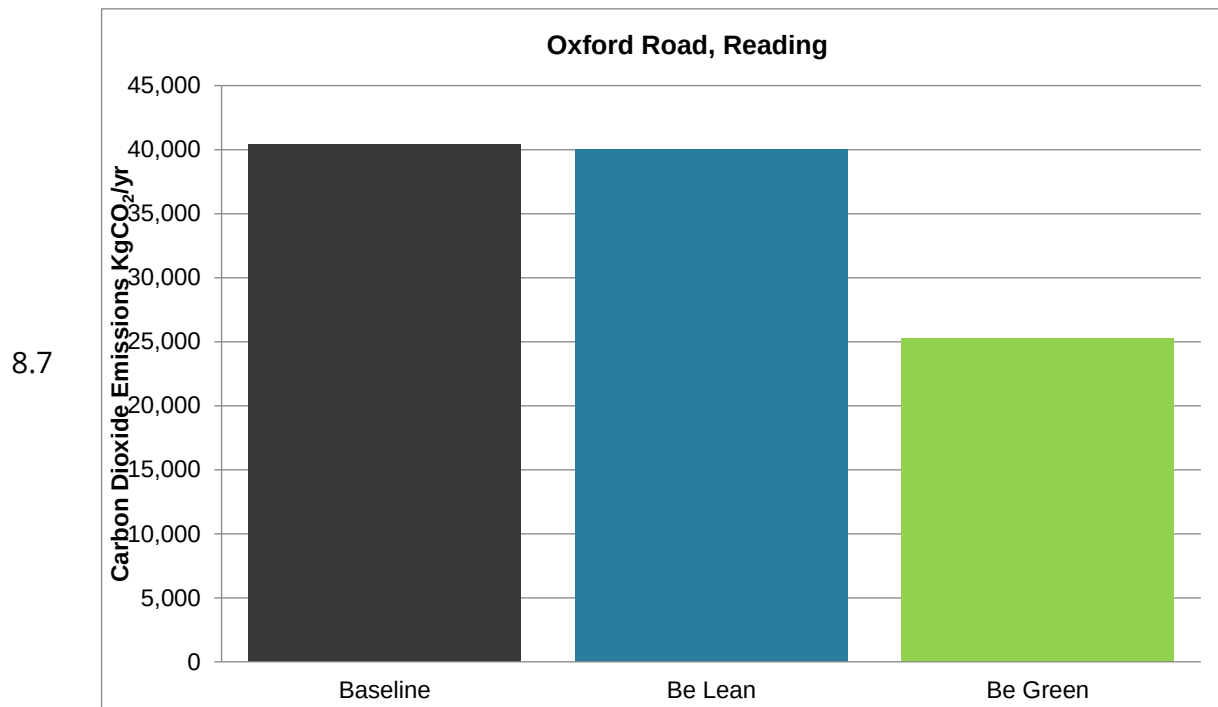


Figure 8.1 Graphical results of energy hierarchy analysis Part L 2013



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