
22-0146 Energy Statement

11-12 Market Place
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1 Introduction

This report will investigate the various options for the provision of decentralised and renewable or low carbon energy sources (LZCs) in relations to the proposed development at 11-12 Market Place, Reading, RG1 2EG. It will discuss the appropriate options available to meet Reading Borough Council requirements.

This Energy Assessment follows the standard approach using the Baseline, Be Lean (addressing the fabric efficiency), Be Clean (addressing the heating systems) & Be Green (including Low or Zero Carbon technology)

1.1 Brief Development Overview

This Energy Strategy Statement seeks to support the Full Planning Application and this project will create two apartments with a total GIA of 127.75 m²

Whilst there is a tangential link there is a complete difference between Energy savings and CO₂ reduction; however, for completeness I have dealt with both in this document:

- The CO₂ reductions are defined by the Dwelling Emission Rate (DER) x Total Floor Area (TFA) and this is what is identified in the executive summary. The DER takes account of factors such as NO_x emissions and the cost of the heating source (mains gas, electricity, etc.) used
- The Energy Savings are related to use of Energy and are defined only by the kWh/year required for the asset to function correctly

The Executive Summary details, in the top part, the hierarchical CO₂ savings both in tonnes per year and percentage against the baseline – the last line shows the Local Authority target savings.

2 Executive Summary

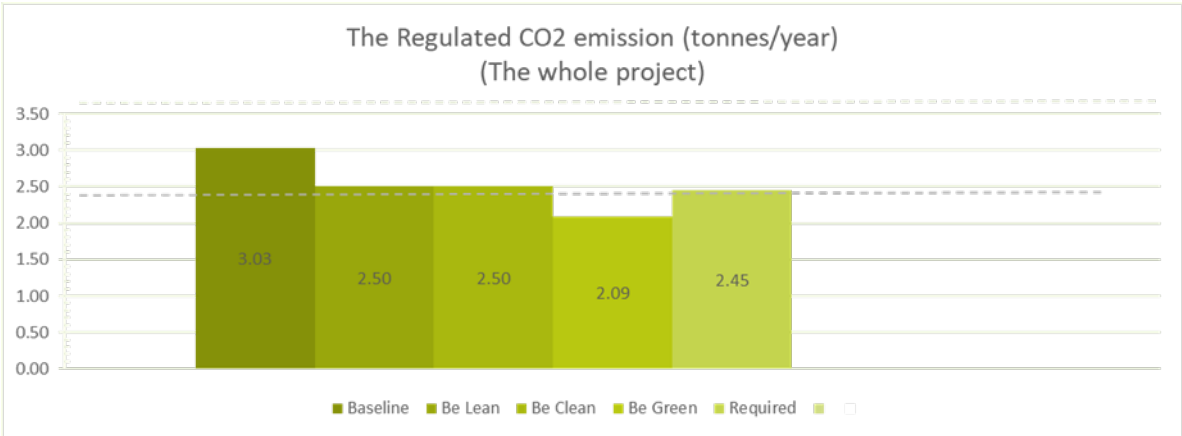


Table 1: Regulated CO2 emissions after each stage of the energy hierarchy

The whole project	Regulated Carbon dioxide savings	
	(Tonnes CO ₂ per annum)	Savings (%)
Savings from energy demand reduction	0.53	17.43%
Savings after addressing heating	0.00	0.00%
Savings from renewable energy	0.41	13.56%
Total Cumulative Savings	0.94	30.99%
Local Authority Target Minimum Savings (whole project)	0.58	19.00%

Table 2: Regulated carbon dioxide savings after each stage of the energy hierarchy

The whole project	Annual (Tonnes CO2)	Cumulative CO2 (Tonnes over 30 years)
Annual Surplus	0.36	10.89

Table 3: Shortfall/Surplus in regulated carbon dioxide savings against 100%

	Energy Requirements			% Energy Savings	
	Regulated	Unregulated	Total	Regulated	Total
Baseline	12,965.57	4,403.00	17,368.57		
Demand Reductions	10,184.24	4,403.00	14,587.24	21.45%	16.01%
Heating addressed	10,184.24	4,403.00	14,587.24	0.00%	0.00%
Renewables	4,027.09	4,403.00	8,430.09	47.49%	35.45%
Total Savings				68.94%	51.46%

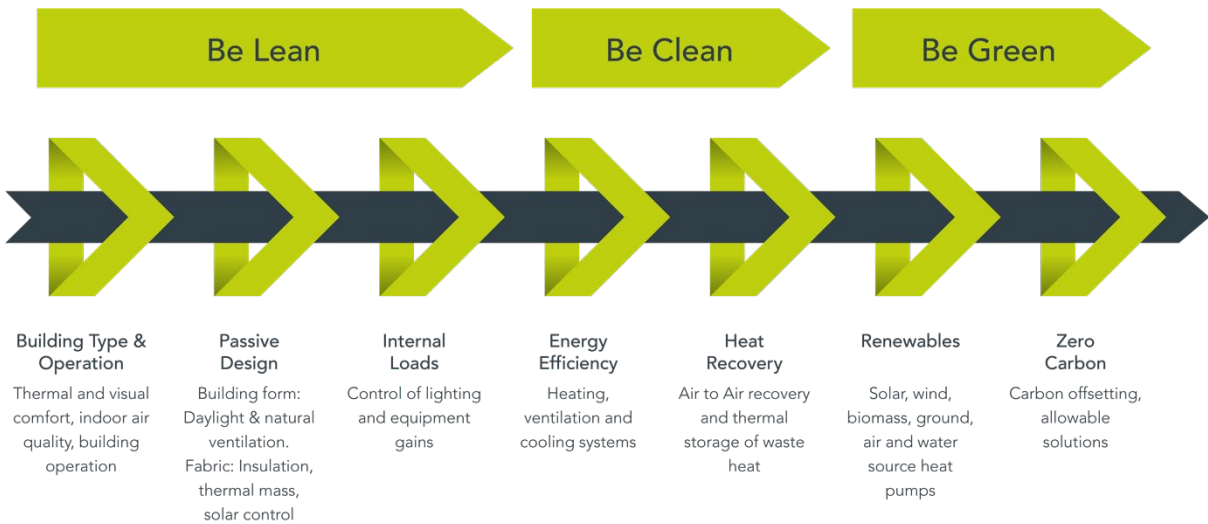
Table 4: Energy savings after each stage of the energy hierarchy

3 Energy Hierarchy

When designing a building, it is advisable to follow an energy hierarchy. The primary aim is to make the building as energy efficient as possible to reduce the demand for energy, and thus the demand of energy from renewable sources.

Building Regulations Part L1a (2013) aims to reduce s emissions from new buildings by 8% compared to those built to 2010 regulations. This can be achieved by making improvements to the fabric of the building by increasing levels of insulation, increasing air tightness, addressing thermal bridging issues and the use of efficient heating & appliances compared to a standard gas boiler. CO₂ emissions can be further reduced by using renewable energy sources.

To reduce by nineteen percent (19%) the carbon emissions of the proposed development, the principle is to follow the energy hierarchy:



3.1 Be Lean

3.1.1 Setting the Baseline

The Baseline is set using a Gas Boiler and ensuring the Dwelling Emission Rate (DER) equals the Typical Emission Rate (TER)

3.1.2 Energy efficiency first

Before any renewable technologies are considered it is good practice to reduce the overall energy demand of a dwelling by using low energy design techniques.

Low energy design involves the consideration and implementation of measures that will increase the dwelling fabric energy efficiency. This can be achieved by improving levels of insulation, reducing the level thermal bridging, use of low-energy lighting & appliances and the use of passive solar design.

Main Fabric Efficiency Improvements

- Increased insulation to main external elements (roof, walls, floor, openings)
- Increase the efficiency of openings (windows, doors, etc.)
- Reduced thermal bridging
- Improved air tightness
- Energy efficient lighting & improved controls (especially important in commercial installations)

Other areas for improvement:

- Controlled ventilation
- Energy efficiency applications (Cooker, washing machine, fridges, etc.)

By decreasing the total energy demand first, the nineteen percent (19%) CO₂ reduction from LZC sources is also reduced ensuring a smaller unit is required, had these efficiencies not been made

3.2 Be Clean

The largest proportion of energy demand of a typical dwelling is from space and water heating thus when addressing the heating infrastructure, we look at, where appropriate, district heating systems, community heating systems and various heat pumps. For larger developments planning for future district heating connectivity is either mandatory or highly recommended

3.3 Be Green

Include renewable energy sources to further reduce the CO₂ emissions.

3.3.1 What are Renewable Energy Sources?

Renewable sources of energy are those which are continually available in the environment. Examples of renewable energy sources are Solar Radiation, Wind, Hydropower, Geo-thermal and biomass.

Up until now the UK has produced most of its energy needs from the burning of fossil fuels (coal, oil, natural gas). This has led to the depletion of these resources as well as to the production of vast quantities of greenhouse gases, created as these fuels are burnt to provide energy. Renewable energy sources emit no greenhouse gases, or in the case of biomass, are considered as carbon neutral over their lifecycle.

3.4 Be Seen

The Be Seen stage of the energy hierarchy requires monitoring and reporting of the actual operational energy performance of major developments for at least five years to ensure the Design assumptions are met in practice

4 Cooling and Overheating

The development has used the Good Homes Alliance – Overheating in New Homes as basis upon which to set out the design standards.

Summer overheating is one of the standard parameters checked as part of Part L1a (2013) compliance. These appear as SAP Appendix P7 and the critical months M6, M7 & M8 are deemed overheated if the calculated temperature will rise above 23.5°C. The details may be found in the SAP reports entitled overheating

4.1 The Cooling hierarchy

4.1.1 Minimising internal heat generation through energy efficient design

The Design & Access Statement provides the details of how this has been implemented in this project; however, Energy Efficiency has been maximised using high quality insulation, glazing and air tightness achieving at least a 10% reduction in emissions for domestic units and 15% for commercial units

4.1.2 Reducing the amount of heat entering the building in summer

Where necessary and practical shading, to avoid summer overheating, has been implemented

4.1.3 Using thermal mass and high ceilings to manage heat within the building

Where practical and possible exposed thermal mass has been used to reduce the likelihood of overheating

4.1.4 Passive ventilation

Where practical and possible openable windows, East West orientation of a shallow floorplate, dual aspects etc. have been used

4.1.5 Mechanical ventilation

As a last resort the design will look at mechanical ventilation and include a summer by-pass on any heat recovery system installed

5 Methodology

This report will use the Standard Assessment Procedure (SAP) and/or Simplified Building Energy Model (SBEM) as a tool to demonstrate energy requirements for the proposed development. This will give an accurate assessment of the individual dwelling including its size, location, and orientation to assess the total energy demand of the development.

SAP (or SBEM) assessments are done on individual dwellings (non-dwellings). Energy usage and reduction for each unit will be calculated and the results summed to provide a site total.

These calculations will be performed for each of the models

Decentralised and renewable, or low carbon technologies will be discussed, with a view to securing a reduction of at least nineteen percent (19%) of the total carbon emissions the development to satisfy the requirements of Reading Borough Council. The advantages and disadvantages for each option will be explored to conclude the most suitable technologies for this development.

Feasible renewable technologies will be assessed in terms of their operational information and suitability. A synopsis will demonstrate the most suitable solutions for the development from a feasibility perspective.

5.1 Be Lean

SAP calculates the energy demand for heating, hot water, lighting, pumps, and fans and this considers any reduction in energy use from built form by considering solar gains and efficiency measures such as lighting, insulation, and the choice of boiler.

5.1.1 Stage 1 – Baseline

The development is modelled so that it meets the minimum requirements of Part L1a (2013) by increasing the efficiency of the various elements using, where relevant and appropriate so that DER = TER

5.2 Stage 2 – Be Lean

5.2.1 Domestic Fabric Enhancements

Another model is developed that increases the thermal efficiency of the development, as a minimum for Part L1a, to those detailed in Table 4 Summary of concurrent notional dwelling specifications, from the Part L1a (2013) manual and look to increase the air tightness and thermal bridging

Description	Limiting Factor	Notional	Proposed (W/m2K)
Walls (external)	0.30	0.18	0.14
Walls (Party)	0.20	0.00	0.00
Communal walls	0.20	0.00	0.00*
Roof	0.20	0.13	0.13
Psi value calculations	None	Partial ACDs	Partial ACDs
Opening (glazed window)	2.00	1.4	1.0
Opening (rooflights)	2.00	1.4	1.2
Opening (glazed doors)	2.00	1.2	1.2
Air Permeability	10 m3/hm2	5 m3/hm2	3.0 m3/hm2
Ventilations	Natural	Natural	Nuaire MVHR, or similar
Low Energy Lights (LED)	75%	100%	100%

* Full fill or solid

5.2.2 Domestic heating enhancement (heat pumps excluded)

Review the heating infrastructure and assess the impact of various alternative heating systems. Heat Pumps are treated as Low or Zero Carbon technology and assessed at the Be Green stage

Description	Notional	Proposed
Primary heating	89.5% efficient Gas Boiler	89.8% efficient Gas combi boiler
Primary controls	Time & temp zoned + weather compensator	Time & temp zone controlled + delayed start thermostat
Secondary heating	None	None
Water heating	None, from combi	None, from combi

5.3 Stage 3 – Be Clean

There are no District Heating Networks available for the project to connect and as a minor project communal heating connectivity is not required therefore there are no improvements at this stage

5.4 Stage 4 – Be Green

If required, include Low or Zero Carbon technology to ensure there is nineteen percent (19%) reduction in CO₂ emissions

5.4.1 Domestic Air Sourced Heat Pumps

Description	Notional	Proposed
Primary heating	89.5% efficient Gas Boiler	Vaillant aroTHERM 3.5kW or similar

6 Building Regulations 25a LZC Summary

	Energy Generation	Return on investment	Physical, Spatial & Land Use Impact	Noise Impact	Suitability of technology	Feasible
 Wind Turbine	Electric	None	Are wind speeds at least 6 m/s for stand-alone or at least 3.5m/s for small scale? Is the area free from obstructions that could cause local wind turbulence?	Wind turbines generate noise that can be heard up to a few hundred metres away. However, this level is normal only marginal greater than the actual wind noise itself.	Windspeed at site is 5.1m/s which is below the requirements for small scale.	No
 Photovoltaics	Electric	None	Will the buildings have an east to west (through south) facing roof or flat roof? Are roofs free from overshadowing for most of the day from buildings or other structures?	None	The installation of PV meets the requirement in energy production	Yes
 Solar Thermal	Hot Water	Renewable Heat Incentive (RHI)	Will the buildings have a year-round demand for hot water? Will the buildings have an open aspect southeast to southwest facing roof of at least 4m2? Is space available for hot water cylinder near the panels?	None	Solar hot water works best when the panels can be located close to the water storage.	Yes
 Biomass Boiler	Heat and Hot Water	Renewable Heat Incentive (RHI)	Is there a local supply and space for storage of biomass fuel or can one be set up? Is a room heater or boiler required?	Normal noises associated with boiler plant. Potential additional noise generation associates with the fuel deliveries.	This is not suitable for the site because of the size of the systems and storage of fuel	No
 Air Source Heat Pump	Heat and Hot Water	Renewable Heat Incentive (RHI)	Is there space for siting the heat pump, including the desired room for air movement?	Minimal noise	The chosen technology	Yes
 Ground Source Heat Pump	Heat and Hot Water	Renewable Heat Incentive (RHI)	Will there be room for a horizontal buried pipe? Is the ground suitable for vertical pipe system?	Minimal noise	The project is on top of an existing development with no space for GSHP infrastructure	No
 Combined Heat and Power	Heat and Hot Water	None	CHP works well with a large demand (large plots) to create more electricity generation, as the boiler itself is not that efficient with small demand requirements.	Normal noises associated with boiler plant	The size of the dwellings within this development makes the installation of CHP plant inefficient.	No

7 Findings

7.1 Preferred options for 11-12 Market Place

The preferred option for this site is individual Air Sourced Heat Pumps in each dwelling

The whole project	Carbon dioxide emissions (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant	3.03	2.49
After energy demand reduction	2.50	2.49
After heating systems addressed	2.50	2.49
After Low or Zero Carbon Technology	2.09	2.49

Table 5: Carbon Dioxide Emissions after each stage of the energy hierarchy

	Energy Requirements		
	Regulated	Unregulated	Total
Baseline	12,965.57	4,403.00	17,368.57
Demand Reductions	10,184.24	4,403.00	14,587.24
Heating addressed	10,184.24	4,403.00	14,587.24
Renewables	4,027.09	4,403.00	8,430.09

Table 6: Energy Requirements after each stage of the energy hierarchy

8 Conclusion

A Be Lean 10.69% reduction in domestic CO₂ emissions for this development by increasing building fabric efficiency, a further 15.75% CO₂ savings may be obtained by installing Air Sourced Heat Pumps in each dwelling providing a total CO₂ reduction of 26.44% will enable the development 11-12 Market Place Reading RG1 2EG to exceed the nineteen percent (19%) reduction in CO₂ emissions required by Reading Borough Council

9 Appendix

9.1 SAP summary results for each hierarchy stage

9.1.1 Summary & Savings

The whole project	Regulated Carbon dioxide savings	
	(Tonnes CO ₂ per annum)	Savings (%)
Savings from energy demand reduction	0.53	17.43%
Savings after addressing heating	0.00	0.00%
Savings from renewable energy	0.41	13.56%
Total Cumulative Savings	0.94	30.99%

9.1.2 Base Line

Description				CO ₂ emissions			Fabric Efficiency		
Unit	L1 a	TFA	DER	TER	Reg. kg/ year	Unreg. Kg/ year	DFEE	TFEE	%improvement
Flat 16	L1a	60.71	24.64	24.64	1495.89	1198.42	67.40	79.40	15.11%
Flat 17	L1a	67.04	22.87	22.87	1533.20	1294.54	59.50	70.50	15.60%

9.1.3 Be Lean

Description				CO ₂ emissions			Fabric Efficiency		
Unit	L1 a	TFA	DER	TER	Reg. kg/ year	Unreg. Kg/ year	DFEE	TFEE	%improvement
Flat 16	L1a	60.71	20.47	24.64	1242.73	1198.42	59.60	79.40	24.94%
Flat 17	L1a	67.04	18.77	22.87	1258.34	1294.54	52.40	70.50	25.67%

9.1.4 Be Clean

Description				CO ₂ emissions			Fabric Efficiency		
Unit	L1 a	TFA	DER	TER	Reg. kg/ year	Unreg. Kg/ year	DFEE	TFEE	%improvement
Flat 16	L1a	60.71	20.47	24.64	1242.73	1198.42	59.60	79.40	24.94%
Flat 17	L1a	67.04	18.77	22.87	1258.34	1294.54	52.40	70.50	25.67%

9.1.5 Be Green

Description				CO ₂ emissions			Fabric Efficiency		
Unit	L1 a	TFA	DER	TER	Reg. kg/ year	Unreg. Kg/ year	DFEE	TFEE	%improvement
Flat 16	L1a	60.71	17.03	24.64	1033.89	1198.42	59.60	79.40	24.94%
Flat 17	L1a	67.04	15.76	22.87	1056.55	1294.54	52.40	70.50	25.67%

9.2 Project energy requirements for each hierarchy stage

9.2.1 Summary & savings

	Energy Requirements			% Energy Savings	
	Regulated	Unregulated	Total	Regulated	Total
Baseline	12,965.57	4,403.00	17,368.57		
Demand Reductions	10,184.24	4,403.00	14,587.24	21.45%	16.01%
Heating addressed	10,184.24	4,403.00	14,587.24	0.00%	0.00%
Renewables	4,027.09	4,403.00	8,430.09	47.49%	35.45%
Total Savings				68.94%	51.46%

9.2.2 Baseline

Energy Demand (kWh/ year)									
Unit	Space	Water	Fans & Pumps	Lighting	Cooking	Appliance	Tot Regulated	Tot Unreg'ed	Total/ dwelling
Flat 16	3802.21	2282.04	75.00	275.11	157.64	1996.09	6434.36	2153.73	8588.09
Flat 17	3770.61	2357.22	75.00	328.38	157.64	2091.63	6531.21	2249.27	8780.48

9.2.3 Be Lean

Energy Demand (kWh/ year)									
Unit	Space	Water	Fans & Pumps	Lighting	Cooking	Appliance	Tot Regulated	Tot Unreg'ed	Total/ dwelling
Flat 16	2403.38	2228.61	192.02	275.11	157.64	1996.09	5099.12	2153.73	7252.85
Flat 17	2249.64	2307.66	208.91	318.91	157.64	2091.63	5085.12	2249.27	7334.39

9.2.4 Be Clean

Energy Demand (kWh/ year)									
Unit	Space	Water	Fans & Pumps	Lighting	Cooking	Appliance	Tot Regulated	Tot Unreg'ed	Total/ dwelling
Flat 16	2403.38	2228.61	192.02	275.11	157.64	1996.09	5099.12	2153.73	7252.85
Flat 17	2249.64	2307.66	208.91	318.91	157.64	2091.63	5085.12	2249.27	7334.39

9.2.5 Be Green

Energy Demand (kWh/ year)									
Unit	Space	Water	Fans & Pumps	Lighting	Cooking	Appliance	Tot Regulated	Tot Unreg'ed	Total/ dwelling
Flat 16	827.76	727.04	162.02	275.11	157.64	1996.09	1991.93	2153.73	4145.66
Flat 17	785.62	751.72	178.91	318.91	157.64	2091.63	2035.16	2249.27	4284.43



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