Energy Statement

Energy and Carbon Reduction

Chatburn Road, Clitheroe

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Company Profile

FES Group was established in 2006, as a Building Surveying firm specialising in sustainable design and construction. Since then, the company has expanded and developed a nationwide footprint becoming one of the leading sustainability and Part L compliance consultancies in the UK marketplace along with adding testing services to our extensive suite of works. With offices in London and York we are a one stop dependable partner providing surveying and technical services for construction projects. Our key services include:

- Energy Strategy Studies
- Part L Compliance Assessments
- BREEAM Assessments
- Code for Sustainable Homes Assessments (and HQM)
- Thermal & Daylight Modelling
- Air & Acoustic Testing & Consultancy Services
- Commercial Portfolio EPCs

We work with a range of clients including national and regional house builders, construction contractors, architects, M&E consultants, town planners and commercial developers. Our work varies from large scale well known projects to smaller individual projects adapting to each projects needs and requirements.

Introduction

This report has been prepared by the FES group on behalf of Oakmere Homes to accompany the planning application for the proposed development known as Chatburn Road, Clitheroe. The development proposals will see the construction of 30 detached & terraced dwelling houses

This report reviews the proposed energy and carbon reduction strategy advanced by Oakmere Homes within the context of local and national planning policy.

The following documents were considered when formulating the report:

- **National Planning Policy Framework 2012 –** The NPPF strengthens the emphasis on sustainable development and encourages Local Authorities to adopt standards consistent with the Government's zero carbon building policy and other nationally described standards.

- **Building Regulations Part L1A 2013 –** Approved Document L1A 2013 Conservation of Fuel and Power in new dwellings sets minimum energy efficiency and fabric efficiency standards for all new domestic buildings.

- **Planning Condition –** "No development shall begin until details identifying how a minimum of 10% of the energy requirements generated by the development will be achieved by renewable energy production methods, has been submitted to and approved in writing by the LPA"

Sustainable Design

The building fabric, the building services and the management of a building broadly determine the energy use of a building. In understanding this, design teams can take measures to advance sustainable design from the earliest stages of a development. However sustainability is not limited to issues concerning energy consumption. Material selection, the protection of local environments, addressing flood risk and the health and wellbeing of future occupants are all issues requiring consideration. Addressing all these issues in an integrated and intelligent manner will result in truly sustainable developments.

Material Selection

Significant amounts of energy and natural resources are consumed in the production, transportation and disposal of building materials. Two issues are of significant importance in the procurement of materials: the environmental impact of materials and the sourcing of materials. Oakmere Homes is dedicated to taking pro-active measures to addressing these issues.

Table 1- Green Guide Rating of Specification

	BRE Green Guide Rating
External Wall	A+
Ground Floor	B
Intermediate Floor	C
Roof	A+
Internal Walls	A
Windows	A

The developer will choose materials which have a lesser environmental impact. This will be implemented during the procurement process. Suppliers will be obliged to produce Environmental Management System certificates covering the sourcing and production of materials. Timber or timber composite products will be sourced from responsible sources. Suppliers will be obliged to provide full Chain of Custody Certificates right through the supply chain; from the initial timber yard, manufacturing process, transformation and distribution. Secure certificates must be produced by valid accrediting bodies – FSC, PEFC, CSA, SFI & MTCC.

Flood Risk

Planning Policy Statement 25, the Code for Sustainable Homes and the Flood and Water Management Act 2010, directs developers to avoid, reduce and delay the discharge of rainfall to public sewers and watercourses through the use of Sustainable Urban Drainage Systems (SUDS) with the aim of protecting watercourses and reducing the risk of localised flooding and pollution.

This obligation is taken seriously:

- Where possible, impermeable surfaces are kept to a minimum, thus allowing for maximum infiltration (e.g. permeable paving)
- Sustainable Drainage Systems will be incorporated where feasible and will be designed in line with the guidance published in the *CIRIA SUDS Manual (2007)*

Pollution during Construction

The contractor will be required, under the terms of their contract, to minimise dust, fumes, discharges and any other form of pollution on site, in line with best practice policies:

- The Control of Dust and Emissions from Construction & Demolition: Best Practice Guidance.
- PPG 5
- PPG 6

The sustainable management and monitoring of waste generated during the construction of a development is a major concern to local and national planners. Due to the size and anticipated construction costs the developer will not be required by regulations to implement a Site Waste Management Plan. Furthermore the site will be too small to allow the successful segregation of waste on site in line with Best Practice policies. However the contractor will be obliged to adopt many of the principles of the waste hierarchy:

- Accurate specifications of materials and volumes.
- Recycling and re-use of waste on site.
- Arrange take back schemes with suppliers.
- Instruct a licensed waste contractor to segregate site waste for recycling.

Health and Wellbeing

In achieving ever stricter levels of energy efficiency, it is important that designers do not lose sight of the fact that they are building homes that people can live in and not just occupy. This is an integral part of sustainability, and a hugely important consideration if the population (and the market place) is to tolerate the sustainability agenda.

While it is quite difficult to measure or even quantify health and wellbeing, the following measures are a sample of the efforts made by Oakmere Homes to address this issue.

- The proposed properties will have sufficient living/dining space. While this is obviously a marketing consideration, it does fall within this category.
- The principal living rooms have sufficient glazing to allow natural light to penetrate into the rooms. Numerous studies have shown this to be beneficial to the general health and happiness of occupants. Daylighting calculations can be undertaken to demonstrate that living rooms, dining rooms, kitchen and home offices receive adequate daylighting.
- The property will benefit from a garden or private space for recreation. This will take the form of secure rear gardens to each property.
- The property has dedicated internal recycling facilities and accessible external storage in line with the local council waste and recycling collection scheme.

Water Efficiency

The average person consumes some 150 litres per day; this represents an annual increase of 1% since the 1930s. Despite the United Kingdom's wet and temperate climate, climate change will most probably result in an increase in the occurrence of drought orders and hosepipe bans. With this in mind, it is not difficult to appreciate that within the next few decades the UK (particularly the South East) will face regular water shortages. In response to this water efficiency has gained equal billing, alongside energy efficiency. The following are the principle policy drivers.

- The new Approved Document G (2010) for the first time restricts new build dwellings to a maximum consumption of 125 litres per person per day. The Water Efficiency Calculator of New Dwellings also includes an allowance for external water use.
- Part L 2013 and SAP 2012 will take account of Part G and water consumption in the calculation of the forecasted energy demand of a dwelling.

Table 2 – Water Consumption

Installation Type	Unit of Measurement	Capacity/Flow Rate	Use Factor	Fixed Use	Litres Per Person Per Day
WC (Dual Flush)	Full Flush (litres)	4	1.46	0.00	5.84
	Part Flush (litres)	2.6	2.96	0.00	5.92
Taps (excluding kitchen tap)	Flow rate (litres/minute)	6	1.58	1.58	11.06
Baths (where shower present)	Capacity to overflow (litres)	140	0.11	0.00	15.40
Showers (where bath present)	Flow rate (litres/minute)	9	4.37	0.00	39.33
Kitchen sink tap	Flow rate (litres/minute)	6	0.44	10.36	13.00
Washing Machine	Litres/kg dry load	8.17	2.1	0.00	17.16
Dishwasher	Litres/place setting	1.25	3.60	0.00	4.50
	TOTAL				112.21

Total Internal Water Consumption	112.21
Normalisation Factor	0.91
Water Consumption with Normalisation Factor	102.11
External Use	5.00
Part G Water Consumption	107.11

Energy Strategy

The Context

The proposed works fall under the scope of Approved Document L1A 2013. The Approved Document sets minimum fabric energy efficiency standards and a maximum CO_2 emission rate for residential buildings. To place the proposed energy strategy into its correct regulatory context it is worthwhile summarising the minimum standards included in the Approved Document.

Table 3 – Minimum Fabric Efficiency Standards

Element	Part L1A 2013 Minimum Standard
External Walls	0.30W/m^2K
Roof	0.20W/m^2K
Floor	0.25W/m^2K
Glazing & Doors	2.00W/m^2K
Air Test	10m^3/h.m^2 at 50Pa

Proposed Strategy

The National Planning Policy Framework requires that all development proposals are in line with the Government's zero carbon buildings programme.

This policy seeks to deliver zero carbon homes by 2016 through stepped changes in the Building Regulations. At the present time the Governments' best practice benchmark is Part L 2013 which is equivalent to Code for Sustainable Homes Level 3, 2014 Addendum.

The figures and calculations detailed in this report have been taken from SAP 2012 (2013 building regulations).

In response to this guidance, and recent shifts within the industry, Oakmere Homes proposes the adoption of a fabric first energy strategy which addresses the core policy goals of sustainable construction:-

- Reduced CO_2 emissions to combat the causes of **climate change**.
- Reduced energy consumption to address legitimate concerns of **energy security**.

By reducing the energy requirement of the building, the sustainable credentials of each development are enhanced and are not validated by simply bolting on expensive renewable equipment. By focusing on fabric performance and the provision of efficient heating systems each dwelling is intrinsically "green".

Before the potential of various technologies can be assessed, it is first necessary to calculate the base line energy consumption of the development and hence the target reduction. The proposed dwellings were modelled in SAP2010 to determine the energy consumption and corresponding CO_2 emissions of the development. Standard Assessment Procedure, or SAP, is the government's approved methodology for the calculation of energy consumption and CO_2 emissions for new build dwellings.

In line with best practice the proposed energy strategy for Chatburn Road, Clithroe will adhere to the principles of the Energy Hierarchy;

- **Be Lean** – reduce the need for energy.
- **Be Clean** – supply and use energy in the most efficient manner.
- **Be Green** – supply energy from renewable sources.

The Energy Hierarchy

Adhering to the principles of the Energy Hierarchy has a number of benefits. The principle benefits are;

- By reducing the energy requirement of each dwelling the renewable requirement shrinks in proportion. This has obvious cost benefits.
- The sustainable credentials of each development are enhanced and are not validated by simply bolting on expensive renewable equipment. By focusing on the fabric performance and the provision of efficient heating systems each dwelling is intrinsically “green”.

Establishing a Baseline

To adequately ascertain the potential of Oakmere Homes preferred strategy, a baseline energy consumption associated with the development must be calculated. As such the development was modelled in SAP 2012 to determine the current CO_2 emission and associated energy requirement prior to the incorporation of improved fabric efficiencies and renewable technologies. The table below summarises the results calculated.

Table 4 – Baseline Energy Consumption & CO_2 Emission Rate

House Type	No	Baseline Emission Rate (kg/year)	Baseline Energy Requirement (kWh/year)
HT - Bowfell	**5**	9,306.97	39,789.65
HT - Caldew	**0**	0	0
HT - Ennerdale	**1**	2,433.60	10,451.77
HT - Grasmere	**4**	9,409.62	40,473.28
HT - Kirkstone	**2**	4,402.58	18,830.00
HT - Loughrigg	**0**	0	0
HT - Rotahay	**3**	3,853.11	16,177.74
HT - Rydale	**0**	0	0
HT - Thirlmere	**4**	8,912.01	38,103.68
HT - Ullswater	**0**	0	0
HT - Wasdale	**5**	10,465.83	44,828.95
HT - Grizdale	**4**	5,561.41	23,519.84
HT - Lowther	**2**	2,792.65	11,801.98
TOTAL	**30**	**57,137.80**	**243,976.89**

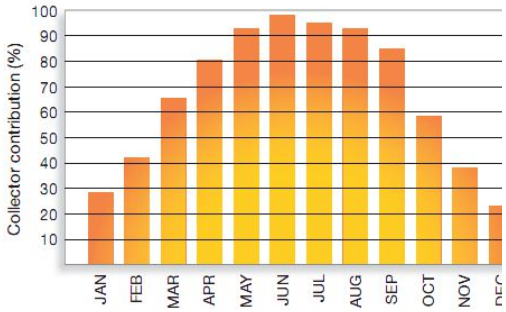
The table above confirms the proposed works at Chatburn Road, Clitheroe has a site wide energy requirement of **243,976.89 kWh/year** and an associated CO_2 emission rate of **57,137.80 kg/year**.

Renewable Technologies

There are a number of recognised renewable technologies which have the potential to reduce the energy consumption of a dwelling. However given the nature of the development, we judge that only three technologies are worthy of consideration;

- Solar thermal panels.
- Photovoltaic panels.
- Air source heat pumps.

Solar Thermal



Solar thermal panels use radiant solar energy to heat water for domestic consumption. The system works successfully across the UK as they can work in diffuse weather conditions. In comparison to other technologies it is considered a reliable and proven technology. The system works most efficiently when the panel or evacuated tube is mounted on a 10-60° pitch facing due south, though other combinations do work successfully. During late spring to early autumn months, the system can be expected to meet some 70-90% of a dwellings domestic hot water needs.

Most systems in the UK are two panel systems, typically 4 sq m in size and accompanied with a 180-250 litre cylinder with a dedicated solar storage capacity of 65-110 litres. The typical installation costs for solar thermal vary, especially when large volumes are considered. However a rough estimate is £3500 per plot. Occupants can expect annual savings in the region of £50-85 per year, which is relatively modest. Solar thermal panels do not qualify for feed in tariffs, however it is expected that solar thermal systems will benefit from the Renewable Heat Incentive. A 20-25 year payback can be expected, dependent on usage and dwelling type.

Taking into consideration the proposed house, the site layout and orientation a two panel systems is most likely. The table overleaf details the reductions thought achievable.

Table 5 – Solar Thermal Energy Consumption & CO_2 Emission Rate

House Type	No	Baseline Emission Rate (kg/year)	Baseline Energy Requirement (kWh/year)
HT - Bowfell	**5**	7,970.56	33,276.40
HT - Caldew	**0**	0	0
HT - Ennerdale	**1**	2,112.48	8,893.20
HT - Grasmere	**4**	8,000.06	33,651.96
HT - Kirkstone	**2**	3,793.71	15,875.74
HT - Loughrigg	**0**	0	0
HT – Rothay**	**3**	3,691.51	15,424.89
HT - Rydale	**0**	0	0
HT - Thirlmere	**4**	7,623.23	31,843.48
HT - Ullswater	**0**	0	0
HT - Wasdale	**5**	8,919.10	37,314.05
HT - Grizdale	**4**	4,800.51	19,722.12
HT - Lowther**	**2**	2,672.60	11,243.50
TOTAL	**30**	**49,583.78**	**207,245.34**

The calculations summarised in the table above confirm the use of a single panel Solar Thermal system on each dwelling with the exception of the, Rothay & Lowther has the potential to reduced energy requirement of **207,245.34 kWh/year** and an associated emission rate of **49,583.78 kgCO_2/year**. These are respectively **15.06%** and **13.22%** reductions over the baseline calculated previously.

Photovoltaic

Photovoltaic panels convert sunlight into electricity for use within a dwelling. PV panels use cells to convert light into electricity. A PV cell usually consists of 1 or 2 layers of a semi-conducting material such as silicon. The greater the intensity of sunlight, the more electricity is generated. PV systems can come in different forms. The most aesthetically pleasing are PV tiles which resemble roof tiles. However the most popular are modules which can either sit on the roof or be integrated into it. The technology is most efficient when oriented due south. However panels orientated south of east or west are suitable. Generally panels orientated away from due south require a greater surface area to generate a set amount of energy.

Table 6 – PV Energy Consumption & CO_2 Emission Rate

House Type	No	Baseline Emission Rate (kg/year)	Baseline Energy Requirement (kWh/year)
HT - Bowfell	**5**	8,320.23	36,752.00
HT - Caldew	**0**	0	0
HT - Ennerdale	**1**	2,181.60	9,587.06
HT - Grasmere	**4**	7,289.90	31,573.36
HT - Kirkstone	**2**	3,936.82	17,276.10
HT - Loughrigg	**0**	0	0
HT - Rotahay	**3**	3,354.68	14,777.19
HT - Rydale	**0**	0	0
HT - Thirlmere	**4**	7,901.88	34,635.76
HT - Ullswater	**0**	0	0
HT - Wasdale	**5**	9,269.09	40,806.10
HT - Grizdale	**4**	5,027.72	22,266.04
HT - Lowther	**2**	2,448.21	10,811.70
TOTAL	**30**	**49,730.16**	**218,485.31**

The calculations summarised in the table above confirm the use of a 0.25 KWP PV array fitted to each dwelling has the potential to reduced energy requirement of **218,485.31 kWh/year** and an associated emission rate of **49,730.16 kgCO_2/year**. These are respectively **10.45%** and **12.97%** reductions over the baseline calculated previously.

Air Source Heat Pumps

Air source heat pumps extract heat from the outside air. The heat is absorbed into a fluid, which is pumped through a heat exchanger. Low grade heat is then extracted by the refrigeration system and after passing through the compressor is concentrated into a higher temperature. This energy is then used to heat water for space and hot water use within the dwelling. While heat pumps use national grid electricity, and so are not a renewable resource, they utilise a heat source which is naturally renewed in our environment and so are considered a low carbon technology.

Heat pumps have stated CoPs in the region of 2-4, though test results outside of the laboratory have produced mixed results. Typically the heat pump is located on an external wall. It is generally accepted that 1kW in heat pump size will provide enough heating for 20m^2 of floor space

While the use of heat pumps reduces the energy consumption of a dwelling (when gas is considered the baseline), the carbon benefit is minimal as electricity has a much higher carbon factor than gas. In addition to this there has been varying anecdotal evidence across the country which suggests differing models are achieving mixed levels of performance. As such we would not recommend this technology as the preferred route to compliance.

Other Technologies

Wind Power - The principle of harnessing wind power is well established in the UK with access to over 40% of the total European wind resource. Until recently, developments have been concentrated within coastal regions; however technological advances mean that wind power is viable in many urban locations.

Wind turbines are a means of capturing the power within a moving air mass (wind) and converting it into electricity. As yet there is no simple and practical method of incorporating wind generated electricity to sites containing a number of buildings, or requiring high energy usage.

Furthermore, the urban location also means that it would prove difficult to harness sufficient wind energy to meet the needs of the development. The high density of urban areas obstructs air patterns and reduces the efficiency of the turbine. The size of the turbine required is also likely to detract unacceptably from the local area and generate a significant amount of noise, both of which prejudice local residential amenity.

For these reasons, together with the high installation costs and potential noise pollution we are not proposing the employment of wind turbines on this site.

Biomass – Biomass boilers offer an environmentally sound, heating solution. Heating is generated by burning biomass, such as wood pellets or logs. This will emit the same amount of CO_2 as is absorbed while the plants were growing, therefore, the biomass is classed as carbon neutral.

Bolt-On Technologies

Waste Water Heat Recovery – WWHR units transfers heat from discharged waste shower water in to the incoming water supply, placing less energy load on the boiler to raise the temperature to the desired level of comfort.

These units are maintenance free and can be easily located within existing boxing, however they are required to be located in close proximity to the bath above.

The House types were modelled with WWHR units in all appropriate house types. The Lowther was excluded due to these being bungalows. The table below summarises the results calculated.

Table 7 – WWHR Energy Consumption & CO_2 Emission Rate

House Type	No	Baseline Emission Rate (kg/year)	Baseline Energy Requirement (kWh/year)
HT - Bowfell	**5**	8,578.89	36,442.30
HT - Caldew	**0**	0	0
HT - Ennerdale	**1**	2,230.56	9,507.52
HT - Grasmere	**4**	8,478.88	36,164.64
HT - Kirkstone	**2**	4,033.10	17,119.90
HT - Loughrigg	**0**	0	0
HT - Rotahay	**3**	3,411.14	14,127.00
HT - Rydale	**0**	0	0
HT - Thirlmere	**4**	8,095.95	34,329.76
HT - Ullswater	**0**	0	0
HT - Wasdale	**5**	9,517.47	40,441.70
HT - Grizdale	**4**	5,276.07	22,205.88
HT - Lowther**	**2**	2,672.60	11,243.50
TOTAL	**30**	**52,294.67**	**221,582.20**

The calculations summarised in the table above confirm the use of a Waste Water Heat Recovery Unit in each dwelling with the exception of the Lowther has the potential to reduced energy requirement of **221,582.20 kWh/year** and an associated emission rate of **52,294.67 kgCO_2/year**. These are respectively **9.18%** and **8.48%** reductions over the baseline calculated previously.

Mechanical Ventilation Heat Recovery – Whole-house MVHR systems extract warm, damp air from the home and draw in fresh air from the outside. The warm air is passed through a heat exchanger and the cool, fresh outside air is also passed through the heat exchanger where it is pre-warmed before being pumped in to the property.

These units can be bulky and consideration of where the heat exchanger unit and the ducting will be located within the dwellings must be done at the design stage.

The House types were modelled with MVHR units in all house types. The table below summarises the results calculated.

Table 8– MVHR Energy Consumption & CO_2 Emission Rate

House Type	No	Baseline Emission Rate (kg/year)	Baseline Energy Requirement (kWh/year)
HT - Bowfell	**5**	8,511.83	34,870.20
HT - Caldew	**0**	0	0
HT - Ennerdale	**1**	2,196.00	8,915.88
HT - Grasmere	**4**	8,419.70	34,486.60
HT - Kirkstone	**2**	4,105.95	16,454.84
HT - Loughrigg	**0**	0	0
HT - Rotahay	**3**	3,535.75	14,121.96
HT - Rydale	**0**	0	0
HT - Thirlmere	**4**	8,265.13	33,198.40
HT - Ullswater	**0**	0	0
HT - Wasdale	**5**	9,715.04	39,183.40
HT - Grizdale	**4**	5,315.70	19,765.12
HT - Lowther	**2**	2,548.26	9,391.08
TOTAL	**30**	**52,613.39**	**210,387.48**

The calculations summarised in the table above confirm the use of a Mechanical Ventilation Heat Recovery Unit in each dwelling has the potential to reduced energy requirement of **210,387.48 kWh/year** and an associated emission rate of **52,613.39 kgCO_2/year**. These are respectively **12.55%** and **7.92%** reductions over the baseline calculated previously.

Unfortunately neither of the proposed bolt-on technologies achieve the 10% reduction required to meet with the planning condition, however a combination of these would exceed the necessary reduction.

Fabric and Building Services Specification

Oakmere Homes propose a series of fabric and building service enhancements that exceeds the minimum requirements of Part L1A. By placing a significant emphasis on the performance of the fabric of each property, reductions in energy and carbon will be achieved. The following table details the anticipated fabric efficiency and building services standards to be incorporated into the design. These measures constitute the **lean** efforts.

Table 9 – Enhanced Specification Summary & Comparison

Element	Part L 2013	Enhanced Specification
Wall	0.30W/m^2K	0.17 W/m^2K
Roof	0.20W/m^2K	0.11 W/m^2K
Floor	0.25W/m^2K	0.16 W/m^2K
Glazing & Doors	2.00W/m^2K	1.20 W/m^2K
Air Test	10m^3/h.m^2 at 50Pa	5m^3/h.m^2 at 50Pa

The U values above show that the minimum requirements of Part L1A have been exceeded.

In addition to the summary above the following additional measures will be incorporated into the design, constituting the **clean** measures to reduce energy consumption;

- Oakmere Homes have had adopted the ACD Details. These reduce thermal bridging throughout junctions and penetrations through the building fabric, typically producing a dwelling Y-value of 0.08.
- Efficient independent heating systems will be provided, with time and temperature zone control and delayed start thermostats. These will allow the eventual occupants to exercise maximum control over their heating system and thus reduce energy consumption.
- Energy efficient lamps will be installed in each light fitting.
- Water consumption is now included in the calculation of a property's energy consumption. Thus each property will adhere to the requirements of Approved Document G– maximum internal water consumption of 125 litres per person per day.

It is clear that the proposed strategy places a great importance on the efficiency of a buildings thermal envelope and internal building services. This emphasis is to be encouraged. It recognises that it is inherently more sustainable to invest resources in reducing a property's long term energy consumption in contrast to short term generation benefits.

Reduced Emission Rate & Energy Requirement

To determine the benefits of the proposed specification, the development was again modelled in SAP 2012. The table below summarises the results calculated.

Table 10 – Reduced Emission Rate & Energy Requirement

House Type	No	Baseline Emission Rate (kg/year)	Baseline Energy Requirement (kWh/year)
HT - Bowfell	**5**	8,880.66	37,831.50
HT - Caldew	**0**	0	0
HT - Ennerdale	**1**	2,293.92	9,802.96
HT - Grasmere	**4**	8,737.12	37,341.88
HT - Kirkstone	**2**	4,160.59	17,707.90
HT - Loughrigg	**0**	0	0
HT - Rotahay	**3**	3,691.51	15,424.89
HT - Rydale	**0**	0	0
HT - Thirlmere	**4**	8,349.72	35,499.36
HT - Ullswater	**0**	0	0
HT - Wasdale	**5**	9,833.59	41,885.60
HT - Grizdale	**4**	5,476.86	23,129.64
HT - Lowther	**2**	2,672.60	11,243.50
TOTAL	**30**	**54,096.60**	**229,867.23**

The calculations summarised in the table above confirm a reduced energy requirement of **229,867.23 kWh/year** and an associated emission rate of **54,096.60 kgCO_2/year**. These are respectively **5.78%** and **5.32%** reductions over the baseline calculated previously.

In order to comply with the planning requirements, it is necessary for this development to show measures have been taken to ensure high energy efficiency and best practice with regards to energy consumption.

Evaluation

The FES Group was instructed by Oakmere Homes to review the performance of the proposed Energy Strategy for the development at Chatburn Road, Clitheroe. The energy strategy was detailed previously but can be best summarised as follows;

- Oakmere Homes proposes an energy strategy which addresses the two policy concerns of sustainable design and construction: climate change and energy security.

- Oakmere Homes has proposed a fabric first strategy which aims to achieve long term reductions in CO_2 emissions and climate change.

- The proposed fabric and building services specification will permanently reduce emissions by **5.32%** and the proposed energy demand by **5.78%** This is a significant betterment and demonstrates that the proposed development will have a reduced reliance on national resources (gas and electricity)

- In order to address the planning requirements, renewable technologies have been proposed capable of producing 10% site wide CO_2 generation. This will be achieved through the generation of **2,672.58 kgCO_2/year** by either of the potential solutions listed in this report.

After detailed analysis we can conclude that the proposed energy strategy adheres to the principles and aspirations of sustainable design and construction as advanced by national and local government and the house building industry. We therefore recommend the adoption of the preferred energy strategy by Oakmere Homes Homes.