Energy Statement

Enplanner ID: 1557

land off Charles Street
Blackburn
Location: BB24AX (53.74, -2.49)

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Summary

Description of development:

1No single storey residential dwelling

This energy statement analyses the energy and CO_2 savings that can be achieved by installing renewable or low-carbon technologies at the proposed development. It also looks at energy efficiency measures that could be implemented at the development to make energy and CO_2 savings beyond current building regulations.

The energy consumption figures for the development are based on benchmark figures for each building type from CIBSE for non-domestic buildings or based on SAP 2012 for domestic buildings.

The development consists of the following building:

Type	Floor area (m^2)	No. of units	Specification	Primary heating	Secondary heating
C3 General residential (*Detached house or bungalow*)	78	1	Building regs	gas (100%)	*N/A*

This project comes under the **Blackburn with Darwen** planning authority where the low carbon policy objective is as follows:

Policy summary

All development must demonstrate how it has been designed to minimise its contribution to carbon emissions and climate change. The Council will be supportive of exemplar developments which demonstrate how particularly high standards of environmental performance can be achieved.

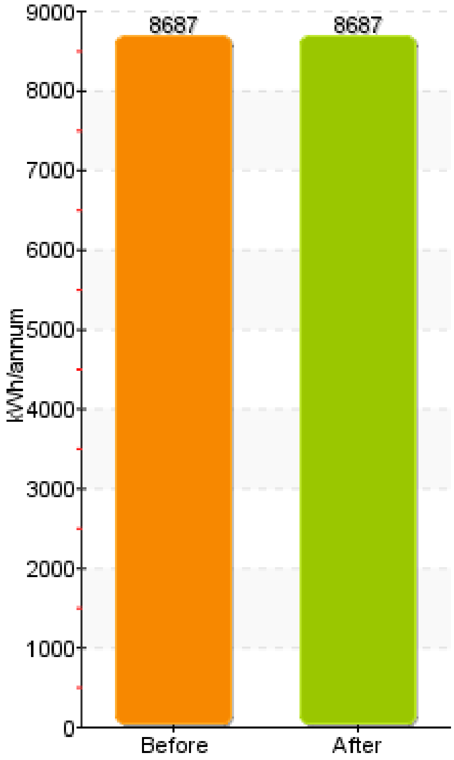
Note: *this is a summary of the local policy provided for indicative purposes only. You should always check directly with the planning authority concerned if you require a formal statement of planning policy.*

The following energy efficiency measures will be implemented to reduce the overall energy consumption and CO_2 emissions of the development before renewable or low carbon technologies are installed:

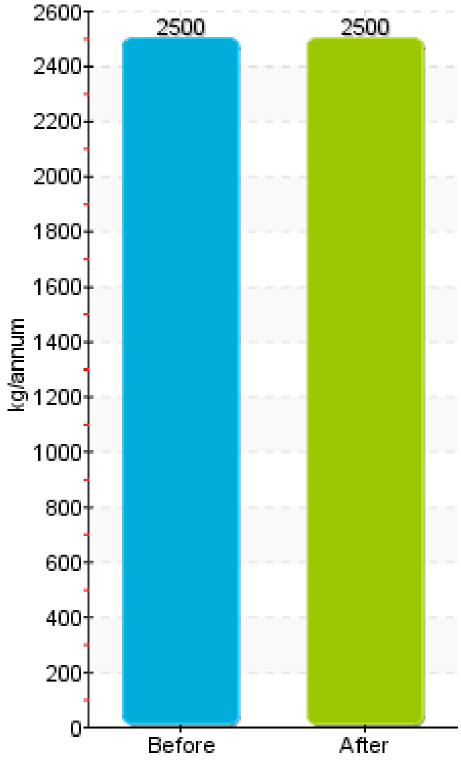
- Fabric insulation
- Heating systems
- Lighting
- Windows and doors

The predicted savings achieved by selected low carbon or renewable technology system after energy efficiency measures are implemented are a **0% saving in energy** and a **0% saving in CO_2 emissions** as shown in the graphs below.

Predicted annual energy consumption for development before and after installing renewable or low carbon technologies



Predicted annual CO_2 consumption for development before and after installing renewable or low carbon technologies



The following sections go into more detail about selected energy efficiency measures, and low carbon or renewable technology system.

Energy efficiency measures

This development will benefit from energy efficiency measures to reduce the energy consumption and CO_2 emissions over and above those required to comply with Building Regulations Part L.

The following have been selected as additional energy efficiency measures for this development. The efficiency measures are explained in more detail in the boxes below

Fabric insulation

Fabric insulation will be improved above and beyond current Building Regulations Part L that is likely to result in a predicted energy saving of 3.75% for the whole development.

Improve insulation to one element of fabric

Heating systems

Heating systems will be improved above and beyond Building Regulations Part L that is likely to result in a total energy saving of 3.00% for the whole development.

Install a slightly more efficient heating system

Lighting

Lighting will be improved above and beyond current Building Regulations Part L that is likely to result in a total energy saving of 2.50% for the whole development.

Install 100% energy efficient lighting throughout the dwelling

Windows and doors

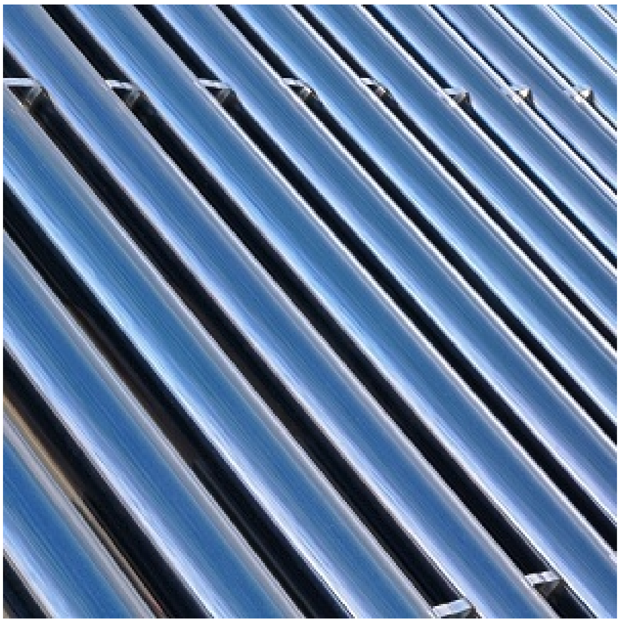
Windows and doors will be improved above and beyond current Building Regulations Part L that is likely to result in a total energy saving of 0.50% for the whole development.

Improve the thermal specification of all windows by a small amount

Adding these measures in Enplanner has reduced the predicted energy consumption over Building Regulations Part L by **9.75%** and the CO_2 emissions by **9.62%.** This brings the predicted energy consumption down to **8687 kWh/annum** and CO_2 emissions down to **2500 kg CO_2/annum**. These figures have been used to calculate the energy and CO_2 savings from renewable and low carbon technologies in the remainder of the report.

Other technologies

Solar Thermal



Solar water heaters generate hot water directly from sunlight, and work even when it is cloudy. The "collector" heats water or another fluid pumped gently through a panel on the roof. The fluid then circulates through a secondary coil inside a hot water tank. This works to heat water in exactly the same way as the coil from a regular boiler. The end result is a reduction in demand for hot water from the existing heating system. A modern, well-insulated hot water tank will keep this water warm for at least twenty-four hours, until it is needed.

Solar water heating systems are generally specified in square metres (m2), which is the collector area, and determines how much sunlight the system can catch. The heating power of a system will also depend on where in the country it is sited and the direction it faces. A common size of solar collector for domestic use is about 3-4m2 (flat plate). This will deliver around 1,500 kWh per year, which will heat just over half the annual hot water demand of a typical house with 3-4 persons. Most of this will occur during the summer months. For this reason, systems are usually sized to meet all of the summer hot water needs or half of the annual needs for a building: making the system bigger will not help in summer and make a marginal difference in winter.

Advantages:

- Low maintenance costs, only to make sure that the panels are free from debris such as fallen leaves.
- Short installation time of 1 to 3 days for small to medium roof mounted systems.

Disadvantages:

- Ideally the roof should be an unshaded roof space that is oriented between southeast and southwest (south facing is best).
- Payback can be longer than the lifetime of the system, especially for smaller systems.

Solar thermal is not appropriate for this development because:

not practical or financially viable on a project of this size

Solar Photovoltaics

A solar photovoltaic (PV) cell consists of two or more thin layers of semi-conducting material, most commonly silicon. When silicon is exposed to light, electrical charges are generated, which are conducted away by metal contacts in the form of direct current (DC). The electrical output from a single cell is small, so multiple cells are connected together and encapsulated to form a photovoltaic module, often referred to as a "PV panel". These are often mounted to a roof and electricity can be used in the building and/or exported to the national grid.

Advantages:

- Very low maintenance costs, only to make sure that the panels are free from debris such as fallen leaves.
- Often has a good payback period for smaller systems in Great Britain (i.e. up to 10kW) due to the feed-in tariff and the export tariff (for any excess electricity the system generates) and falling installation costs.
- PV panels have a lifetime in excess of 25 years.
- Short installation time of 1 to 3 days for small to medium roof mounted systems

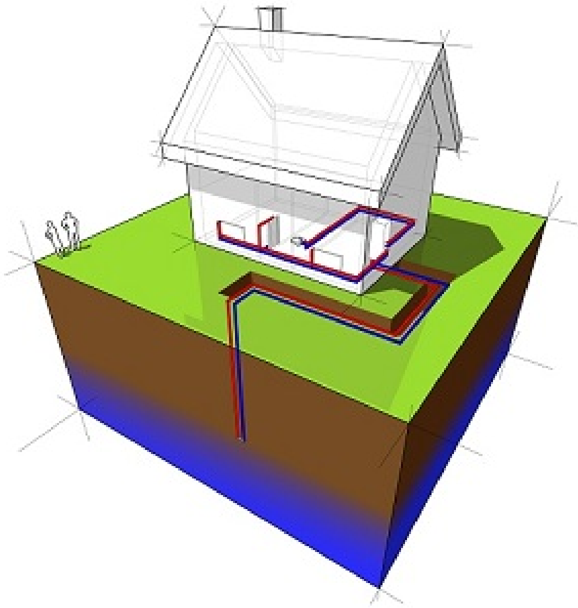
Disadvantages:

- Ideally the roof should be unshaded roof space that is oriented between west and east in a southerly direction (south facing is best).
- Although payback is good, up-front installation costs can be high

Solar PV is not appropriate for this development because:

not practical or financially viable on a project of this size

Ground Source Heat Pump



The Earth's surface acts as a huge solar collector, absorbing energy from the sun. The temperature of the ground just below the surface will remain fairly constant throughout the year, and in winter will be higher than that of ambient air. Ground source heat pumps (GHSP) are used to extract this heat and transfer it to a property.

There are three main components to a GSHP system, the ground loop, the heat pump and the heat distribution system. The ground loop is a network of plastic pipes that are buried in the ground, either in a vertical borehole or a horizontal trench (see diagram), around which a mixture of water and antifreeze circulates. A GSHP works like a refrigerator, removing heat from the ground and transferring it to a heat distribution system via a heat pump. The heat pump is run by electricity, but the amount of energy this requires is far less than the heat energy it is able to transfer, therefore we say it has an efficiency of, for example, 300%. This is also known as the Coefficient of Performance (COP) and 300% is equal to a COP of 3. The COP typically falls in the range of 2.5 to 4.

Advantages:

- They provide a reliable source of heat energy all year around.
- Maintenance is very simple, usually amounting to cleaning the heat exchanger periodically.
- They have a long life time as they have no moving parts and no combustion chamber.

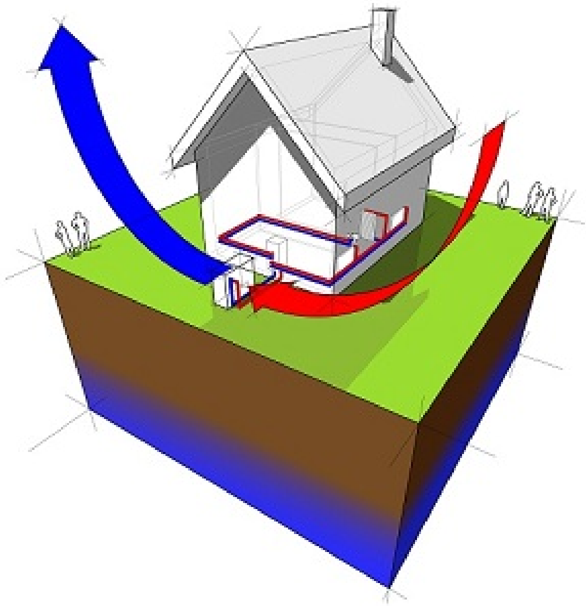
Disadvantages:

- The ground works, especially for boreholes, mean that the pipe-work can be expensive to install.
- Ground source heat pumps require larger radiators than conventional boilers since the operational temperature is a lot lower (30 degrees rather than 60 degrees). This means that they may not be suitable for old properties with an existing heat distribution system. Underfloor heating systems are a more suitable heating distribution method.

Ground source heat pumps are not appropriate for this development because:

not practical or financially viable on a project of this size

Air Source Heat Pump



An air source heat pump (ASHP) works in a very similar way to a ground source heat pump, like a refrigerator, removing heat from the outside air and transferring it to a heat distribution system via a heat pump. The heat pump is run by electricity, but the amount of energy this requires is far less than the heat energy it is able to transfer, therefore we say it has an efficiency of, for example, 300%. This is also known as the Coefficient of Performance (COP) and 300% is equal to a COP of 3. The COP typically falls in the range of 2 to 4. To achieve a COP of 4 in heating mode the outside air temperature would need to be at least 10°C. At a temperature below 5°C the COP in heating mode is more likely to be around 2.5.

It is for this reason that, during the coldest periods, it is more efficient for a back-up heating system incorporated into the heat pump system to provide the required heating. The automatic switch-over temperature for this varies depending on the back-up energy source, but is usually between -2 and -10°C. The back-up heating system is typically a less-efficient panel of electric resistance coils, similar to those in a toaster. This is why air-source heat pumps aren't always very efficient for heating in areas with cold winters. Some units now have gas-fired back-up boilers instead of electric resistance coils, allowing them to operate more efficiently.

Advantages:

- They provide a reliable source of heat energy for most of the year.
- Maintenance is very simple, usually amounting to cleaning the heat exchanger periodically.
- They have a long life time as they have no moving parts and no combustion chamber.

Disadvantages:

- Air source heat pumps require larger radiators than conventional boilers since the operational temperature is a lot lower (30 degrees rather than 60 degrees). This means that they may not be suitable for old properties with an existing heat distribution system. Underfloor heating systems are a more suitable heating distribution method

Air source heat pumps are not appropriate for this development because:

not practical or financially viable on a project of this size

Wind Turbine

Wind turbines use the power of the wind to generate electricity. They usually have a life in excess of 20 years before requiring a major overhaul. Some larger turbines require an annual inspection survey where the turbine will need to be lowered to the ground.

They can be installed on buildings or on masts. It must be noted that surrounding features such as tall trees and buildings and even the building that the wind turbine is mounted on, can disrupt wind flow to such an extent that the amount of electricity generated is significantly reduced. Wind turbines have a cut-off wind speed of around 3 m/s (this varies depending on the model), below which it will not generate any electricity.

Advantages:

- In the right location, an exposed, windy site, the payback periods can be very good.
- It is a well established renewable technology.

Disadvantages:

- They have planning restrictions where noise, shadow flicker and environmental impact (both visual and physical) must be considered.
- Wind is an inconsistent renewable resource so proper wind speed measurements should be made over a long period (at least 6 months) before a wind turbine is considered.

Wind turbines are not appropriate for this development because:

not practical or financially viable on a project of this size

Biomass Boiler

Biomass boilers are a general description for any boiler that burns organic material (such as wood) which is considered to be a carbon neutral fuel. The most common types of biomass boiler use either wood chips, pellets, or logs as a fuel to produce heat.

Wood chips are suitable for medium to large properties. The boilers can be highly automated, operating in a similar mode to a gas or oil boiler. Wood pellets are more compressed and uniform in shape - they require much more energy to produce and so the CO2 savings will be lower for pellets. They are suitable for smaller properties. Pellet boilers can also be highly automated. Large scale log boilers are quite rare, they are more commonly found in domestic properties where they can be manually batch fed. Logs are the cheapest form of biomass fuel since they require the least amount of processing, they will also give the best carbon savings because of this.

Advantages:

- Biomass fuel is usually readily available for both domestic and commercial properties.
- They can provide heat to a development with an efficiency of around 80%, this is a much higher efficiency than extracting energy from some other renewable technologies.
- Biomass boilers can be installed with a conventional radiator heating system.

Disadvantages:

- Substantial space is required to store the biomass fuel, and access considered for delivery vehicles.
- Biomass fuel is not free like other renewable sources, unless there is a source of woodfuel on site, therefore biomass boilers are not always the most cost effective solution when compared with heating with gas.

Biomass boilers are not appropriate for this development because:

not practical or financially viable on a project of this size

Combined Heat & Power

Combined heat and power (CHP) systems generate electrical power and useful heat at the same time. Domestic systems are designed to replace the conventional central heating boiler and supplement the grid supplied electricity. Units are 'heat led', meaning that they are thermostatically controlled and follow the pattern of heat demand, generating electricity at the same time.

Micro-CHP units are designed to be grid connected, and surplus power can be sold. CHP can provide a secure and highly efficient method of generating electricity and heat at the point of use. The units will consume more fuel per kWh of heating demand than a conventional condensing boiler. But electricity is generated at the same time and so the overall efficiency will likely exceed 90%.

Combined heat and power has been used in industrial and commercial premises in the UK for a long time. These tend to be electrical generators that produce heat as a by-product. Domestic boiler-type systems, however are still in their infancy. Boiler-type micro-CHP units use waste heat from a conventional condensing boiler to generate a small amount of electricity. For this, a Stirling Engine is used. Stirling engines operate very simply by using the waste heat and cool water to move a piston

Advantages:

- Domestic micro CHP Stirling engines have no combustion chamber so they will operate quietly and reliably over many years.
- Micro CHP units are small (the same size as a conventional boiler) and are powered by mains gas.
- Large CHP units tend to generate far more electricity per kWh of heat than domestic micro CHP systems, making them more efficient.

Disadvantages:

- The electricity output from micro CHP units can be very small.
- Larger CHP units are typically noisier than those that use the Stirling engine.
- Large CHP units generate 3-phase electricity, and most domestic houses with only have a single phase supply.

Combined heat and power systems are not appropriate for this development because:

not practical or financially viable on a project of this size

Hydroelectricity

Hydroelectric turbines come in many shapes and sizes, but they all have the same fundamental concept. They rotate with the force of water flowing past them and the rotation is used to power a generator that produces electricity. Micro hydro electric systems are classified as less than 100kW in capacity; they are not very common in the UK due to the difficulties of finding a suitable site and funding the installation.

Advantages:

- The generation of electricity will be relatively consistent if the water source has a year round flow.
- The systems utilise establish technologies which can be easily operated and maintained.

Disadvantages:

- Finding a suitable site to install a hydro electric turbine can be very difficult. The development must be close to a river and the flow must be sufficiently high.
- Unless there are existing civil works onsite (e.g. old milling sites), there may be considerable and costly ground works to install hydroelectric turbines.
- An abstraction license is required from the Environmental Agency to divert a flow of a watercourse. Provisions must also be made for wildlife and fish swimming upstream.
- Installation costs can be prohibitive.

Hydroelectric turbines are not appropriate for this development because:

not practical or financially viable on a project of this size

District Heating

District heating can involve a range of technologies, but the underlying principle is that the heat generation is centralised and distributed by a network of heat pipes to a number of different properties. These schemes can be sized for a few houses up to city sized systems. Generating heat on a large scale can mean better efficiencies and lower maintenance costs per property. The district heating system is often owned and run by an Energy Services Company (or ESCO) who will sell heat per kWh to each property, in exactly the same way as electricity is bought.

A popular technology for district heating is Combined Heat and Power fuelled by gas or biomass, or both. Other technologies can include geothermal, anaerobic digestion, energy from waste, biomass boilers or even solar thermal.

Advantages:

- The cost of maintenance or operation of the heating system is all included in the price paid for heat.
- A boiler does not need to be installed, only a small heat exchanger and the heating distribution system, e.g. radiators, which would have to be installed with any heating system.
- Heating costs should be lower since the systems are more efficient.

Disadvantages:

- Pipework must be installed from the district heating system to the development and this can be costly.
- It is not always available, especially in areas where the heat demand is low.

District heating is not appropriate for this development because:

not practical or financially viable on a project of this size

Disclaimer

The energy and CO_2 figures for the development have been calculated using either benchmarks for typical building types or figures from SAP or SBEM calculations as entered by the applicant, therefore no responsibility is taken for the accuracy of the figures in the energy statement. Renewable and low-carbon technology specifications and energy efficiency measures are indicative only and should not be used for design or construction purposes without seeking additional professional advice. All text in bordered boxes has been written by the applicant therefore no responsibility is taken for their content.