

**Environmental Standards and
Energy Efficiency Measures**
For
New Residential Detached Dwelling
At
**No.9 Ansleigh Avenue
Crumpsall
Manchester
M8 5SU**

FuZED Architecture and Design
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1.0 INTRODUCTION

This document outlines the energy savings and energy efficiency measures including use of renewable technologies that are to be employed as part of the proposed new residential premises at 9 Ansleigh Avenue.

The proposed heating, domestic hot water, comfort cooling systems and efficient lighting in conjunction with various low and zero-carbon renewable energy systems have been considered and adopted or dismissed as detailed herein.

The key low carbon technology deemed as the most viable option for the proposed dwelling is the use of a Solar PV system connected to provide power and to assist in heating and domestic hot water.

2.0 ENERGY EFFICIENT MEASURES APPLIED TO THE PROPOSED DWELLING

The energy consumption of the building will be reduced further by incorporation of energy efficiency measures in the design of the mechanical and electrical engineering systems. The following energy efficiency measures proposed for the new dwelling are described in more detail below:

2.1 DESIGN

The energy performance of the building is affected by the design, its construction and its use. Whilst occupant behaviour is beyond the remit of this statement, improved design and construction methods can significantly reduce the cycle emissions of a building and assist the occupant to reduce consumption. Sustainable design is not just incorporating renewable technologies but should be designed at the outset to provide suitable environmental conditions for the occupant's whilst also consuming as little energy as practically achievable.

2.2 THERMAL ELEMENTS

The proposed new building's fabric elements shall be in compliance with the Approved Building Regulations Part L1A 2010.

Element	Design U-Values (W/m ² K)
External Walls	0.13
Roof	0.13
Floor	0.11
Windows	1.30
Doors	1.00

Table 1: Design U-Values

A design air permeability rate has been set at 4m³/m²/hr at 50Pa.

2.3 HEATING

The residential premises will utilise an efficient gas boiler such as a Worcester Bosch Greenstar 24i boiler, or equal approved, located in the utility room serving the full space heating load utilising underfloor solutions and warm air heating. It will also serve the domestic hot water demand. Subject to how the space heating will be provided this will be sized to cover load, a provisional allowance for background heating in the region of 13 kW. The areas within the building shall be suitably zoned for space heating provision.

2.4 DOMESTIC HOT WATER SERVICES

The hot water generation shall be supplied by the same efficient gas central heating system that serves the building heating systems. Provisionally 300 litres of hot water storage has been allowed for heated in part by power generated by the pv solar panels.

2.5 ARTIFICIAL LIGHTING

The provision of natural daylight is considered an important factor in the design in order to minimise the use of artificial light within the building. Floors from ground level upward have access to natural light with high specification glazing being specified to maximise day lighting levels and minimise associated heat loss. High efficiency LED lamps will be considered in conjunction with the client's preferences and facilities for automatic switching and dimming systems shall also be incorporated where possible. This will however be subject to the client's and interior designer's agreement.

3.0 ON-SITE RENEWABLE ENERGY ASSESSMENT

A number of technologies were appraised in terms of technical, physical and financial feasibility, as potential low carbon system for use on the project.

3.1 Ground source heat pumps

Heat pumps use refrigerant gases and an electrical compressor to take heat from a source and deliver it to an output. In this way they can be used to supply heat to a building. The ground acts as a huge solar collector and thermal store, which dampens fluctuations in ground temperature. The fluctuations reduce with depth and stabilise at the annual mean by about 12m below the surface; for the UK this is in the range 9–12°C.

Ground source heat pumps make use of this heat stored in the ground and raise it to a more useful temperature of around 40-50°C. It should be noted that at these temperatures, the heat produced is only useful for low temperature applications such as under floor heating installations; otherwise, a degree of top-up by conventional means is required when used for

generating domestic hot water for example.

The viability of such a system and therefore costs rely almost entirely on the site area to install an underground loop system. From the survey it shows the site is insufficient in size to install a ground source heat pump. It is therefore, not proposed to install ground source heat pump systems to provide heating and cooling and hot water within the building.

3.2 Air Source Heat Pumps

Air source heat pumps operate using the same reverse refrigeration cycle as ground source heat pumps; however the initial heat energy is extracted from the external air rather than the ground.

These heat pumps can be reversed to provide cooling to an area although this reduces the coefficient of performance of the pumps.

The heat pump connects multiple inside units with a single outside unit. The latter resembles an air conditioning condenser unit and care must be taken to locate the unit where any noise generation is not obtrusive and the location should ensure the unit is not visually obtrusive. Since there is already adequate thermal load provided by the proposed Worcester Bosch Greenstar 24i boiler, or equal approved, and since air-source cannot provide as high efficiencies as a gas boiler rated at 94% efficiency, there is no need to make use of air-source technology in addition to the gas boiler specified.

3.3 Solar Water Heating

Solar collectors, which are at the heart of most solar systems, absorb the sun's energy and provide heat for hot water, heating and other applications.

There is useable space at second floor roof level to accommodate the panels, however the building domestic hot water demand is already met with the use of the proposed gas boiler system and the space could instead be used for solar photovoltaic panels.

Solar hot water heating therefore will not be progressed further.

3.4 Photovoltaics

Photovoltaic panels (PV) provide clean silent electricity and generate green power during most daylight conditions although they are most efficient when exposed to direct sunlight or are orientated to face plus or minus 30 degrees of due south.

PV panels typically have an electrical warranty of 20 – 25 years and are eligible for the Government's Feed in Tariff (FITs) incentive scheme for the 25 years after the installation. Since there is space to accommodate panels at roof level, provisionally 14 solar panels achieving an approximate total output of 3.3kWp will be proposed.

3.5 Wind turbines

Wind power can be used to generate electricity either in parallel with mains supplies or as standalone solutions using battery back-up.

In order to generate worthwhile quantities of electricity, average wind speeds of between 5-6 m/s are necessary (the UK government is currently advising 5.5-6.0m/s as the threshold).

However Government wind speed database predicts local wind speed at South End Road to be 4.6 m/s at 10 m above ground level and 4.9 m/s at 25 m above ground level thus rendering the option unviable.

3.6 Combined Heat and Power (CHP)

Combined heat and power (CHP) also called co-generation is a de-centralised method of producing electricity from a fuel and 'capturing' the heat generated for space heating and hot water usage.

The production and transportation of electricity via the National Grid is very inefficient with over 65% of the energy produced at the power station being lost to the atmosphere and

through transportation.

The system would generate electricity for use within the building with any surplus being sold back to the grid. The heat would be distributed via a communal heating and hot water infrastructure within the building. For a CHP plant to be efficient it needs operate for as much of the time as possible (usually deemed to be in excess of 14 hours per day). Therefore the size of the unit is usually based upon the hot water load of the building with additional boilers meeting the space heating demand.

In order to optimize a CHP system, whether it is fuelled by biomass or other means the proposed building needs to have a continuous heat demand throughout the year, which unfortunately the proposed building does not have, therefore this option is unfeasible.

3.7 Biomass boilers

Energy from biomass is produced by burning organic matter. Organic matter is harvested and processed to create bio-energy which can take the form of liquid or solid fuels.

Although biomass is carbon-based (and hence generates carbon emissions), the carbon that is released during combustion is equal to that carbon that was absorbed during growth and so the fuel is classed as carbon neutral (the fuel generally requires treatment and transport, with associated carbon emissions however, but these effects will be ignored here).

This system based on an 11 kW load would require approximately 5 tonnes/year of wood pellets and an estimated fuel store in the region of 6m³. This would give rise to a number of deliveries of fuel a year which would be an unacceptable option and shall not be considered further

4.0 CONCLUSIONS

This report demonstrates how a variety of technologies that may or may not be incorporated into the design of the proposed new building in order to reduce the Carbon emissions.

Technology	Feasible For This Site	Reason
Photovoltaics	Yes	18 solar PV panels proposed
Solar Water	No	Dismissed since load already supplied by gas boiler
Ground Source heat pumps	No	Insufficient site area and cost inhibiting
Air Source heat pumps	No	Not necessary as gas boiler can accommodate heating load more efficiently.
Wind Generators	No	Insufficient wind speeds at site.
CHP	No	There is not a consistent heat load throughout the year with which to justify the use of CHP plant.
Biomass Boilers	No	Regular fuel deliveries would be unacceptable and require considerable fuel storage space.