

ENERGY ASSESSMENT

Rev P1

**16 Saxon Street
Manchester**

waterfox
consulting engineers

first floor, rafts court, brocas street, eton, berkshire. sl4 6rf
tel. 01753 290 590, www.waterfox.co

CONTENTS

Executive Summary.	3
Regulated and Unregulated Energy	3
The Site	4
Baseline Energy Predictions	5
Be Lean Energy Efficiency.	5
Insulation	5
Air Tightness	5
Windows	6
Ventilation	6
Hot Water	6
Lighting and Appliances	6
Improvements Applied	6
Be Green Energy Efficiency	6
Wind Turbine	7
Photovoltaic Panels	7
Solar Hot Water	7
Biomass	7
Heat Pumps	8
Improvements Applied	9
Summary of CO2 Emission Reductions	9
Conclusion	9
Post Completion Monitoring	9

1. Executive Summary.

This Energy Assessment has been prepared by Waterfox Consultancy Ltd as a supporting document for the demonstration of compliance with The National Planning Policy Framework, February 2021.

The primary aim is to reduce the regulated CO₂ emissions beyond Building Regulations (ADL 2021) following the energy hierarchy:

- **Be lean**; use less energy
- **Be clean**; supply energy efficiently
- **Be green**; use renewable energy

We will show how the buildings reduce energy and associated CO₂ emissions compared to the notional building.

The proposed development is a pair of matching traditional style semi detached dwellings within the garden of/land adjacent to 16 Saxon Street. The development will utilise high performance materials, insulation and glazing along with low energy fixed equipment and appliances. Heat producing equipment will be highly efficient and will utilise renewable sources where technically feasible. The assessment below refers to a single dwelling but is equally applicable to both units.

By adopting improvements associated with the building fabric and construction techniques along with the introduction of an air source heat pump technologies the new dwelling reduces CO₂ emissions over the notional building by approximately 38% and reduces energy consumption by approximately 44%.

Please note: the notional building is based on a proposed dwelling compliant with Building Regulations minimum standards.

2. Regulated and Unregulated Energy

The Building Research Establishment (BRE) Home Quality Mark One, Technical Manual SD239 2018 defines regulated and unregulated energy thus:

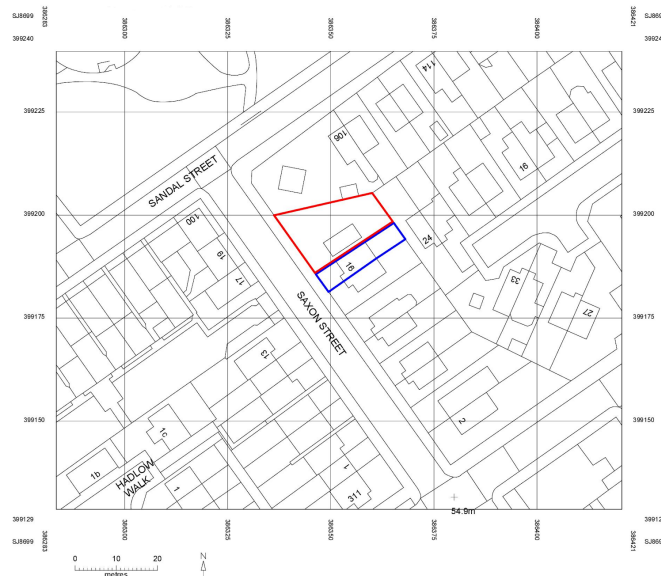
Regulated Energy - building energy consumption resulting from the specification of controlled, fixed building services and fittings, including space heating and cooling, hot water, ventilation and lighting.

Unregulated Energy - building energy consumption that is not controlled, i.e. energy consumption from aspects of the building on which Building Regulations do not impose a requirement.

3. The Site

The site is situated at 16 Saxon Street, Manchester. M40 7BY.

Site location plan



Site plan



The site occupies an urban location.

4. Baseline Energy Predictions

An assessment has been made together with approximate calculations to determine the baseline CO₂ emissions for the building. This baseline represents the notional building rating.

The following results were achieved.

- Annual energy consumption: 9,562kWh/yr
- Annual CO_{2e} emissions: : 1,836tCO_{2e}/year

Construction and equipment details used for the baseline calculations:

- Fabric U-values in accordance with Part L minimum standards
- Air permeability of 10m³h⁻¹m⁻¹@50Pa

Fuel for heating:	Natural gas
Space heating:	Condensing gas fired boiler
Domestic hot water:	Indirect vie gas boiler
Controls:	Time and zone temperature control
Lighting:	LED
Ventilation:	Local extract to WC's and bathrooms

5. Be Lean Energy Efficiency.

The first steps in the energy hierarchy are to improve the design of the building fabric to minimise the energy requirement and also maximise the energy efficiency of the installed services. The following items have been considered.

5.1 Insulation

Insulation is a key component to increase energy efficiency as a major form of heat loss is through the building fabric. Creating a highly insulated building envelope (floors, walls, roofs and windows) using significantly lower U-values than required by Building Regulations will create a reduced space heating demand resulting in reduced energy use.

5.2 Air Tightness

Unwanted infiltration and air leakages cause a huge amount of heat loss in a building, accounting for up to 20% of a dwelling's heat loss. By creating a tighter thermal envelope through a reduction in air permeability rates the space heating requirement will be reduced resulting in less energy use.

5.3 Windows

The use of windows with U-Values exceeding current Building Regulations benchmarks will further reduce space heating demand in the development.

5.4 Ventilation

The installation of Mechanical Ventilation Heat Recovery units will allow heat to be extracted from exhaust air and recirculated around the dwellings via the incoming fresh air. This will reduce space heating demands further.

5.5 Hot Water

Installing super insulated hot water vessels, separately controlled and timed will allow the heating of the hot water to become far more efficient and thus reduce energy demand for this critical aspect of the dwelling energy use.

5.6 Lighting and Appliances

The use of a higher percentage of energy efficient lighting over and above that required by Building Regulations will provide a reduction in energy demand. The use of 'A' and 'A+' rated appliances throughout will reduce the electricity demand further still from the baseline calculations.

5.7 Improvements Applied

The heatloss from the building has been reduced by increasing the levels of insulation in the building fabric to better than that required by Building Regulations by a factor of 20% over the minimum standards as required within Part L.

Air permeability has been reduced by 20% below the maximum permissible level.

Note: the Target values stated above will be subject to further design consideration at the appropriate time.

Further energy demand reductions have been made by the incorporation of the following features within the building:

- Separately controlled and timed super-insulated hot water calorifier
- 100% use of energy efficient (LED) lighting
- 100% use of 'A', 'AA' and 'AAA' rated appliances

6. Be Green Energy Efficiency

The third step in the energy hierarchy is to use renewable energy sources. The following systems have been considered

6.1 Wind Turbine

Wind Turbines use natural energy to turn a turbine, creating mechanical energy; this is then converted into usable electricity via a generator. There are two types of turbine. Horizontal Axis Wind Turbines (HAWT) and Vertical Axis Wind Turbines (VAWT).

Despite the UK being classed as the most productive European country for the generation of wind power, it is very site specific. In rural, coastal areas in the West and North of the UK potential is high, however in the midlands wind speeds are generally not high enough to maximise output. There are concerns over the siting of turbines in urban areas as advice suggests the flow of air will be affected and turbulence will affect performance.

Due to the nature of this site being situated in an urban residential area and the site's average wind speed being estimated at 3.0ms^{-1} (the minimum recommended speed being 5.5ms^{-1}) the provision of a wind turbine is considered unfeasible.

6.2 Photovoltaic Panels

This form of renewable energy generation uses photovoltaic (PV) semiconductor materials that produce electricity when exposed to irradiation from the sun. There are many varying types of PV panel with the most common being monocrystalline and polycrystalline. These can then be arranged into rigid panels and attached to a building's roof

or walls to generate electricity either for use in the building or fed into the national grid.

In order to maximise energy output in the UK the panels need to be South facing at a pitch of between 30° and 45°. Panels can be fitted with alternative orientation and pitch but it will have an effect on output. The use of PV is currently not included due to the West / West orientation of the roofs..

6.3 *Solar Hot Water*

This form of solar technology uses the power of the sun to heat water, which is then used within a building. There are two types of system, a flat plate panel and evacuated tubes system. A flat plate system is a panel placed on a roof which contains liquid that absorbs the heat from the sun. The liquid is then circulated via a heat exchanger into the hot water system of a building. An evacuated tube system works in a similar way but has glass tubes that have a highly absorbent surface with no air inside, this means that they offer a higher output than standard flat plate panels. As with solar PV panels in order that the panel generates its maximum energy output it must receive maximum exposure to the sun.

There needs to be reasonable demand for hot water in the building to ensure that the hot water generated is used, ideally this demand will be during times when the sun is present. The use of SWH is currently not included due to the West / West orientation of the roofs..

6.4 *Biomass*

Biomass is biological material derived from living or recently living organisms. In terms of energy use biomass generally refers to timber and crops grown specifically to be burnt to generate heat and power. Biomass is renewable and a low carbon fuel because the carbon released in combustion is offset by the carbon absorbed by the organic matter during its growth. The vital difference between biomass and fossil fuels is one of time scales. Biomass takes carbon out of the atmosphere while it is growing, and returns it as it is burned, to be absorbed by the next harvest. Fossil fuels are releasing carbon captured years ago, therefore increasing CO₂ concentrations into the atmosphere.

There are either stoves (which can include back boilers for water heating) or boilers (in a similar vein to traditional gas fired boilers) for generating heat and hot water. Stoves will use logs as the primary fuel source while boilers can use either wood chips or wood pellets, which are usually made of highly compressed waste sawdust.

Considerations when installing biomass heating systems include:

There are space issues for plant equipment and fuel storage. A biomass boiler is slightly larger than a traditional boiler and if an automated feeding system is specified then space for this will be required. Storage space will need to be a dry, protected area that can have easy access for regular deliveries.

Regular supply of a suitable fuel will be required. Securing supply will be vital and will undoubtedly lead to large lorries delivering and as with all fuel sources will have fluctuations in price depending on supply and demand.

Compliance with clean air regulations will be required, while this probably won't cause issues due to biomass systems being compliant, checks with the local authority will be needed.

Due to the factors mentioned above the incorporation of a biomass boilers/stoves on this development is considered unfeasible.

6.5 *Heat Pumps*

There are three main types of heat pump: ground source, air source and water source.

Ground Source Heat Pumps (GSHP) and Water Source Heat Pumps (WSHP) work by absorbing the heat from the sun which is stored in the earth or water between 1m - 2m deep. This heat is constant throughout the year and not

affected by the weather. They use a system of flexible pipes containing fluid which are buried underground or in water, which, after they absorb the heat, transport it to the building. This heat goes through a heat exchange to 'upgrade' it. Significant land area is required to utilise ground source heat pumps and a suitable water source is required for WSHPs.

Air Source Heat Pumps (ASHP) extract heat from the outside air with the help of an air handling system. This heat is then passed through a heat exchange to 'upgrade' it.

Due to the heat being provided at a lower temperature than conventional boilers these systems work better with under floor heating, however larger specifically designed radiators are a viable alternative.

The heat pumps do require electricity to operate and an increased supply capacity is often required.

The use of a ground source heat pump for this development is not viable due to the limited land area available; there is no source of water to consider the use of a WSHP.

An air source heat pump is a potentially feasible on site renewable technology and is considered suitable for this project.

6.6 Improvements Applied

Further carbon reductions have been made by the incorporation of the following systems:

- Air source heat pump for space heating and domestic hot water

7. Summary of CO₂ Emission Reductions

The following demonstrates the regulated energy and carbon saving following the improvements stated above.

The following results were achieved:

Energy	Energy Consumption kWh/yr	Reduction in Energy kWh/yr	% Reduction
Baseline:	9562		
Be Lean:	8848	714	7.47%
Be Clean:	5342	3506	36.67%
Total:		4220	44.13%
CO ₂ :	tCO ₂ /yr	Reduction in CO ₂	% Reduction
Baseline:	1836		
Be Lean:	1687	149	8.11%
Be Clean:	1134	553	32.78%
Total:		702	38.23%

8. Conclusion

By adopting improvements associated with the building fabric and construction techniques along with the introduction of heat pump technologies the new dwelling reduces CO₂ emissions over the notional building by approximately 38% and reduces energy consumption by approximately 44%.

Please note: the notional building is based on the proposed dwelling compliant with Building Regulations minimum

standards.

9. Post Completion Monitoring

Smart meters will be provided to allow monitoring of energy usage.