

Energy Statement

Ref: Z52388.1

52No New Build Dwellings

at

**Oakenrod,
Rochdale**

for

Hallmark Ltd



FS 560187

Energy Counsel
Viridor House
No.3 Bolholt Terrace
Bury/Gtr Manchester

BL8 1PP
Tel: +44 (0)161-762 1055
Fax: +44 (0)161-761 1094

Matthew.Gibson@energycounsel.co.uk
www.energycounsel.co.uk

Document Status – Draft

Reference: Z52388.1			Date:
Produced by:		Paul Ahern	28 th September 2022
Checked by:		Tony Turner	29 th September 2022
Approved by:		Matthew Adams	30 th September 2022

Disclaimer

This report has been prepared by Energy Counsel with all reasonable skill, care, and diligence within the terms of the Contract with the client, incorporating our Standard Terms and Conditions of Business and taking into account the resources devoted to it by agreement with the Client.

We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.

This report is confidential to the client, and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own discretion and risk.

Contents

1. Introduction	6
1.1. Location	7
1.2. Floor Plans	9
2. Policy Drivers for Energy Efficiency and Renewable Energy	10
2.1. National Policy	10
2.2. Local Policy	11
3. Methodology	13
4. Baseline Energy Assessment	15
4.1. Predicted Baseline Energy Requirements	15
5. Passive Design and Energy Efficiency	16
5.1. Passive Design Measures	16
5.2. Energy Efficient Systems	17
6. District & Communal Heating Networks	18
6.1. Decentralised Heating Networks	18
7. Renewable Energy Technologies	20
7.1. Photovoltaics (PV)	20
7.2. Solar Thermal HW Panels	21
7.3. Ground Source Heat Pump (GSHP)	22
7.4. Air Source Heat Pump/Exhaust Air Heat Pump	23
7.5. Micro Wind Power	23
8. Energy Assessment of Proposed Scheme	26
9. Conclusion	27
9.1. Low and Zero Carbon Technology Review	27
9.2. Summary Headlines	28
10. Appendices	29
10.1. LZT Feasibility Table	29
10.2. Specification for Energy Assessments (ADL1 2021 - SAP)	30

Executive Summary

This Energy Statement has been developed in support of the planning application for the proposed 52No dwellings at Oakenrod in Rochdale. The proposed development consists of 4No apartments, 12No. 2-bed 4-person semi-detached houses, 32No 3-bed 5-person semi-detached houses and 4No. 4-bed 6-person semi-detached houses. This statement will evaluate the technical and economic feasibility of using both passive and low and zero carbon technologies and will assess the practical levels of CO₂ reduction possible for this development to comply with the following planning requirements:

- Rochdale Core Strategy (2016)
- National Planning Policy Framework (2021)

The following low and zero carbon technologies have been evaluated:

- Biomass
- Wind
- Biogas
- Air Source Heat Pumps
- Geothermal
- Combined Heat & Power (CHP)
- Solar Hot Water
- Solar Photovoltaic

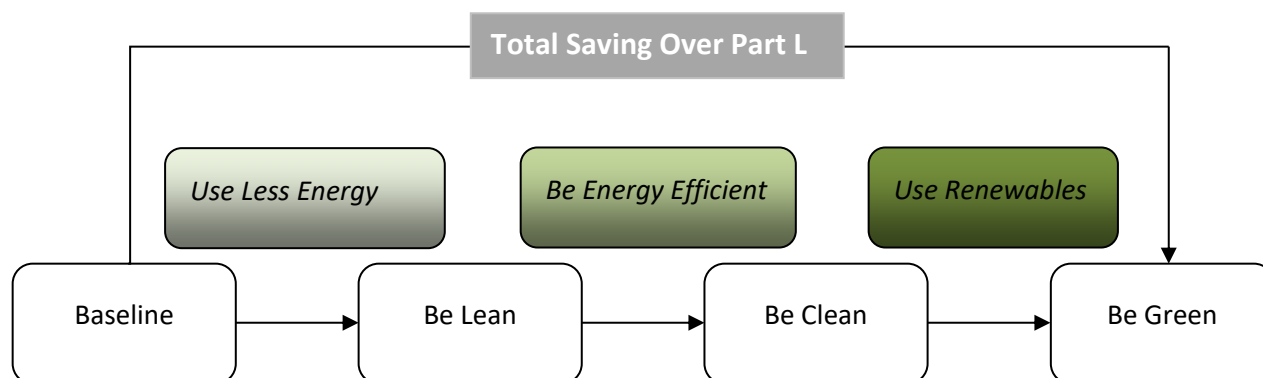
The approach for the proposed development is to embed sustainability into the heart of the development through a range of design measures based on the 'Be Lean, Be Clean, Be Green' design hierarchy. Measures will include:

- 1) Enhanced building fabric to meet the new Building Regulations ADL1 2021 (15/06/2022)
- 2) Enhanced air tightness and thermal bridging
- 3) Efficient decentralised extract ventilation system
- 4) Heating and hot water will be provided by individual air source heat pumps
- 5) Efficient lighting strategy using CFL or LED type fittings

For the purpose of the assessment, we have evaluated the prospective dwelling in SAP 10 (Standard Assessment Procedure) to provide an accurate estimate of predicted energy/ CO₂ emissions. We have completed SAP calculations based on the proposed design layouts to provide an estimation of the total energy/emissions on site.

Summary

The development has been provided with energy savings through the use of passive improvement measures such as improved energy efficiency. This passive approach to compliance will complement the integrated approach to the sustainable energy objectives of the national and local policies. In addition, an air source heat pump has been provided to the dwellings to achieve further carbon reductions.



The principles of a Be Lean, Be Clean, Be Green design philosophy have been applied, which results in a 56% carbon emissions improvement and a 12% primary energy improvement over Building Regulations Part L1 2021, as indicated in Table 1. A full design specification that confirms inputs used within the SAP calculations is provided within the Appendices of this report.

Table 1 - Proposed development CO₂ emissions against Building Regulations Part L1 2021

	Total CO₂ Emissions (kgCO₂/yr)	Total Primary Energy (kWh/yr)
Target Dwelling Performance	41,097	216,400
Proposed Dwelling Performance	18,162	190,615
Total Reduction	22,935	25,785
Percentage Improvement (above ADL1 2021)	55.81%	11.92%

1. Introduction

The Oakenrod development consists of a 4No 1-bed 2-person apartments, 12No. 2-bed 4-person houses, 32No 3-bed 5-person houses and 4No. 4-bed 6-person houses, located at Oakenrod Rochdale. The development is required to achieve compliance under Building Regulations Approved Document Part L1 (2016).

Supporting information is provided within this report for the proposed energy strategy to be considered on site in accordance with the following planning policies:

- Rochdale Core Strategy Plan (2016)
- National Planning Policy Framework (2021)

Throughout this report, passive design techniques, energy efficient equipment and appropriate low carbon technologies will be appraised in line with the 'Be Lean, Be Clean, Be Green' philosophy of relevant planning documents and the Energy Hierarchy.

An assessment of CO₂ emissions will be made based on the calculation methodology dictated by the Standard Assessment Procedure (SAP) and in line with the requirements of Rochdale Council Planning Policy.

1.1. Location

The area for the proposed development in Rochdale is highlighted by the red line boundary shown in Figure 1. Rochdale town centre is located one mile East of the site.



Figure 1 - Location and surrounding area of proposed Oakenrod development

The site is accessed off Bury Road, after the junction for Mellor Street. Just North of the site is Rochdale Cricket Club, with the surrounding area being a mixture of residential and commercial properties.



Figure 2 – Architectural site plan for the proposed Oakenrod development

The proposed development consists of 4No. 1-bed 2-person apartments, 12No. 2-bed 4-person houses, 32No 3-bed 5-person houses and 4No. 4-bed 6-person houses, located at Oakenrod Rochdale as indicated in Figure 2 above.

1.2. Floor Plans

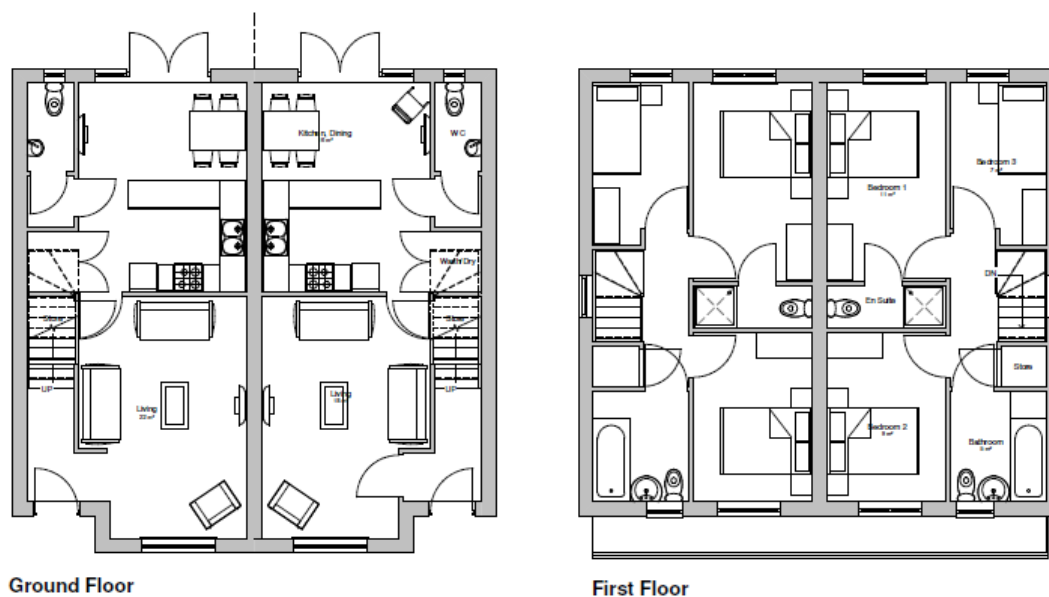


Figure 3 – Typical Floor plans for the proposed Oakenrod development

Typical floor plans are shown in Figure 3 above. The development consists of a variation of house sizes, from 1-bed 2-person apartments to 4-bed 6-person houses.

2. Policy Drivers for Energy Efficiency and Renewable Energy

This section presents a range of planning policy that is applicable to the Oakenrod development, at both a national and a local level.

2.1. National Policy

The National Planning Policy Framework was published in July 2021 and sets out the government's planning policies for England and they should be applied. Table 2 sets out the relevant energy standards for new developments and provides an indication of the design response to be provided.

Table 2 – Key National Planning Policy Requirements and Design Responses

Section	Policy Requirements	Design Response
14. Meeting the challenge of climate change, flooding and coastal change	The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: Shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.	This development will follow the principles set out in the Rochdale Core Strategy (2016) using a 'Be Lean, Be Clean, Be Green' approach in reducing operational carbon emissions. An overview of current decentralised energy schemes in Rochdale and an assessment on the potential for future schemes in relation to this development is provided in Section 6 of this report. This energy statement appraises site specific information to determine the most appropriate approach to minimise energy consumption.

2.2. Local Policy

The Adopted Rochdale Core Strategy (2016) provides a set of guidelines for new development within the local area. All relevant energy policy within these documents is provided within this section together with a design response.

Table 3 – Key Local Planning Policy Requirements and Design Responses

Rochdale Core Strategy (2016)		
Section	Policy Requirements	Design Response
G2 – Energy and New Development	All new development will be expected to adhere to the following energy hierarchy to the extent that policy G2 reflects national policy, targets and requirements for that type of development: 1. Demand Reduction – Achieve the maximum possible reduction in demand for energy through building design (i.e. the use of passive systems). At the design stage of new developments, every effort should be made to ensure that buildings use as little energy as possible throughout their lifetimes, using siting, orientation, layout, construction and landscaping to optimise use of natural passive systems such as solar gain and natural lighting, shading, ventilation and cooling to minimise heating, cooling and lighting demands. Green roofs and green walls should be incorporated into developments wherever feasible. 2. Energy efficiency and low / zero carbon technologies and networks – Design to maximize energy efficiency, and use on-site or linked low or zero carbon technologies or direct connection to a low or zero carbon heat source (not necessarily on-site). 3. ‘Allowable solutions’ – use wider energy efficiency / CO₂ reduction measures, which could include developer contributions, to compensate for ‘residual emissions’ not addressed by 1 or 2 above	The proposed development will follow the principles of the Energy Hierarchy by adopting a passive fabric-first approach to design and adopting the use of renewable technologies. The servicing strategy consists of an energy efficient air source heat pump system to provide low carbon heating and hot water to the dwellings with a coefficient of performance of >300+% Enhanced thermal fabric and low air leakage is proposed to ensure the energy demand is reduced before considering any low/zero carbon technologies. The proposed development aims to look attractive whilst keeping the local identity and character of the area. An overview of current decentralised energy schemes in Rochdale and an assessment

		on the potential for future schemes in relation to this development is provided in Section 6 of this report.
--	--	--

3. Methodology

The first step of the full energy strategy assessment has been to undertake a baseline energy assessment. The baseline energy assessment consists of calculating the total CO₂ emissions of the development to meet Building Regulations and then compare the proposed improvement measures against this baseline. Building Regulations Part L1 2021 (SAP) applies to the proposed dwellings and provides carbon emissions from regulated energy.

The building can then be benchmarked/ thermally modelled using the energy hierarchy:

1. Be Lean <i>A reduction in energy use as a result of passive design and energy efficiency</i>
Thermal performance of envelope (U values) Glazing design Airtight construction Efficient mechanical ventilation Variable speed fans and pumps Efficient lighting
2. Be Clean <i>A focus on supplying energy to the development through efficient means</i>
Connect to low carbon heat networks Develop site wide heat network from single energy centre On site CHP Provide energy efficient individual heating
3. Be Green <i>The installation of renewable technologies to meet energy demand where possible</i>
Consider the feasibility of renewable energy technologies Assess the integration of renewable technologies based on the above measures

The development must be provided with energy savings through the use of thermal improvements to fabric (a 'fabric first' approach), followed by other clean energy solutions (energy efficiency

improvements, district heating, etc.) and finally the use of renewable energy technologies, where practical. This hierarchy complements the integrated approach to the sustainable energy objectives of Rochdale Council.

The planning policies require a full review of the technical and economic feasibility of the following renewable technologies:

- Biomass heating
- Biomass combined heat and power
- Solar hot water
- Solar photovoltaic
- Ground source heat pumps
- Air source heat pumps / exhaust air heat pumps
- Wind power

To achieve the targets set the development must achieve a balance between fabric, heating and control, ventilation and air leakage improvements, the amount of zero or low carbon technology installed and the capital, life cycle and running costs, maintenance and operation, etc.

Feasible renewable energy technologies have been considered during the assessment to ensure the most suitable renewable energy is chosen for the demands of this scheme. The pros and cons of each technology with respect to this site are considered as part of this statement.

4. Baseline Energy Assessment

Energy Counsel have based the analysis on current Building Regulations ADL1 2016 (SAP 2012), taking into account solutions that must not only be energy efficient but also practical, reliable and user friendly.

Energy Counsel have carried out preliminary SAP 2012 calculations for the dwellings. To meet compliance with Building Regulations Part L1 2016, the Dwelling Emissions Rate (DER) must be lower than or equal to the Target Emissions Rate (TER). SAP 2012 is the Governments Standard Assessment Procedure (SAP) for calculating the energy aspects of a dwelling. SAP is a measure of fuel costs for heating, hot water and lighting for a dwelling. SAP 2012 can also be used to ascertain the energy requirements of a development.

To assess the baseline energy we must make an estimation of the energy demands based on current Building Regulations in order to set a target upon which the actual development can be compared.

4.1. Predicted Baseline Energy Requirements

The predicted baseline CO₂ emission demands for the development:

Table 4 - Baseline dwelling carbon emissions

Ref	Dwelling Type	No. on Site	TER (kgCO ₂ /m ²)	TPER (kWh/yr/m ²)	Area (m ²)	Total Carbon Emissions (Kg CO ₂ /yr)	Total Target Primary Energy (kWh/yr)
Z52388	House Type A – 1B2P	2	13.98	73.56	44.71	1,250	6,578
Z52389	House Type A – 1B2P	2	16.72	92.07	48.51	1,622	8,933
Z52390	House Type B – 2B4P	12	12.04	62.92	75.42	10,897	56,945
Z52391	House Type C – 3B5P	14	11.04	57.58	88.56	13,688	71,390
Z52392	House Type D – 4B6P	4	10.70	55.87	115.34	4,937	25,776
Z52393	House Type E – 3B5P	6	13.03	70.03	111.33	8,704	46,779
Z52394	House Type F – 3B5P	12	10.84	57.08	124.50	16,195	85,278
Total		52				41,097	216,400

The baseline carbon emissions are **88,191 KgCO₂/yr** and the baseline primary energy rate is **216,400 kWh/yr**.

5. Passive Design and Energy Efficiency

The approach of the development is to embed sustainability into the heart of the design from the outset of the project design process. The design will be developed with sustainable solutions, taking into account the relevant policies and strategies of Rochdale Council.

The development will seek to consider all aspects and principles of sustainable development, taking into account environmental, social and economic impacts.

5.1. Passive Design Measures

The philosophy for the site is to achieve as much of the necessary reduction in carbon emissions through the use of passive design techniques and energy efficient measures as possible, before resorting to the use of LZCs. This ensures that the highest standards of building fabric and energy efficiency are achieved, rather than offsetting a poorer performance with LZC contributions.



Figure 4 - Architectural representation of Oakenrod Dwellings elevations

This will be undertaken through a fabric first energy efficient design approach with high levels of thermal efficiency and a reduction in energy demand through efficient lighting design.

5.2. Energy Efficient Systems

Options have been reviewed for improving the energy efficiency of the development by installing an efficient heating system. The scheme will benefit from an air source heat pump for heating and hot water.

A high efficiency System 3 type decentralised extract system will serve the kitchen and bathroom, with an overall specific fan power (SFP) of $<0.18\text{W/l/s}$, in line with the requirements of Building Regulations Part F (2016). This system operates constantly on low extract and provides a boost when the wet room is in use. Ventilation will be provided throughout the rest of the dwelling by openable windows.

6. District & Communal Heating Networks

This section outlines how consideration of energy supplied efficiently from a district heating network can be provided to the dwelling in line with the energy hierarchy.

6.1. Decentralised Heating Networks

The energy policy reaffirms the view that energy generated by centralised power stations and transmitted through the national grid is highly inefficient and wasteful.

One of priorities for reducing CO₂ emissions is to reduce the city's reliance on centralised power stations. This means increasing the use of local, low-carbon energy supplies through de- centralised energy systems.

Decentralised plant generally means any heating and hot water and/or electricity generation provided on a district wide (DHN) or site wide (CHN) basis. DHN and CHN can typically include combined heat and power equipment (CHP). CHP is an engine which, when running, generates electricity and heats water which can then be distributed around a development.

A number of heat network opportunities across the city region are at various stages of development. Benefits of district heating networks can include:

- Provision of low carbon / lower cost heat to domestic and commercial customers
- Diversification of the energy mix
- Reductions in region-wide carbon emissions
- Targeting and reduction of fuel poverty
- Potential long term revenue streams for local authorities
- Alignment with regeneration programmes
- Driving the growth of the low carbon services sector

There are currently no existing district heating networks within proximity to the site, as indicated in Figure 5. The nearest district heating network is located at St Mary's Estate, Oldham, around six miles South of the site.



7. Renewable Energy Technologies

Energy Counsel have reviewed options for the use of on-site renewable energy/ Low or Zero Carbon Technology (LZT) in line with Rochdale Council policy aspirations.

This renewable energy statement/strategy reviews the technical and economic feasibility of the following technologies –

- Solar Photovoltaic
- Solar Hot Water
- Ground Source Heat Pumps
- Air Source Heat Pumps / Exhaust Air Heat Pumps
- Micro Wind Power
- Biomass

7.1. Photovoltaics (PV)

Photovoltaic panels convert sunlight into electricity to run lights and appliances. Photovoltaic panels use cells to convert light into electricity. A PV cell normally consists of 1 or 2 layers of a semi conducting material such as silicon. When light shines on a cell it generates energy causing electricity to flow, the higher the light intensity is, the more electricity flows.

The amount of energy PV cells generate is referred to as Kilowatt Peak (KWp). PV arrays now come in a variety of shapes and colours, ranging from grey 'solar tiles' that look like roof tiles to panels and transparent cells that you can use on conservatories and glass to provide shading as well as generating electricity. Solar panels are not light and the roof must be strong enough to take their weight, especially if the panel is placed on top of existing tiles. For flat roofs the panels can be mounted on A-frames to give the optimum angle.

The optimum panel inclination for solar collection is 35°, oriented due south; however panels that are inclined between 35° and 45° and oriented south of west or east are generally suitable. If solar

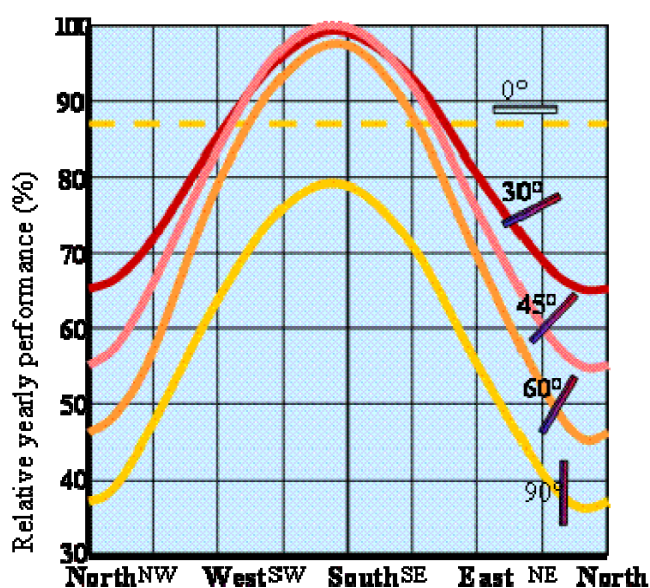


Figure 6 - Performance of photovoltaic panel orientation

collectors are oriented away from due south then a larger surface area will be required to generate a set amount of energy. The effect of non-optimal orientation is illustrated by the graph above:

The cost to install PV is typically £1,000 - £1,500 per kWp for 'on-roof' panel systems.

The existing roof should be able to support the addition of photovoltaic panels with space for an inverter within the roof. A rooftop PV array is considered to be the most renewable solution to reduce carbon emissions. PV has been discounted as the dwellings achieve over and above the requirements in ADL1A using air source heat pumps and enhanced fabric details



Figure 7 - Photovoltaic array on a pitched roof

7.2. Solar Thermal HW Panels

Solar panel heating uses the radiant energy from the sun to heat hot water, most commonly for domestic hot water needs. There are two types of collectors used for solar water heating – flat plate collectors and evacuated tubes collectors. The systems function successfully in all parts of the UK, as they can work in diffuse light conditions. The collector should be mounted on a 10-60 degrees pitch facing south, although other variations can be used, south is the most efficient.

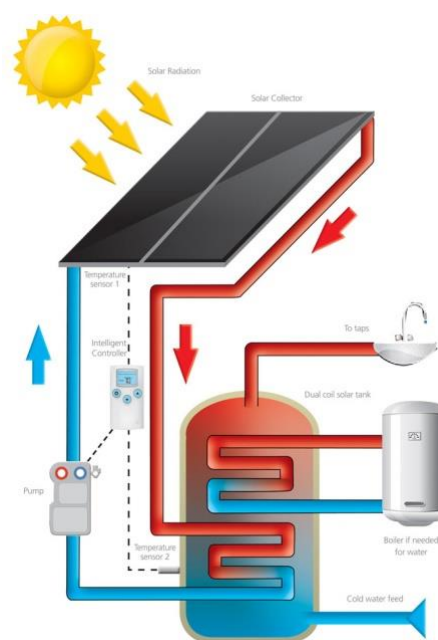


Figure 8 - The principles of a solar thermal system

The cost of installing the system is dependent on the distance between the solar collector and the hot water storage and therefore costs vary. The closer the collectors are to the hot water storage, the less pipe work is required. Annual maintenance checks are recommended. The solar collectors are connected to a condensing boiler via a HW cylinder with twin coil.

A typical installation in the UK has a panel size of 3-5m² which is used in conjunction with a HW storage tank of 180-300litres, of which a minimum of 90-150 litres must be dedicated to solar hot water storage.

They are a 'simple' and guaranteed technology which will act as a pre-heat for the Hot Water and Heating usage. Payback between capital cost and energy saving can normally be achieved within 12 – 20 years, subject to usage and dwelling type.

The use of solar thermal panels, work best in conjunction with individual heating systems for each dwelling. The orientation of the development is fine for the utilisation of solar water heating to provide domestic hot water however it will not achieve significant carbon savings. Carbon savings of approximately 4-5% are achievable with this technology. A solar thermal array could work for the proposed development due to the likely hot water consumption, however an ASHP feeding an immersion heater are preferred in this instance.

7.3. Ground Source Heat Pump (GSHP)

GSHPs have been developed specifically for the housing market and are now considered to be an established reliable technology. The GSHP would be sized to cater for the heating and domestic hot

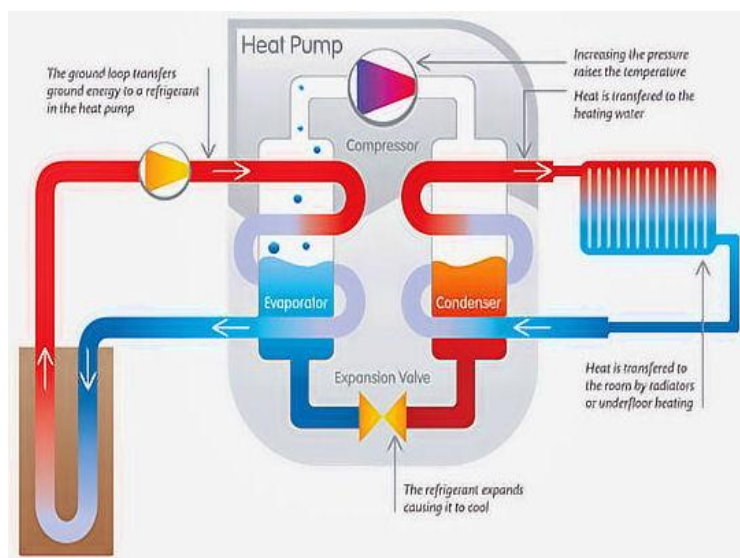


Figure 9 - Principles of a GSHP system

water requirements. Typically, they are more suited to apartments as a centralised system would be installed with multiple bore holes to a depth of up to 125 metres depending on the ground conditions. GSHPs use a heat exchanger to extract heat from the earth.

The efficiency of ground source heat pumps is measured by Co-efficient of Performance (CoP), this is the ratio of units of heat output for each unit of

electricity used to drive the compressor and pump for the ground loop. Average CoP is around 2-4 although some systems may produce a greater rate of efficiency. This means that for every unit of electricity used to pump the heat, 2-4 units of heat are produced, making it an efficient way of heating a building. If grid electricity is used for the compressor and pump, then there is the opportunity to

consider a range of energy suppliers to benefit from the lowest running costs, for example by choosing an economy 10 or economy 7 tariff.

GSHPs have been considered due to the dwelling scale and the requirement for a system to meet both heating and hot water demand as efficiently as possible. However, there isn't significant area of land available for boreholes or coils to be installed, and therefore air source heat pumps are the preferred option.

7.4. Air Source Heat Pump/Exhaust Air Heat Pump

Air source heat pumps (ASHP) and exhaust air heat pumps (EAHP) work in a similar way to GSHP. Air source heat pumps can be fitted on the external façade or in the roof space. An air source heat pump uses small amounts of electricity to take in large quantities of air and extract heat. The efficiency of ASHP is measured by Coefficient of Performance (CoP); this is the ratio of units of heat output for each unit of electricity used to drive the system. Average CoP is around 2-4 although some systems may produce a greater rate of efficiency.

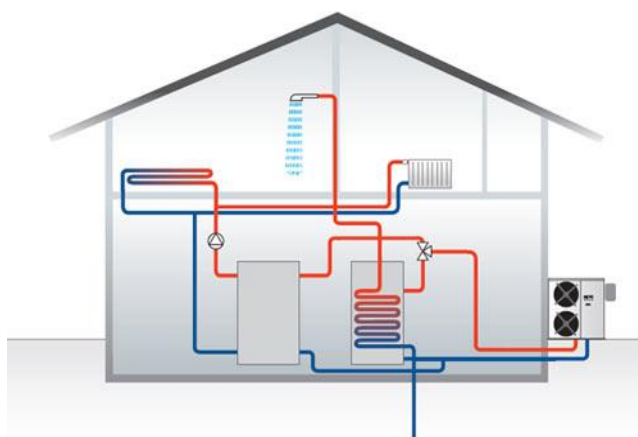


Figure 10 - Principles of an ASHP system

Exhaust air heat pumps such as the NIBE F370 work in a similar manner to ASHP units but have only indoor units (no outdoor compressors) and in addition they also recover heat from their integral exhaust air ventilation system. These units work well on apartment blocks and dwellings where mains gas is unavailable or unsuitable for a development. They are expensive in terms of capital cost of the equipment, installation and the enhanced structural requirements.

ASHPs are considered an appropriate technology for this scheme, due to their high COPs. Each dwelling will have its heating and hot water served by an individual ASHP.

7.5. Micro Wind Power

Wind power is one of the cleanest and safest methods of generating electricity. However, wind power is not feasible due to the fact the development is not in a windy and rural area located off a hillside. Most small wind turbines generate Direct Current (DC) electricity. Systems that are not connected to

the national grid require battery storage and an inverter to convert DC electricity into Alternating Current (AC) which is mains electricity.

There are two types of wind turbine available:

- Roof mounted – These are mounted on the roof of dwellings
- Mast mounted – Which are free standing

Important issues to consider when using wind turbines are:

- Wind speed increases with height so it's best to have the turbine high on a mast or tower.
- Generally speaking the ideal site is a smooth top hill with a flat, clear exposure, free from excessive turbulence and obstructions such as large trees, dwellings or other buildings.
- Small scale wind power is particularly suitable for remote off grid locations where conventional methods of supply are expensive or impractical.
- Where the local annual average wind speed is 6 m/s or more.
- Where there are no significant nearby obstacles such as buildings, trees or hills that are likely to reduce the wind speed or increase turbulence



Figure 11 - Mounted wind turbine

The average wind speed in this area is 4.2 m/s at a height of 10 metres, which is below the 6 m/s recommended. Therefore, micro wind would not be a viable technology for this development.

Biomass

Biomass is a generic name for any fuel produced from organic sources and falls into mainly two categories:

- Woody biomass- forest products, untreated wood products, energy crops and wood pellets
- Non-wood biomass – liquid biofuels (such as biodiesel, bioethanol) or animal waste industrial municipal products and high energy crops such as rape seed, sugar cane and maize.

For domestic properties the fuel used is normally wood pellets, wood chips or wood logs. For larger applications, biomass boilers replace conventional fossil fuel boilers and come with an automated feed by screw drives from hoppers.

Biomass systems require more cleaning than gas or oil boilers and they must be capable of being taken out of service for cooling and cleaning whilst maintaining the building heating supply particularly in communal heating systems. Centralised gas boilers are therefore still required to support the biomass boiler, which would be the lead boiler. The size of the dedicated plant rooms is substantial. Fuel availability, delivery and storage are also important issues to consider.

Air quality issues are also an important factor when looking to install biomass. The cost of the fuel depends on the type, delivery distances and whether it is obtained as simple waste product or from another organisation. The cost of wood pellets is currently a little more expensive than

mains gas, and woodchip is approx. 30% cheaper, however prices are fluctuating rapidly in the bio-fuel market at the present time creating uncertainty over their take up.



Figure 12 - Biomass boiler and hopper

Biomass CHP is still relatively new to the UK market and is more suitable to large developments where energy demand does not require significant modulation. There are technical issues with small scale Biomass CHP and until these can be resolved and proven the take up of these systems in the UK and Europe has been slow.

Overall carbon savings of 40%+ are achievable with biomass technology. Biomass is more suited to a communal heating system; there is insufficient space to accommodate the equipment and fuel storage to facilitate a biomass boiler. Furthermore, there are noise and air quality issues associated with this type of technology. For this reason biomass is discounted.

8. Energy Assessment of Proposed Scheme

The Oakenrod development will adopt the principles of the 'Be Lean, Be Clean, Be Green' energy hierarchy.

The most practical and economically feasible solution for the development is a good quality thermally insulated fabric, airtight envelope, passive improvements and the use of highly efficient heating and hot water systems supported by an efficient ventilation extract system.

Table 5 - Proposed carbon emissions from the Oakenrod development

Ref	Dwelling Type	No. of Type	TER	DER	TPER	DPER	Total Carbon Emissions (Kg CO ₂ /yr)	Total Primary Energy (kWh/yr)
Z52388	House Type A	2	13.98	6.57	73.56	69.40	587	6,206
			53%		6%			
Z52389	House Type A	2	16.72	6.34	92.07	66.95	615	6,495
			62%		27%			
Z52390	House Type B	12	12.04	5.54	62.92	58.32	5,014	52,782
			54%		7%			
Z52391	House Type C	14	11.04	5.10	57.58	53.54	6,323	66,381
			58%		7%			
Z52392	House Type D	4	10.70	4.47	55.87	46.77	2,062	21,578
			59%		16%			
Z52393	House Type E	6	13.03	5.33	70.03	55.65	3,560	37,173
			59%		21%			
Z52394	House Type F	12	10.84	5.04	57.08	52.60	7,530	78,584
			54%		8%			
Total		52	56%		12%		18,162	190,615

The carbon emissions are 18,162 Kg/CO₂/yr. This is a total carbon reduction of 22,935 Kg/CO₂/yr from the baseline emissions of 41,097 Kg/CO₂/yr this equates to a 55.81% carbon reduction.

The primary energy rate is 190,615 kWh/yr. This is a primary energy reduction of 25,785 kWh/yr. This equates to a 11.92% primary energy reduction.

The development proposal meets local policy through a highly efficient thermal fabric, energy efficient lighting and ventilation, low air leakage, a highly efficient air source heat pump for space and water heating.

9. Conclusion

Following the 'Be Lean, Be Clean, Be Green' hierarchy, the proposed design solutions are predicted to reduce the total carbon emissions by 22,935 Kg/CO₂/yr from the baseline emissions of 41,097 Kg/CO₂/yr this equates to a 55.81% carbon reduction.

The approach for the Oakenrod development is to embed sustainability into the heart of the development through a range of design measures based on the 'Be Lean, Be Clean, Be Green' design hierarchy. Measures will include:

- 1) Enhanced building fabric to meet the new Building Regulations ADL1 2021 (15/06/2022)
- 2) Enhanced air tightness and thermal bridging
- 3) Efficient decentralised extract ventilation system
- 4) Heating and hot water will be provided by an air source heat pump
- 5) Efficient lighting strategy using CFL or LED type fittings

9.1. Low and Zero Carbon Technology Review

- Solar Thermal Hot Water has not been proposed as an option as an air source heat pump is proposed and the majority of hot water demand will be provided through this system.
- PV has been discounted within the preliminary SAP calculations as it is currently not needed to comply with ADL1A and local planning policies. However, it is considered the most appropriate route to achieving the lower carbon emission reductions.
- Biomass has been discounted as it poses problems in terms of air quality, delivery of fuel, storage and transportation for deliveries etc. It would require a centralised larger plant space for storing fuel, which on this constrained site is not viable.
- A micro wind-turbine would not provide significant levels of energy generation as the wind speeds in the area are not high enough generate electricity. Due to the layout of the site, there could be issues with turbulence, wind shading and noise, therefore this hasn't been included within the initial calculations.
- GSHPs are not considered for this development, due to the availability of land around the property for boreholes. There would need to be some plant room space required, and a full review of ground conditions and financial viability should be undertaken by a ground source heat pump manufacturer to ensure any unit is sized correctly.
- ASHP are considered for this development with each individual dwelling having its own system. The ASHP will provide the heating and hot water demand for all dwellings.

A more detailed overview of LZT technologies is provided in the appendices of this report.

9.2. Summary Headlines

- A fabric-first approach has been undertaken for the Oakenrod development, as defined within the 'Be Lean, Be Clean, Be Green' energy hierarchy. The proposed design provides compliance with Building Regulations ADL1 2021
- The use of high-efficiency air source heat pumps reduces carbon emissions by 56% and provides a primary energy reduction of 12% when compared to new building regulations Part L 2021.
- A wind turbine is not viable due to the wind speeds at this site.
- Site constraints and viability for District Heating Network (DHN) and Communal Heating Network (CHN) have been reviewed. Existing DHN is not sufficiently close to connect into. In addition to this, the scheme's heating and hot water (HW) demand is too small to justify connection to DHN or CHN.

An overall 56% improvement in CO₂ emissions and a 12% improvement in primary energy above the Building Regulations baseline is proposed to support our application and to meet policy requirements

	Total CO ₂ Emissions (kgCO ₂ /yr)	Total Primary Energy (kWh/yr)
Target Dwelling Performance	41,097	216,400
Proposed Dwelling Performance	18,162	190,615
Total Reduction	22,935	25,785
Percentage Improvement (above ADL1 2021)	55.81%	11.92%

10. Appendices

10.1. LZT Feasibility Table

Technology	Technical Feasibility	Carbon Savings	Estimated Costs	Financial Viability
Solar photovoltaics	A solar photovoltaic array could be provided on the pitched roofs to ensure carbon emissions reductions.	A 1kWp system could save around 427 kg of CO ₂ / year per dwelling.	Average cost for such a system is around £1.5K/kWp per dwelling.	A fuel cost saving of around £180 / year per kWp. Any unused energy can be sold back to the grid at an agreed price via energy supplier.
Wind	Average wind speeds on the site according to the <u>NOABL</u> Wind Speed Database are 5.2m/s. To be technically feasible a minimum of 6m/s is required, therefore there is no potential for installation.	TBC by wind turbine installer / manufacturer following a review of the proposed site and confirmation on grid connection.	TBC by wind turbine installer / manufacturer following a review of the proposed site and confirmation on grid connection.	TBC
Micro Hydro	Micro hydro generation has not been considered for this development.	N/A	N/A	N/A
District Heating	There are no existing or planned district heating networks to facilitate connection at this stage.	N/A	N/A	N/A
Solar Hot Water	This technology has been discounted as hot water generation will predominantly be met by the ASHP.	N/A	N/A	N/A
Heat Pumps	GSHP: Ground conditions on site are unknown, ASHP is the preferred technology for this development. ASHP: Heating and hot water to be provided by individual ASHPs to each dwelling.	GSHP: 1400 kg CO ₂ / year per dwelling ASHP: 1,700 to 2,700 kg CO ₂ per year per dwelling.	GSHP @ £15-20K per dwelling. ASHP: £7-11K per dwelling	GSHP: Fuel saving of £930 / year minimum based on SAP calculations. ASHP: £920 minimum annual RHI income generation per dwelling with fuel saving of £335 per year minimum per dwelling
Biomass	The development would not facilitate the installation of biomass boilers due to the space required for pellet storage. There are also air quality issues with this technology.	N/A	N/A	N/A

10.2. Specification for Energy Assessments (ADL1 2021 - SAP)

Item	Brief Description	Notes	Confirm
	The following information is required for the design submission (as per requirements of approved doc L1).	Please note submission is now in two stages. A) Design , B) As installed	
1. Dwelling Type			
1.1	Building Regulations Part L1 2021 apply.		
1.2	Post code of site is TBC		
1.3	Electricity is supplied by standard tariff rather than economy 7, 10 or 24.	<i>Assumed standard tariff</i>	
1.4	It is assumed that the dwelling has a medium thermal mass parameter.		
2. Floor Construction Details			
2.1	Ground floor is to achieve the U-value stated opposite.	U-Value = 0.12 W/m ² K	
3. Wall Construction Details			
3.1	Main external walls are insulated to achieve the U-value stated opposite.	U-Value = 0.18 W/m ² K	
3.2	Party Walls are fully filled and sealed to achieve the U-value stated opposite.	U-Value = 0.00 W/m ² K	
4. Roof Construction Details			
4.1	Pitched timber roofs are insulated with 500mm of mineral wool insulation to achieve the U-value indicated opposite.	U-Value = 0.09 W/m ² K	
5. Openings			
5.1	External doors are installed to achieve the U-value stated opposite.	U-Value = 1.00 W/m ² K	
5.2	All double-glazed windows and patio type doors/windows with Low-e glass soft coating to achieve the U-Value stated opposite.	U-value = 1.30 W/m ² K. g-value 0.63	
6. Ventilation			
6.1	Design SAP calculation presumes an air permeability of 4m ³ /m ² /hr at 50pa will be achieved.	<i>Air leakage testing and sealing is required to all plots</i>	
6.2	System 3 decentralised MEV installed	Greenwood CV2 GIP or equal and approved in wet areas SFP = 0.18 W/l/s	
7. Space Heating			
7.1	There is only one main heating system installed to each dwelling.		
7.2	Heating is provided by individual air source heat pump systems.	SAP default used for the calcs. <i>Expect further improvements when specifying a high-quality unit</i>	
7.3	The heating system has a programmer and room thermostats.		
7.4	Radiators or Underfloor heating can be provided throughout with pipes in a thin screed.		
7.5	Weather compensation is not installed.		
7.6	The central heating pump is located inside the dwelling.	<i>Within the heated space</i>	
8. Water Heating			
8.1	Hot water is provided from the air source heat pump.	Storage = 200L 100mm factory fitted foam insulation	

8.2	Water usage per person per day is ≤ 105 Litres.	To exceed Part G. Requires good specification of flow rates on all water consuming appliances – taps, showers, etc	
9. Renewables			
9.1	No renewable technology provided.		
10. Other			
10.1	Low energy (LE) lights are installed throughout.	All lighting must be specified with efficacy of 80 lumens/circuit watt or more.	
10.2	Windows can be half opened in summer to prevent overheating.		
10.3	No cooling is installed to the dwelling.		
10.4	The default standard will be enhanced construction details to match or exceed the psi values below. To enhance the thermal bridging the specialist values will be adopted.	Specialist Psi values will be adopted. Thermal bridging calcs are required	
10.5	Showers will be supplied from the air source heat pump system	Flow regulated to 9l/min @3bar	

10.3. Index of Tables and Figures

Figure 1 - Location and surrounding area of proposed Oakenrod development	7
Figure 2 – Architectural site plan for the proposed Oakenrod development	8
Figure 3 – Typical Floor plans for the proposed Oakenrod development	9
Figure 4 - Architectural representation of Oakenrod Dwellings elevations	16
Figure 5 - Location of site in relation to current heat networks (Source: ADE District Heating Installation Map)	19
Figure 6 - Performance of photovoltaic panel orientation	20
Figure 7 - Photovoltaic array on a pitched roof	21
Figure 8 - The principles of a solar thermal system	21
Figure 9 - Principles of a GSHP system.....	22
Figure 10 - Principles of an ASHP system.....	23
Figure 11 - Mounted wind turbine.....	24
Figure 12 - Biomass boiler and hopper	25
 Table 1 - Proposed development CO ₂ emissions against Building Regulations Part L1 2021.....	5
Table 2 – Key National Planning Policy Requirements and Design Responses.....	10
Table 3 – Key Local Planning Policy Requirements and Design Responses	11
Table 4 - Baseline dwelling carbon emissions.....	15
Table 5 - Proposed carbon emissions from the Oakenrod development.....	26