HYDE ROAD

GORTON

MANCHESTER

M18 7FB

ENERGY STATEMENT

For:

Grays Architecture

September 2017

Project no. 6121

HYDE ROAD

GORTON

MANCHESTER

M18 7FB

ENERGY ASSESSMENT

GRAYS ARCHITECTURE

REVISION	DATE	PREPARED BY	REVIEWED BY	COMMENTS
0	08/09/2017	Tracey Walsh	M Heptonstall	For Comment

The current report provides a brief overview of the wide range of opportunities for renewable energy and is not intended as detailed design advice. As such data and information should only be treated as INDICATIVE at this stage of the process. Further investigation can be undertaken when more accurate and detailed information is required on specific measures.

No part of this document may be reproduced or transmitted in any form or by any means, in whole or in part, without the written permission of C80 Solutions.

Whilst C80 Solutions has endeavoured to ensure that all information contained within this document is correct, it cannot be held responsible for any inaccuracies within or problems arising out of the use of this document.

2nd Floor Suite
Sanderson House
22 Station Road
Horsforth
Leeds
LS18 5NT
E: mail@c80solutions.co.uk
W: www.c80solutions.co.uk

Contents Page

1.0 Introduction..... 3

1.1 About C80 Solutions 3

1.2 Introduction to Developments 4

1.3 Planning Policy.....7

1.4 Methodology.....14

2.0 Predicted Annual Carbon Emissions.....15

3.0 Predicted Annual Energy Demand 16

4.0 Reducing Carbon Emissions through Energy Reduction 17

5.0 Feasibility Study of Renewable Technologies.....18

6.0 Improvements.....21

1.0 Introduction

1.1 About C80 Solutions

C80 Solutions are independent Sustainability and Energy Consultants providing carbon reduction solutions to help the UK achieve its carbon emission reduction target of 80% by 2050 - as set out in the Government's Climate Change Act 2008.

Our range of affordable but comprehensive solutions for the construction industry are broken down into two sectors; i) Building Compliance and ii) Consultancy.

Building Compliance:
Our Building Compliance services include; Code for Sustainable Homes Assessments, SAP Calculations, On Construction Energy Performance Certificates, Water Efficiency Calculations, SBEM Calculations, Commercial EPCs, BREEAM assessments and Air Tightness Testing.

Consultancy:
Our experience and exposure to building compliance combined with previous experience and IEMA accredited training means we have built up a vast amount of knowledge which enables us to provide our clients with invaluable advice. Our Consultancy services include; Renewable Energy Feasibility Reports, Energy Statements for planning, Sustainability Statements and Building Compliance Advisory Reports.

1.2 Introduction to Developments

C80 Solutions have been instructed by Grays Architecture to prepare an Energy Statement for the proposed residential new build development at Hyde Road, Gorton, Manchester, M18 7FB

The project anticipates the new build of 26 2 and 3 bed, 2 and 3 storey properties.

The site is located in a residential area of Manchester.

The plan of the proposed development can be seen in Figures 1 & 2 below.

Figure 1: Plan of the Proposed Development (Ground, First & Second Floors)



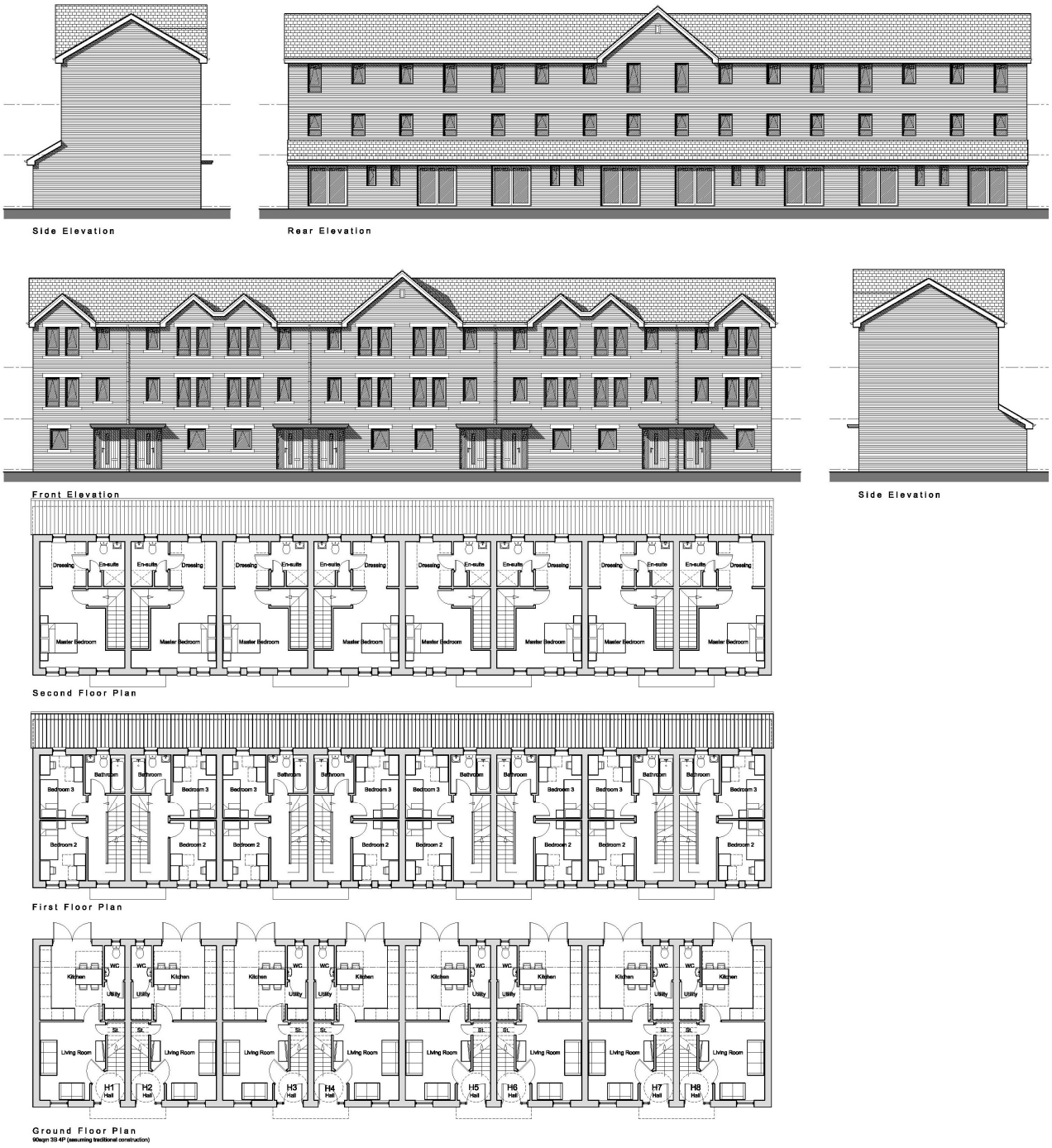
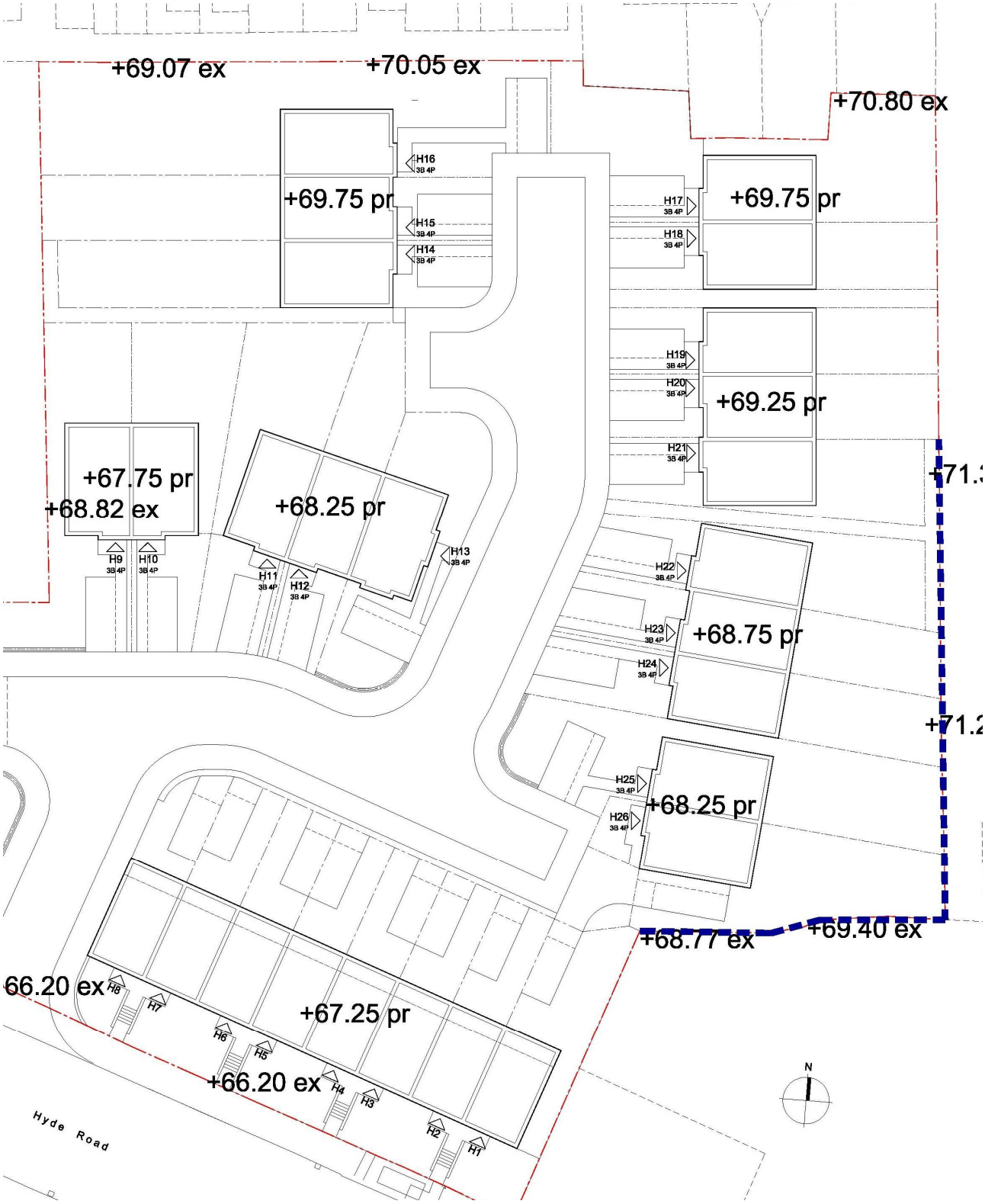


Figure 2: Site Plan of the Proposed Development


+69.07 ex
+70.05 ex
+70.80 ex
+69.75 pr
+69.75 pr
+69.25 pr
+67.75 pr
+68.82 ex
+68.25 pr
+68.75 pr
+68.25 pr
+67.25 pr
+66.20 ex
66.20 ex
+68.77 ex
+69.40 ex
+71.3
+71.2
H1
H2
H3
H4
H5
H6
H7
H8
H9
H10
H11
H12
H13
H14
H15
H16
H17
H18
H19
H20
H21
H22
H23
H24
H25
H26
3B 4P
Hyde Road
N

This statement will demonstrate how the predicted CO2 emissions of the proposed development will be reduced by % compared with a typical 2013 Building Regulations Part L compliant building, as required by the Manchester City Council.

1.3 Planning Policy

The following Energy/CO2 related planning policies are applicable to this development:



Policy	Indicator	
EN1 - EN3	No of planning permissions compliant with EN1	100%
	No of planning permissions compliant with EN2	100%
	% of appeals based on EN2 dismissed	100%
	Buildings of Grade 1 and 2* at risk of decay	To reduce from 8% to national average (3.1% in 2010)
	Buildings of Grade 2 at risk of decay	National average
	Review of Conservation Areas (to be developed)	All reviewed by 2016 (5-year programme starting in 2011)

Design to reduce carbon emissions

12.24 Climate Change and its impact on the environment both urban and natural is recognised as one of the most significant challenges facing Manchester. It is essential that the way in which Manchester develops over the plan period and beyond is set within the context of mitigating the impacts of climate change and adapting to its affects on the local environment. This affects all areas of the City and references to climate change are found throughout the document. This section however sets out specific policies aimed at increasing local decentralised energy and reducing carbon emissions and the impacts of climate change. The Green Infrastructure and Environmental Protection section includes managing increased localised flood risk, enabling urban environments to deal with increased summer temperatures and other policy areas where an element of protection is required to ensure that a high standard of environment is created and maintained.

Policy EN 4

Reducing CO_2 Emissions by Enabling Low and Zero Carbon Development

The Council will seek to reduce fuel poverty and decouple growth in the economy, growth in CO_2 emissions, and rising fossil fuel prices, through the following actions:

- All development must follow the principle of the Energy Hierarchy, being designed:



- to reduce the need for energy through design features that provide passive heating, natural lighting and cooling
- to reduce the need for energy through energy efficient features such as improved insulation and glazing
- to meet residual energy requirements through the use of low or zero carbon energy generating technologies

- Wherever possible new development and retrofit projects, including energy generation plant, must be located and designed in a manner that allows advantage to be taken of opportunities for low and zero carbon energy supplies.
- Where possible new development and retrofit projects will be used as a mechanism to help improve energy efficiency and provide low and zero carbon energy supplies to existing buildings.
- Where appropriate new development and retrofit projects will be required to connect to and/or make contributions to low or zero carbon energy schemes and/or to incorporate provision to enable future connection to any existing / potential decentralised energy schemes.
- The use of building materials with low embodied carbon in new development and refurbishment schemes.

12.25 Reduction in CO_2 emissions is seen as a major component in mitigating climate change. In this regard, areas of Government policy give rise to the following three national and regional targets:

- A national reduction in CO_2 emissions by 34% in 2020 and by 80% in 2050, (from a 1990 baseline) to which buildings will need to make a proportionately higher contribution, as set out in the Climate Change Act 2008.
- 'Zero' carbon targets for all new housing by 2016 and for all new non-residential development by 2019, for which preparation will be required (See table 12.3).
- A national increase in renewable energy capacity by 15% by 2020 as set out in the UK Renewable Energy Strategy, which will require an uplift in current levels.

12.26 The vision for the City to be a growing economy in the front rank of European and world cities will inevitably mean increased development and an increasing population. In this context there are three main challenges for the Council in seeking to reduce CO_2 emissions:

- To achieve growth in the economy in a sustainable manner which reduces CO_2 emissions from energy and transport in line with national targets;
- To protect the future competitiveness of the economy by taking measures to insulate it from further fossil fuel price rises and increase energy security;
- To position the City as a low carbon investment location, in line with Manchester City Region's designation as a Low Carbon Economic Area.



12.27 Current projections suggest that without further concerted action the City will not be able to achieve CO_2 reductions in line with the overarching national target by 2020. There is therefore a strong justification for strong planning policies.

12.28 In December 2009 Manchester City Council formally adopted the stakeholder climate change action plan 'Manchester - A Certain Future'. The action plan commits Manchester City Council, through its own operations and by influencing partners, to lower CO_2 emissions by 41% by 2020 from 2005 levels. This equates to a CO_2 emissions reduction from 3.2 million tonnes per annum (2005) to less than two million.

12.29 In order to achieve these demanding targets new development and activities in Manchester will need to be located where they are easily accessible and well connected to the rest of the city by walking, cycling and public transport (See Spatial Principles and Transport). It will also be essential that as a minimum new development reduces CO_2 emissions in line with the Government programme for achieving zero carbon levels for new development. Where opportunities exist, however, measures will be taken to achieve greater reductions, with regard to the energy hierarchy, Policy EN6 and supplementary guidance to be published by the City.

12.30 It is recognised that much of the City's CO_2 emissions do, however, arise from the existing commercial and residential building stock. It is essential therefore that wherever the opportunity exists new development be used as a catalyst to enable the retrofitting of energy efficiency improvements and low or zero carbon infrastructure to the existing building stock. Similarly where existing buildings are to be improved any proposed works should also follow the principles of the energy hierarchy. It is beginning to be recognised that carbon is embedded within all activities and goods. It is important that the total carbon footprint of new and refurbished buildings is considered, and that where possible renewable materials and/or those with low embodied carbon are used.

12.31 Fuel poverty is an issue in Manchester and the opportunities to increase energy efficiency and reduce carbon emissions will also have a significant effect on reducing the cost of heating to individual households.

Policy EN 5

Strategic Areas for low and zero carbon decentralised energy infrastructure

Within Manchester it is considered that the following strategic areas, indicated on the key diagram, will have a major role to play in achieving an increase in the level of decentralised, low and zero carbon energy supplies available:

- The Regional Centre, which also includes the Oxford Road Corridor and Eastlands
- District Centres and associated major development sites
- Airport Strategic Site



- Strategic housing location
- Strategic employment locations

Within these areas new development, regeneration and retrofit projects, will be expected to take place in the context of more detailed proposals for decentralised low and zero carbon energy infrastructure in the form of energy proposals plans. The Council will work with all relevant stakeholders, which may include developers, landowners, residents, community groups, private sector partners, utilities companies, neighbouring authorities and other public sector bodies, as appropriate, to bring forward such plans.

Where investment or development is being undertaken into or adjacent to a public building/asset or district heating network, full consideration shall be given to the potential role that these can have in providing an anchor load within a decentralised energy network or in creating opportunities for CO_2 reduction funded by contributions.

12.32 The ten local authorities which make up AGMA jointly commissioned a study into the resources available to promote decentralised and renewable energy within the Manchester City Region. This study called the 'AGMA Decentralised and Zero Carbon Energy Planning Study' was finalised in January 2010 and provides the evidence base for the spatial approach to energy planning proposed by Manchester.

12.33 The AGMA study identified the potential for achieving higher levels of CO_2 reduction by identifying lower cost technology opportunities associated with different 'character areas of change', as well as the use of local energy assets and resources and the linking together of new and existing buildings. This potential was demonstrated through thirteen detailed case studies undertaken across the range of character areas and involving different types of development. Using this evidence base, the areas listed in policy EN5 above have been identified as having a strategic role to play in reducing carbon emissions for three main reasons:

- They are the anticipated focus for new development and population growth over the Core Strategy plan period and are therefore the locations where new low and zero carbon technology can be included at the earliest design stages.
- They will contain the highest density of development and therefore are more likely to offer opportunities for the introduction of heat networks.
- They are areas where the mix of development types proposed will again provide greater opportunities for the development of heat networks.

12.34 In line with the recommendations of the AGMA study, the City intends to bring forward energy proposals plans and associated business plans for investment in appropriate low or zero carbon infrastructure in the areas listed in Policy Approach EN5. These will facilitate the cost effective achievement of the CO_2 target framework set out in Policy Approach EN6 and contribute to the City's overall low and zero carbon technology mix, thereby supporting Policy EN4. An example of this approach is contained within the West Gorton Energy Proposal Plan



Study which was commissioned by New East Manchester and the Council, in partnership with the Carbon Trust. This investigated the most viable energy opportunities available for a proposed development masterplan, the associated reductions in carbon emissions that could be achieved and also set out a business case to demonstrate how this could be achieved in a cost effective manner.

12.35 A set of 'allowable solutions' will also be specified for each energy proposals plan that developers will be able to, or in some cases be required to, make contributions to in order to obtain CO_2 credits. If it can be shown that further CO_2 reductions can be made at no extra cost by using an 'allowable solution' developers will be required to use this solution or provide an equivalent reduction in CO_2 emissions.

12.36 Another key outcome of the AGMA study has been to demonstrate that it may not be possible to achieve the greatest sub-regional reduction of CO_2 emissions unless work is undertaken jointly on projects with other Districts. The Council will, therefore, work together with other local authorities to promote a co-ordinated approach to planning energy infrastructure across the City Region with the aim of achieving greater CO_2 reductions than would be possible through Manchester acting unilaterally.

12.37 The Council will also work to ensure that strategic investment decisions by the public and private sector are based around and aligned to the need to strengthen the business case of energy investments and therefore to attract long-term investment in the low and zero carbon energy infrastructure required.

Policy EN 6

Target Framework for CO_2 reductions from low or zero carbon energy supplies

Applications for residential development of 10 or more units and all other development over 1,000 sq m will be expected as a minimum to meet the target shown in Tables 12.1 or 12.2, unless this can be shown not to be viable. This should be demonstrated through an energy statement, submitted as part of the Design and Access Statement. Such a statement will be expected to set out the projected regulated energy demand and associated CO_2 emissions for all phases of the development.

Developments smaller than the above threshold, but involving the erection of a building or substantial improvement to an existing building will also be expected to meet the minimum target, where viable, but will not be expected to submit an energy statement.

The target framework relates to three broad development locations and their potential for low and zero carbon, decentralised energy. The areas are defined as follows



- Target 1 Network development areas: Locations where the proximity of new and existing buildings, the mix of uses and density of development provide the right conditions to support district heating (and cooling).
- Target 2 Electricity intense areas: Locations where the predominant building type has an all electric fit-out such as retail units and leisure complexes.
- Target 3 Micro-generation areas: Locations where lower densities and a fragmented mix of uses tend to mean that only building scale solutions are practical.

Domestic CO_2 emissions reduction targets

Table 12.1

Target	% Minimum requirement
Target 1: Network development area	CHP/district heating anchor or connection or where not feasible a 15% increase on Part L 2010
Target 2: Electricity intense buildings	+15% increase on Part L 2010
Target 3: Micro generation area	+15%increase on Part L 2010

Non-domestic CO_2 emissions reduction targets

Table 12.2

Target	% Minimum requirement
Target 1: Network development area	CHP/district heating anchor or connection or where not feasible, a 15% increase on Part L 2010
Target 2: Electricity intense buildings (Applies to commercial uses with a high proportion of emissions from electricity use (>45 kg CO2/m2))	+10%increase on Part L 2010
Target 3: Micro generation area	+15% increase on Part L 2010

1.4 Methodology

The methodology that has been applied in this report is as follows:

1. Prepare baseline energy calculations for the site based on a Part L 2013 compliant construction specification designed for the development.

2. From the baseline energy calculations, the predicted energy demand for the development in kWh/year and the predicted CO2 emissions in kgCO2/year for the site can be established.

3. Multiplying the site wide predicted CO2 emissions figure by % will provide the CO2 reduction target required.

4. Apply energy efficient design principles (improved fabric spec) in order to reduce the energy demand and CO2 emissions of the site. Prepare energy calculations using the improved fabric specification.

5. From these improved calculations, the reduced energy demand for the development in kWh/year and the predicted CO2 emissions in kgCO2/year for the site can be established.

6. Carry out a renewable energy feasibility study to ascertain which LZC technologies would be suitable for the development.

7. Establish the sizing of suitable renewable technologies to ensure the energy generation target is met.

2.0 Predicted Annual Carbon Emissions

Baseline SAP 2012 calculations were prepared based on the construction specification shown in table 1 below.

Aspect		New Build
Fabric U-values W/m²K	Ground Floor	0.20
	External Walls	0.30
	Pitched Roof	0.20
	Windows	2.2
	Doors	2.2
	Party Walls	N/A
	Thermal Bridging	ACDs
Ventilation	Airtightness m3/(hr.m²)	5
Heating	Boiler	Gas Combi
	Compensator	none
	Hot Water	As per boiler
	Controls	Fully Time & Temperature Controlled
	Secondary Heating	N/A
Low energy lighting		100%
Ventilation		Natural ventilation with extracts
Renewables / LZC		None

Table 1: Part L compliant construction specifications

The conducted SAP calculations have shown the proposed development will generate **39,721 kgCO2/year.** In this instance, the Target Emission Rate (TER) according to Building Regulation Standard is **43,683** kgCO2/yr, therefore, since the development's predicted CO2 emissions is **39,721 kgCO2/yr**, we will be seeing an 9.1% reduction in kgCO2 from the TER and once the 8.5% reduction has been calculated, this would equate to a reduction of **3,962 kgCO2/yr.** In other words, providing the total site-wide emissions comes equal to or less than the target emissions rate (TER) this would prove that a % reduction has been met.

3.0 Predicted Annual Energy Demand

Based on using the specification outlined in table 1 above, this would create a total predicted energy demand for the development of **184,592kWh/year**. The breakdown of this predicted energy demand can be seen in table 2 below. The figures quoted have been derived from the Design Stage SAP 2012 Calculations for the development.

			Total Predicted Energy Requirement (kWh/yr)			
			Space Heating	Water Heating	Lighting, Pumps, Fans	Total Predicted Energy Requirement (kWh/yr)
Plot	No.	Units	Gas	Gas	Electric	
Plot 1	1	kWh/yr	4,468	2,180	516	7,164
Plot 2	1	kWh/yr	3,725	2,198	516	6,440
Plot 3	1	kWh/yr	3,725	2,198	516	6,440
Plot 4	1	kWh/yr	3,725	2,198	516	6,440
Plot 5	1	kWh/yr	3,725	2,198	516	6,440
Plot 6	1	kWh/yr	3,725	2,198	516	6,440
Plot 7	1	kWh/yr	3,725	2,198	516	6,440
Plot 8	1	kWh/yr	4,393	2,182	516	7,092
Plot 9	1	kWh/yr	3,812	2,129	477	6,498
Plot 10	1	kWh/yr	3,812	2,129	477	6,498
Plot 11	1	kWh/yr	3,722	2,124	457	6,303
Plot 12	1	kWh/yr	3,414	2,175	482	6,071
Plot 13	1	kWh/yr	3,728	2,124	457	6,308
Plot 14	1	kWh/yr	3,915	2,129	477	6,522
Plot 15	1	kWh/yr	3,915	2,129	477	6,522
Plot 16	1	kWh/yr	3,800	2,123	457	6,379
Plot 17	1	kWh/yr	3,495	2,123	482	6,151
Plot 18	1	kWh/yr	3,805	2,174	457	6,385
Plot 19	1	kWh/yr	3,800	2,123	457	6,379
Plot 20	1	kWh/yr	3,495	2,174	482	6,151
Plot 21	1	kWh/yr	3,805	2,123	457	6,385
Plot 22	1	kWh/yr	3,800	2,123	457	6,379
Plot 23	1	kWh/yr	3,495	2,174	482	6,151
Plot 24	1	kWh/yr	3,805	2,123	457	6,385
Plot 25	1	kWh/yr	3,915	2,129	477	6,522
Plot 26	1	kWh/yr	3,915	2,129	477	6,522
Total			**107,119**	**64,894**	**12,578**	**184,592**

Table 2: Baseline Predicated Annual Energy Demand

4.0 Reducing Carbon Emissions through Energy Reduction

The Energy Hierarchy sets out the most effective way to reduce a dwelling's CO_2 emissions. Firstly by reducing energy demand, then by using energy efficiently and lastly by incorporating LZC/Renewable technologies.

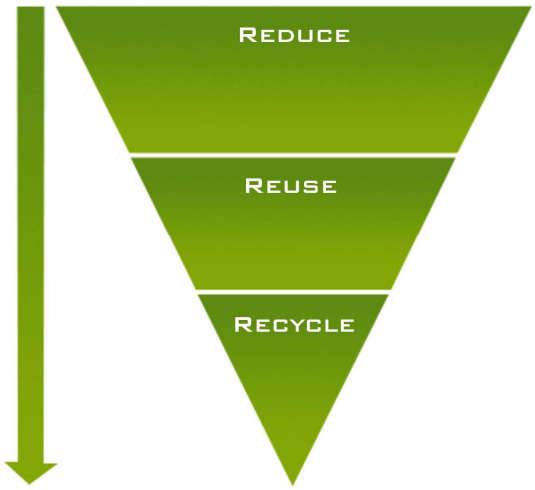


Figure 3: The Energy Hierarchy

Reducing the need for energy usage in the dwelling's design:

The first and most cost beneficial action is to reduce the amount of energy needed by the occupants of the dwelling whilst still maintaining or even improving the comfort conditions. A lot can be achieved through passive design, improving the dwelling's external fabric and following principles to reduce air infiltration.

The developer is attempting to reduce the energy demand and CO2 emissions of the development by making the following fabric and energy efficiency improvements to their standard Part L 2013 building specification:

Energy reduction strategies include:

- Adopting enhanced fabric specifications
- Installing high efficiency gas boiler
- Incorporating energy-efficient lighting: 100% of all new lighting to be energy efficient
- Adopting principles of airtight construction
- All new windows will be double –glazed
- Passive Solar Design – Solar gain, solar shading, thermal mass
- Natural / Passive Ventilation strategy

5.0 Feasibility Study of Renewable Technologies

This section will assess the technical viability of the following renewable energy technologies for the site in order to rule out unfeasible options:

- Mast mounted wind turbines
- Roof mounted wind turbines
- Solar PV (Photovoltaic) Panels
- Solar Thermal Panels
- ASHP (Air Source Heat Pump)
- GSHP (Ground Source Heat Pump)
- Biomass
- CHP

The following observations have been made with regard to the technical feasibility of integrating renewable energy technologies into this development.

Renewable Technology	Feasible	Reasons
Mast Mounted Wind Turbine	No	There is no sufficient open land for a mast mounted wind turbine to be installed on site.
		The site is situated in a densely populated area. Surrounding properties aren't far enough away to be unaffected by turbine noise, reflected light and shadow flicker.
		The site area is surrounded by buildings and other obstructions that could cause uneven and turbulent wind patterns. Turbulent air conditions may reduce lifespan of components.
		Currently the BWEA suggests a large wind turbine to be viable where wind speed is 7m/s or above. According to the NOABL database the average wind speeds for the site is: 4.8 m/s at 10m, 5.4 m/s at 25m and 6 m/s at 45m height for the property postcode (M18 7FB). Therefore the wind speeds are not sufficient for a mast mounted wind turbine to be viable.
Roof Mounted Wind Turbine	No	The site area is surrounded by buildings and other structures that could cause uneven and turbulent wind patterns. Turbulent air conditions may reduce lifespan of components.
		Roof mounted wind turbines are not yet a proven technology and a number of technical problems have been identified by manufacturers which are being investigated to rectify these issues. Vibration that can be transmitted to the building structure. Noise from a turbine may cause irritation to occupants of the dwelling and adjacent buildings. Noise may also adversely affect ventilation strategy.
		Currently the BWEA suggests a large wind turbine to be viable where wind speed is 7m/s or above. According to the NOABL database the average wind speeds for the site is: 4.8 m/s at 10m, 5.4 m/s at 25m and 6 m/s at 45m height for the property postcode (M18 7FB). Therefore the wind speeds are not

		sufficient for a roof mounted wind turbine to be viable
Solar PV (Photovoltaic) Panels/Tiles	No	The proposed development has sufficient flat roof area for solar panels accommodation.
		Most of the roofs should be free from overshadowing for most of the day from other buildings, structures or trees.
		The site is located in the region with high level of global horizontal irradiation (1,000-1050 kWh/m2/year)
Solar Thermal Collectors	No	The proposed development has sufficient flat roof area that can accommodate solar thermal panels.
		Most of the roofs should be free from overshadowing for most of the day from other buildings, structures or trees.
		The site is located in the region with high level of global horizontal irradiation (1,000-1050 kWh/m2/year)
		Solar thermal collectors would be compatible with the planned heating system.
		There will be a year round hot water demand.
		In practical domestic solar hot water systems, the solar hot water system is usually run in conjunction with, rather than instead of, a backup conventional boiler and as a result the carbon intensity of the combined system is high relative to other renewable. Moreover the high efficiency of modern condensing boilers, which can convert over 90% of means that the carbon intensity of these heat sources is relatively low at 200-300 Gco2/kWhth. As a result domestic solar water heating systems are a relatively expensive way of mitigating carbon emissions when they replace heat from efficient modern boilers. For this reason they are not recommended.
ASHP (Air Source Heat Pump)	No	The proposed development has not been designed to accommodate the space for a hot water cylinder.
		The buildings are suitable for a low-grade heat distribution system (e.g. underfloor water system, oversized radiators).
		Condenser units can be noisy and also blow out colder air to the immediate environment causing nuisance to the residents.
		An external ASHP will have to be installed close to the bedrooms, causing noise issues.
		There are reported performance issues with this technology. During the heating season the outside air temperature is often less than the ground temperature. This lower temperature has the effect of reducing the COP. For an air-to-water heat pump the standard specifies test conditions of 7Oc outdoor air temperature (source temperature). At external air temperatures lower than this, the COP will fall, as will the heating output of the heat pump. Depending on the application this reduction may be significant, such as during a cold winter morning when building pre-heat is needed.
GSHP (Ground Source Heat Pump)	No	It may be possible to drill a limited number of vertical or horizontal boreholes for GSHP on the site.

		It is possible for developments to accommodate a low-grade heat distribution system (e.g. underfloor water system, oversized radiators).
		The site and neighbourhood contain mature trees. Drilling boreholes on the site create the risk of damaging their roots.
		There is not sufficient space inside all the proposed dwellings for the heat pump equipment.
Biomass Boiler	No	There is an established fuel supply chain for the area.
		There isn't sufficient space for a delivery vehicle (vehicular access to fuel storage, turning circle etc)
		There isn't sufficient space in the proposed buildings for a wood-fuel boiler and associated auxiliary equipment.
		There isn't sufficient space for fuel storage to allow a reasonable number of deliveries.
		Biomass systems are management intensive (fuel sourcing, transport, storage) and require adequate expertise from users.
CHP	No	Given the proposed building use there won't be a high demand for heat for most of the year, therefore CHP won't be suitable.
		A CHP unit only generates economic and environmental savings when it is running at least 4,500 hours per year. This equates to an average heat demand of about 17 hours a day for five days a week throughout the year. The proposed development energy and heat demand profile does not match this requirement.
		CHP is typically utilized on buildings with high electricity and heating demand for most of the year such as local authority buildings, leisure centres, universities, hotels, and district heating schemes where CHP is used to provide electricity, space and water heating.
		CHP should be considered wherever there is demand for electricity and an appropriate demand for heat in the near vicinity.

Table 4: Feasibility Study of Renewable Technologies

Based on the feasibility study in table 4 above, the following technologies have been identified as being feasible for the proposed development.

- Solar PV (photovoltaic) panels

Unfortunately, due to the developer being a charitable organisation funds are not available for the provision of renewable resources.

6.0 Fabric Improvement

Prior to the addition of any renewable energy, the developer has focused on the fabric of the property and looked at ways in which to improve this by means of:

- The installation of additional fabric insulation
- An upgrade in glazing
- An improved heating system

Which means that once the above improvements have been carried out, the building will have reduced its C02 by 3,962Kg per annum from the proposed fabric improvements shown in table 1 above to the improved in table 2:

Aspect		New Build
Fabric U-values W/m²K	**Ground Floor**	0.13
	External Walls	0.19
	Pitched Roof	0.13
	Windows	1.4
	Doors	1.4
	Party Walls	N/A
	Thermal Bridging	ACDs
Ventilation	**Airtightness m3/(hr.m²)**	4
Heating	**Boiler**	Worcester Greenstar 25Cdi
	Compensator	none
	Hot Water	As per boiler
	Controls	Fully Time & Temperature Controlled
	Secondary Heating	N/A
Low energy lighting		100%
Ventilation		Natural ventilation with extracts
Renewables / LZC		None

Table 2: Part L compliant construction specifications

Table 5 below shows the percentage reduction in CO2 emissions following the proposed improvements.

The fabric improvements will allow the development to achieve a minimum of 9.1% reduction in the total CO2 emissions over Building Regulations 2013.

	Associated Total CO_2 ($kgCO_2/yr$)
Baseline (2)	43,683
With Fabric Imp	39,721
Reduction in CO2 (1)	3,962
% Reduction (1) / (2) x 100	**9.1%**