New Lubbesthorpe

New Community

Green Energy Statement

January 2012

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Proposals for 4,250 new homes
and related facilities and strategic
employment development

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Introduction

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This Green Energy Statement assesses the energy requirements of the proposed New Lubbesthorpe sustainable urban extension and strategic employment sites development in Blaby near Leicester and identifies a range of suitable renewable energy technologies to help meet the demands, consistent with policy targets The planning application applies for Outline consent (with details of the access) for up to 4,250 homes, the strategic employment site is 21 hectares accommodating approximately 84,000m2 of proposed employment development. The development proposals are described in the application and the accompanying Design and Access Statement and their environmental impacts assessed in the Environmental Statement, which assesses a development of 4,500 homes. The application site is adjacent to the existing urban area of Leicester and Blaby with the M1 to the east and residential and employment areas of Leicester Forest East and Enderby to the north and south respectively.

Planning Policy and Sustainable Development

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There is currently a range of Government policy targeted at improving the sustainability of our built environment through improved energy efficiency and the inclusion of low and zero carbon energy technologies. Much of this policy focuses on new development as this is one of the areas easiest to make advances in sustainability. This section briefly describes the policy, regulatory and financial frameworks within which renewable energy is being promoted. While the policy and regulatory frameworks set the overall standards, the scale and focus of financial incentives has a significant effect on the choice of which technologies are applied.

Planning Policy Framework

The current Planning Policy Statements (PPS) put renewable energy at the forefront of policy and require local authorities to set targets for renewable energy generation, specifically for new development. Blaby District Council is looking to incorporate the regional targets for renewable energy and Draft Policy 19 of the emerging draft Core Strategy states:

"10% of energy provided on new developments should be from decentralised and renewable or low carbon sources."

The Government is currently consulting on a new National Planning Policy Framework to replace the existing PPSs. The proposed policy aims to promote sustainable growth and encourage the use of renewable resources. The draft NPPF states:

"At the heart of the planning system is a presumption in favour of sustainable development, which should be seen as a golden thread running through both plan making and decision taking. Local planning authorities should plan positively for new development, and approve all individual proposals wherever possible."

NPPF page 4

Building Regulations

The Building Regulations provide a regulatory framework to ensure that buildings are safe, healthy, accessible and sustainable and are reviewed regularly by the Government.

Part L (conservation of fuel and power) of the Building Regulations was revised in 2010 to achieve higher levels of energy efficiency in new buildings. In effect this should result in a 25% reduction in CO2 emissions over the 2006 Part L Building Regulations, in line with Code 3 of the Code for Sustainable Homes (see below). It is anticipated that the Building Regulations will be reviewed upwards again in 2013.

Code for Sustainable Homes

The Code for Sustainable Homes (CfSH) was launched in 2006 and has been a mandatory assessment standard for the sustainability of all new dwellings since 2008. The code has a series of star ratings based on a sustainability score which assesses:

- Energy and CO2 Emissions
- Water Usage & Surface Water Run-off
- Construction Materials
- Waste
- (Operational) Pollution
- Health and Well-Being
- Environmental Impact
- Ecology

The ratings range from Code 1 (the lowest) to Code 6 which is considered the highest level of sustainability equivalent to achieving zero CO2 emissions from a building and accounting for both regulated and unregulated energy demand.

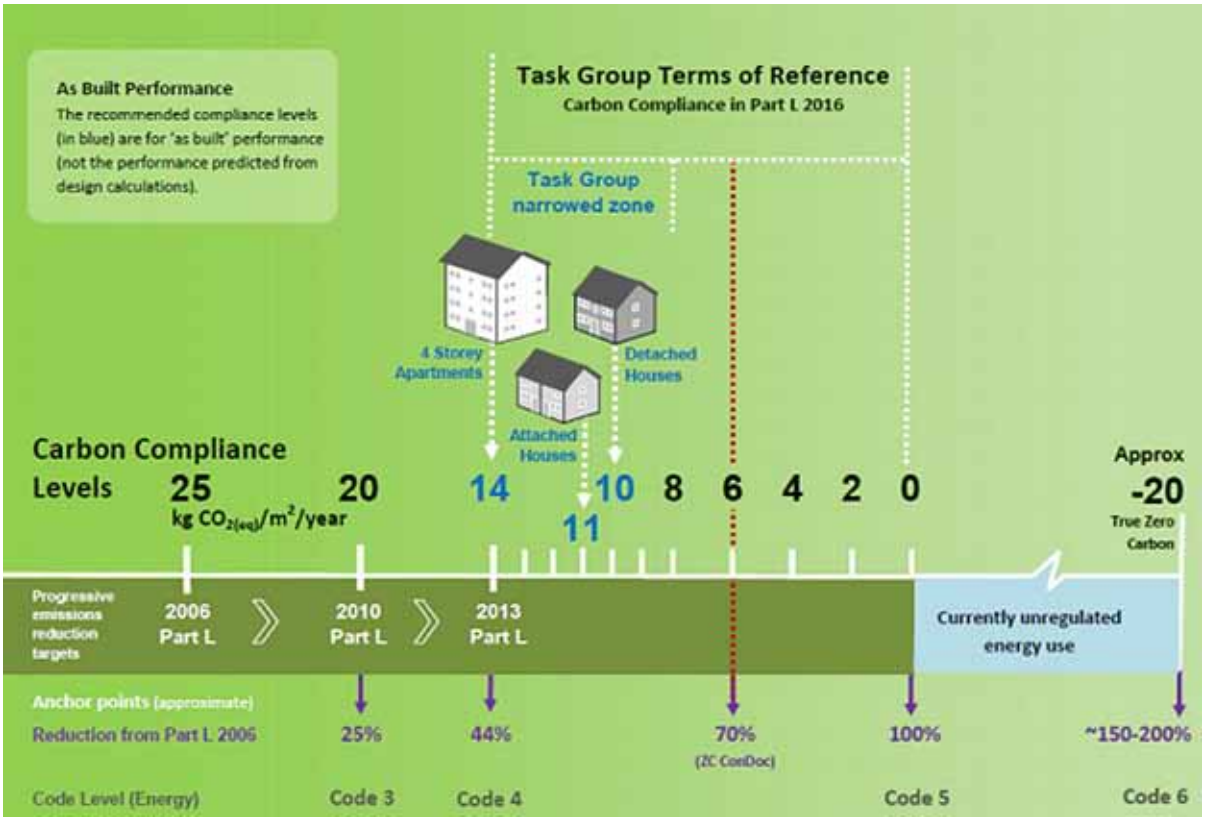
Zero Carbon Homes

In July 2007, the previous government published 'Building a Greener Future: Policy Statement' which announced that all new homes will be carbon zero from 2016 onwards. Plans to reduce CO2 emissions from new developments were originally detailed in the 'Definition of Zero Carbon Homes and Non-domestic Buildings' consultation paper. The policy largely focused on a reduction of CO2 emissions from the 2006 Building Regulations (Part L) in line with the Code for Sustainable Homes. In 2010 the Building Regulations were bought in line with Code 3, as discussed above.

The Coalition Government has recently stated in its Housing Strategy *'Laying the Foundations'* a commitment to Zero Carbon Homes (Chapter 7 paragraph 27).

The Zero Carbon Hub, a task force given lead responsibility by the Government for achieving zero carbon standards by 2016 has recommended a carbon compliance level for all new dwellings from 2016 depending on the house type, rather than a reduction on previous emissions levels. This compliance is expressed as kgCO2/m2 and is the amount of CO2 a dwelling can produce. Anything above this must be offset on site through further improved energy efficiency measures or renewable energy.

Figure 2.1 shows the recommended carbon compliance levels and how this corresponds with the Building Regulations and the Code for Sustainable Homes.



Renewable Energy Incentives

The Government operates a range of financial incentives designed to improve the investment potential of renewable energy technologies and increase their deployment. The current financial mechanisms are available for renewable heat and electricity generation for both homeowners and commercial generators. The take-up of technologies is sensitive to changes to the financial incentives.

Renewables Obligation

Introduced in 2002, the Renewable Obligation (RO) provides a competitive market to promote the uptake of renewable electricity generation. The RO requires electricity supply companies to source a growing proportion of electricity from renewable sources. Electricity suppliers can also meet the RO by purchasing Renewable Obligation Certificates (ROCs) from accredited renewable electricity generators, thus providing an extra stream of revenue. Each ROC represents 1MWh of renewable electricity generated.

Feed in Tariff

In April 2010 a Feed in Tariff (FIT) was introduced for renewable energy generators up to 5MW. The FIT runs alongside the RO and is aimed at promoting small scale renewable electricity generation. Generators below 5MW can choose to opt for either the FIT or the RO. The FIT allows accredited renewable electricity generators to obtain a FIT payment for every kWh of electricity generated, whether this is used on site or exported to the grid. FIT payments are banded to allow greater support for certain (emerging) technologies.

Renewable Heat Incentive

The Renewable Heat Incentive was recently introduced to support renewable heat technologies. The mechanism provides a tariff for each kWh of heat generated. At present only non-domestic installations are eligible for the RHI. It is anticipated that the RHI will extend to domestic installations in the future.

New Lubbesthorpe

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The New Lubbesthorpe community will comprise of mixed-use development providing up to 4,250 dwellings with primary schools, a secondary school, shops, health care and community facilities, local services and employment opportunities with the Strategic Employment Site to the south.

The Site

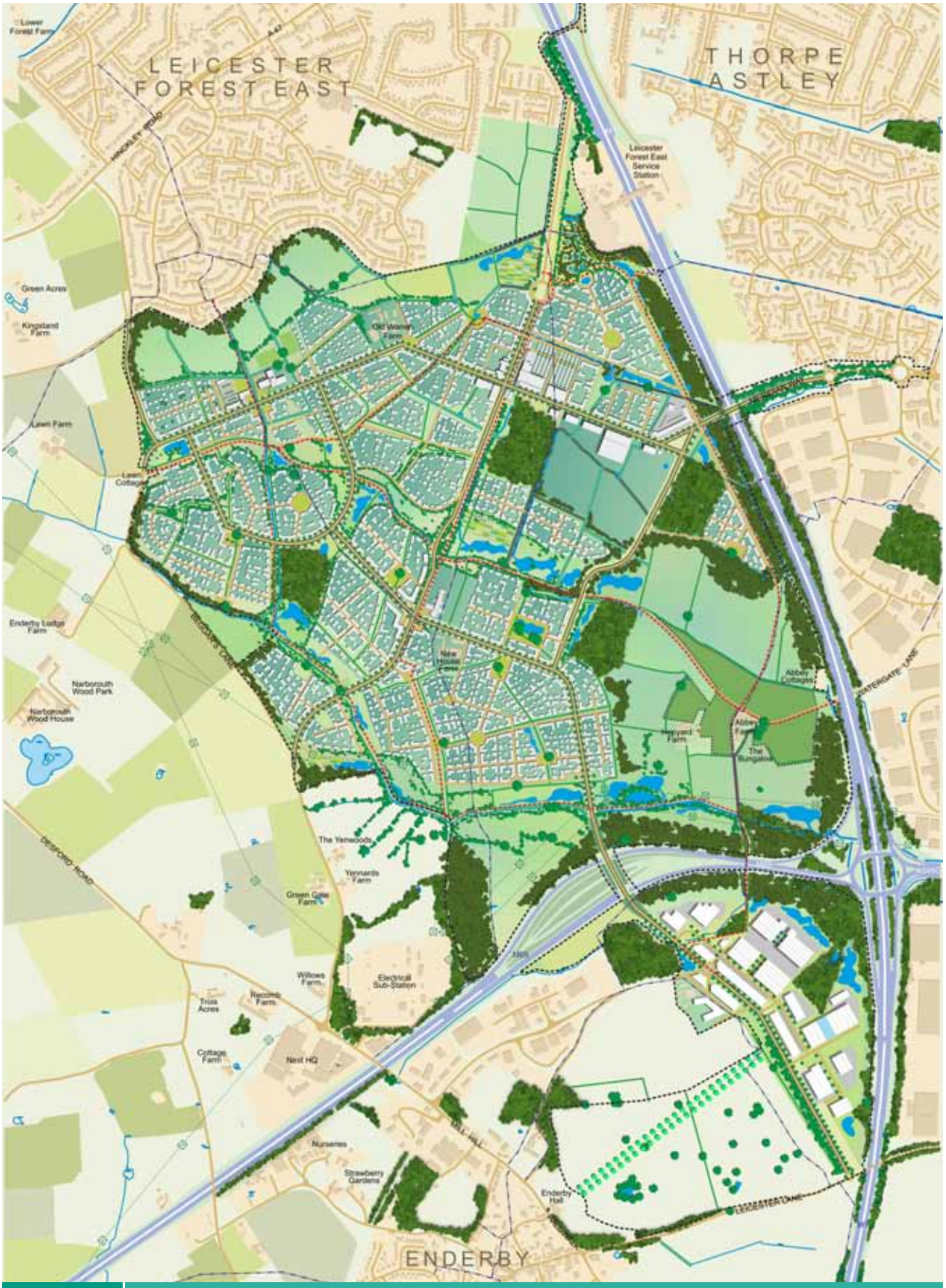
The proposed site is alongside the existing urban area and is between the residential areas of Leicester Forest East and the employment and residential areas at Enderby. It is bounded on the east side by the M1 Motorway and countryside to the west. The M69 Motorway divides the site into two parts, with the Sustainable Urban Extension to the north and Strategic Employment Site to the south. New motorway bridges will connect across the M1 and the M69.

There are four main constraints within the development area which may prohibit the deployment of some renewable energy technologies:

1. The Lubbesthorpe Ancient Village Scheduled Monument is located in the south eastern part of the site with the scheduled area extending each side of the Lubbesthorpe Bridle Road. The monument and its setting, which includes the related farm buildings at Hopyard and Abbey farms are a major factor influencing the location of the new development. Through consultations with English Heritage and the County Council's archaeological advisor, the setting of the SM has been determined where views from and to the site would be protected. Given the sensitivity of the location, it is unlikely that prominent energy infrastructure such as wind turbines or power plants which impinge on this setting would be acceptable. Similar constraints apply to the remnant Enderby Park south of the M69, which while not registered as an historic park is locally significant and provides the landscape setting to Enderby Hall which is a listed building.

2. The existence of two major highways on and near the site further limits the potential for tall structures. The Highways Agency may require substantial offsets from both the M1 and M69 to guarantee that there is no 'topple risk' posed by tall structures, such as large wind turbines or chimney stacks, to either motorway. It will also be necessary to ensure suitable offsets from both existing and proposed residential dwellings to safeguard against environmental impacts to occupants, such as noise and air pollution.

3. The Council has designated an Air Quality Management Zone because of the levels of air pollution generated by traffic on the M1 and this is focused on the crossing of the M1 by the A47 Hinckley Road to the north of the New Lubbesthorpe site. The Council monitors local air quality closely and has an Air Quality Management Plan to improve air quality and resist any further deterioration in local air quality within the zone. Air quality is a major issue for local residents and any energy infrastructure which gives rise to greater levels of local air pollution is unlikely to be acceptable. The topography of the site also means that locating any energy plant away from the housing and existing residents puts it closer to the Scheduled Monument and at the lowest part of the site, which is likely to require an increased stack height and therefore potentially greater visual and historic impacts.



2.2 New Lubbesthorpe Illustrative Master Plan Revisions

4. For these reasons, the most suitable location for a community power plant would be within the Strategic Employment Site to the south of the M69. However, the viability of this would be dependent upon infrastructure links between the north and south of the New Lubbesthorpe community which may not be put in place until large parts of the development are already completed.

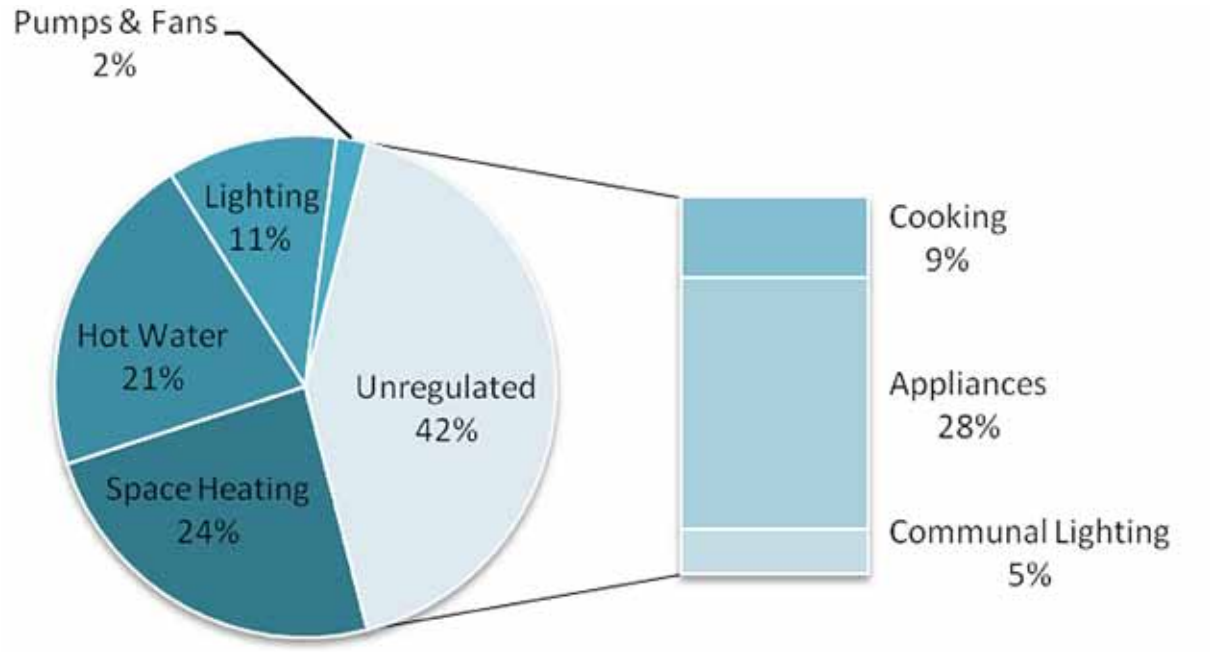
Although none of these limitations rule out large scale low or zero carbon technologies, they present issues in how the relevant technologies should be applied. These constraints have been considered in the scenarios outlined later.

Estimating Energy Demand

Estimates of the projected energy demand of the New Lubbesthorpe development have been based on the development proposals and energy benchmarks, as discussed below.

Residential Sector

For the purpose of estimating the energy demand the Fabric Energy Efficiency Standard (FEES) was applied in conjunction with the energy use estimates published by the Royal Town Planning Institute and shown in Figure 3.1. The baseline data applied to each dwelling is shown in Table 3.1.



3.1 Domestic Energy Use in New Buildings - Source: Royal Town Planning Institute

Table 3.1: Regulated Energy Use Benchmarks kWh/m2/yr					
Building Type	Space Heating	Domestic Hot Water	Lighting	Pumps& Fans	Total
Apartment blocks & mid terrace	39	34	18	3	94
End terrace & detached houses	46	40	21	4	111

The exact housing mix will be determined at the detailed design stage. For the purposes of the assessment the mix shown in Table 3.2 has been used. Combining this with the data in Table 3.1 allows the energy requirements for the New Lubbesthorpe residential component to be estimated. It is likely that this represents a worst case scenario.

Table 3.2: Residential Energy Use and CO2 Emissions					
House type	Estimated dwelling floor area m2	Number of houses	Heating MWh/ yr	Electricity MWh/yr	Energy MWh/yr
Flat	60.9	465	2071	598	2669
Mid-terraced	78.8	931	5365	1550	6914
End-terraced	78.8	310	2107	609	2716
Semi-detached	88.8	1535	11757	3396	15153
Detached	104	1009	9051	2615	11665
Total		4,250	30,350	8,768	39,117

Non Residential Sector

The development will include a number of amenities to provide services and job opportunities for the residents of New Lubbesthorpe. Following discussions with DLA, the project planners, this is expected to consist of two key areas, The Sustainable Urban Extension (SUE) north of the M69 and the Strategic Employment Site (SES) south of the M69. The SUE will incorporate two local centres and a district centre which will include:

- 2000m2 of office space within the district and local centres
- 4,500 m2 employment site
- 5000m2 of retail space
- A 1200m2 healthcare facility
- A 1500m2 community centre

There will also be a secondary school and two primary schools located within the SUE. The secondary school is anticipated to have a capacity of 863 pupils, whilst it is estimated that the two primary schools will be able to take up to 1036 pupils. Using area guidelines from the Department for Communities and Local Government (DCLG) the predicted area of the secondary school buildings is 5356m2 and the combined area of the primary schools is 4067m2.

To the south of the M69 a Strategic Employment Site (SES) is proposed which will provide 21ha (net of strategic infrastructure) of employment development comprising of:

- 7600m2 of office space
- 19700m2 of general industry space
- 56700m2 of warehouse and distribution space

The energy benchmarks derived from the DCLG 2010 CO2 reduction targets allow the energy requirements to be estimated. This has been adjusted to incorporate the savings achieved through the 2010 Building Regulations to reflect improvements to the building fabric. The estimated demand is shown in Table 3.3.

Table 3.3: Estimated Non-Residential Energy Use

Non-Domestic Buildings		Area m2	Heating MWh/yr	Electricity MWh/yr	Energy MWh/yr
SUE	Primary School	2034	109	124	233
	Primary School	2034	109	124	233
	Secondary School	5356	287	327	615
	Day Nursery	500	27	31	57
	Office	2000	123	222	345
	Retail	5000	170	1252	1422
	Health Centre	1200	78	235	314
	Community Centre	1500	81	166	247
	Employment	4500	277	499	776
SES	Office	7600	468	843	1311
	Light Industrial	19700	61	2378	2439
	Warehouse	56700	3478	1008	4486
Total	108123	5269	7210	12478	

Creating Sustainable Development

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In view of the policy void regarding the detailed implementation of Zero Carbon Homes and the expected timeframe for the project, the promoters of new Lubbesthorpe have in consultation with Blaby District Council and ATLAS decided the most suitable benchmark for assessment are the carbon compliance levels put forward by the Zero Carbon Hub. However, further scenarios have been tested to demonstrate the how different technologies can be utilised on the site to deliver different standards should they be required or desired by individual developers during the course of the development. These are shown in paragraph 4.3 onwards. Table 4.1 shows the recommended carbon compliance levels, including the 2013 target. These compliance levels are currently only applicable to residential properties.

Table 4.1: Residential Carbon Compliance Levels

Carbon Compliance levels for 44% reduction - 2013	All dwellings	14	kgCO2/m2/yr
Carbon Compliance levels for Zero Carbon Homes - 2016	Detached houses	10	kgCO2/m2/yr
	Attached houses	11	
	Low rise apartment blocks	14	

The energy demand estimates presented in section 3.2 have been used to estimate the regulated CO2 emissions of the residential sector of the development. For the purpose of this report it has been assumed that all space and water heating would conventionally be derived from gas whilst all other energy consumed will be met by electricity. CO2 conversion factors published by the Zero Carbon Hub have been applied to determine the overall emissions.

The development will also aspire to meet the requirement for 10% of energy demand from on-site renewable energy sources as set out in the Blaby Local Development Framework Core Strategy Submission Version (July 2009) which follows the East Midlands Plan targets.

Table 4.2 shows the carbon compliance target and on-site renewable energy generation that the development would need to achieve.

Table 4.2: Carbon Compliance and Renewable Energy Targets			
2013	Compliance target	6,367	tonnes CO^2
2016	Compliance target	7,489	tonnes CO^2
10%	Renewable Energy target	5,082	MWh/yr

It will be possible to achieve these targets through a mixture of energy efficiency measures and low and zero carbon technologies; possible approaches are described below.

Energy Efficiency

Current national thinking on the journey towards Zero Carbon strongly encourages a 'fabric first' approach to achieving CO2 emission reductions. The industry is now moving towards a fabric first approach with the introduction of the proposed Fabric Energy Efficiency Standard produced by the Zero Carbon Hub. Embedding a high level of energy efficiency within the 2016 Zero Carbon Homes policy will ensure that dwellings utilise Low and Zero Carbon (LZC) energy sources in the most efficient way, helping to meet carbon reduction targets whilst assisting with long term energy security and reducing fuel poverty. Focusing efforts on the building fabric helps to 'future proof' the homes.

Securing CO2 reductions in the fabric has the following benefits:

- CO2 emissions are inherent for the design life of the building (approx. 60 years), whereas LZC energy generation technologies typically have a lifespan of 25 years.
- There are virtually no maintenance and/or replacement costs to maintain CO2 reductions and therefore are less likely to have expensive upgrades at a later date.
- There is no reliance on occupier's behaviour to ensure potential CO2 reductions are actually achieved. LZC energy generation technologies require education, awareness and behavioural changes.
- There is nothing to commit occupiers of the homes to replace the LZC energy generation technology after the 25-year lifespan, therefore impacting the future CO2 emission reductions in the future.

The level of energy efficiency measures employed within the New Lubbesthorpe development will be finalised in the detailed design stage when the buildings have been designed. At present it is anticipated that each developer will encourage high standards of energy efficiency to reduce the reliance on LZC technologies to achieve the carbon compliance levels.

Low and Zero Carbon Energy Generation Technologies

There are a number of low carbon and renewable energy technology options available to the New Lubbesthorpe development. The suitability of some or all of these technologies will be dependent on the detailed design and the onsite constraints discussed previously. Notwithstanding this, the following low and zero carbon technologies were considered worthwhile investigating further for their applicability to Lubbesthorpe:

- Wind
- Solar (photo-voltaic and solar thermal)
- Ground Sourced Heat Pumps
- Biomass (including CHP systems)

Hydroelectric turbines and water-sourced heat pumps were rejected as there are no suitable watercourses in or close to the site. Anaerobic digestion was not considered appropriate as a large amount of organic material would need to be imported on to the site to meet any significant level of demand.

Wind

The New Lubbesthorpe site has an average wind speed of 6.3 m/s at a height of 45m above ground level, which is considered a moderate wind resource. A study of the feasibility of including a wind turbine within the development suggested that the only available location would be to the south of the site, west of the proposed SES.

Installing a single 2MW wind turbine in this location would generate 4421 MWh/yr, 11% of the overall energy demand of the site and achieve 31% of the 2016 Carbon Compliance target.
However, this location falls within Enderby Park and the setting of Enderby Hall which is a listed building. In addition, a turbine of this scale, which measures 100m to the blade tip, would be visible from the Scheduled Monument. In view of the general sensitivity of the landscape at this location, it is considered unlikely that a turbine of this scale would be supported by the relevant consultees.

Small or medium scale turbines could be utilised on the site, however, these may be subject to similar constraints as the large turbines considered above. The potential for this scale of turbine could be investigated further as the strategy is developed..
Alternatively roof mounted wind turbines could be deployed on domestic and commercial buildings. To achieve the level of CO2 savings to meet the compliance level, a substantial number of roof mounted turbines would be required as the annual energy output of each unit is low. This would cause a significant visual impact and increase structural requirements. These turbines would also result in substantial noise levels and are therefore unlikely to represent a viable option.

The installation of wind turbines of any scale is therefore considered less likely to form part of any strategy for the site.

Solar Photovoltaic Systems

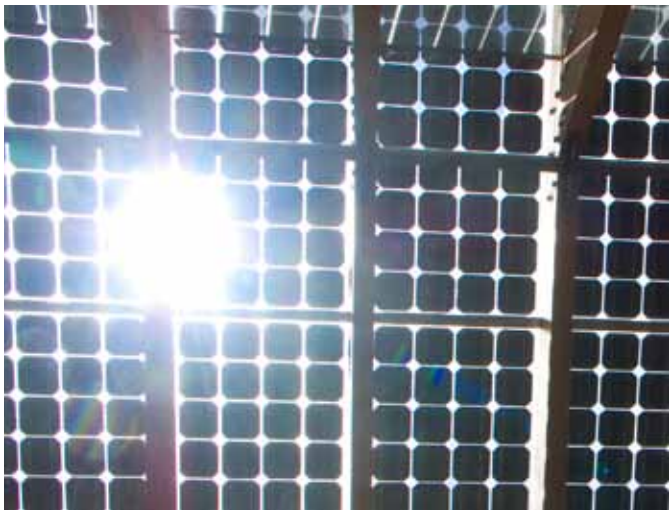
PV panels utilise photoelectric cells to capture the Sun's energy and convert it in to electricity. The efficiency of PV panels has increased in recent years due advances in technology and the introduction of financial incentives has led to a rise in deployment of PV systems with domestic properties.

The performance of a domestic solar PV array is dependent on the available roof area and orientation, and exposure to shading. It is impossible to determine these factors at this stage of development and for purpose of this report assumptions have been made as to suitable domestic roof areas. All roofs were considered eligible for PV except the flats. These were then reduced by 50% to account for orientation and shading limitations. The available roof space on each eligible property was limited to 40% of the total floor area, as prescribed in the Zero Carbon Hub recommendations.

Installing solar PV on 50% of eligible domestic roof space would provide 6,258 MWh/yr, 16% of the total energy demand. This would achieve 44% of 2016 Carbon Compliance.

Solar PV arrays could also be installed on the non-residential properties. Commercial arrays may be less restricted as commercial and industrial buildings often have large flat roofs which allow greater flexibility for installing PV panels. It has been assumed that available roof space would be equivalent to 40% of the non-residential floor area. This allows for roof pitch and any infrastructure mounted on the roof. Installing solar PV arrays on all the available non-residential roof area would provide 5,605 MWh/yr, meeting 11% of the total energy demand.

Solar PV systems are considered a practical option for the New Lubbesthorpe community. The individual dwelling design will determine the feasibility of PV arrays and will dictate the achievable deployment of these systems. This technology has been considered in the Energy Scenarios for New Lubbesthorpe.



Solar Thermal Systems

The Sun's energy can be used to provide background heating or domestic hot water heating harnessed through installation of solar thermal panels. There are two main types of solar thermal panel: flat plate collector and evacuated tube.

Solar thermal panels are best suited to applications that require a constant supply of hot water. Typically solar thermal systems can provide up to 60% - 70% of domestic water heating needs, electric immersion heaters are usually installed to meet the rest of the demand.

Flat plate solar collectors, while not quite as efficient as evacuated tubes, are less visually obtrusive as they can be integrated into the roof. They also have a longer life span. A collector connected to a 250–300 litre cylinder by a riser to the roof should be sufficient to supply ~900kWh assuming a 2.5m2 catchment area. These systems have been sized for the residential houses on site. Again, the performance of the solar thermal system will be subject to the same limitations as solar PV and it will be impossible to identify suitable properties until the detail design stage. At this stage assumptions have been made to estimate the potential for solar thermal systems in the New Lubbesthorpe development. All residential properties were considered eligible for solar thermal systems except the flats. Of these eligible properties 50% were assumed to be suitable for solar thermal systems. This would provide 6,955 MWh/yr in hot water, equivalent to 14% of the site's overall energy demand. This would achieve 21% towards the 2016 Carbon Compliance target.

Solar thermal systems could also be deployed throughout the New Lubbesthorpe community where their integration is feasible within the final dwelling design. This technology has been considered in the Energy Scenarios for New Lubbesthorpe.

Heat Pumps

Heat pumps offer an energy efficient method of heating and cooling through the movement of heat. Essentially the heat pump uses electricity to move heat from a cold space into a hot space. This movement of heat, rather than generation of heat, can provide up to 4 times as much heat energy compared with the electrical energy the heat pump consumes. There are two main types of heat pumps, air sourced heat pumps (ASHP) and ground sourced heat pumps (GSHP). ASHPs are less expensive than GSHPs and do not require a ground loop to operate. However, they are less efficient than GSHPs and do not produce significant CO2 savings, consequently they will not be considered any further. Heat pumps provide a constant low grade heat best suited to energy efficient buildings with low heat demand spread over a continuous period of time.

It has been assumed that heat pumps could be installed in all the residential properties except the flats. Multiple occupancy properties such as flats may be better suited to communal heating such as biomass boilers, as discussed below. Heat pump capacities were estimated using 40W/m2 of floor area for residential buildings and 50 W/m2 for non-residential buildings, which are based on good levels of energy efficiency in line with current Building Regulations. A seasonal average Co-efficient of Performance (COP) of 4.0 was assumed to calculate the GSHP electrical loads.

Installing ground source heat pumps in eligible residential properties could provide 15,082 MWh/yr of heat equivalent to 30% of the development's total energy demand. This would achieve 16% towards the 2016 Carbon Compliance target.

Heat pumps would also be suitable for the non-residential buildings. Installing ground source heat pumps could provide 5,269 MWh/yr, equivalent to 10% of the site's heat demand.

Heat pumps could technically meet a substantial portion of the New Lubbesthorpe heating demand. However the overall CO2 saving will be less significant as heat pumps are powered by electricity. Nevertheless this technology is considered within the Energy Scenarios.

Biomass

Biomass boilers can provide both water and space heating. Boilers range in size from small scale units for single dwellings to large boilers supplying a district heating scheme. For large scale boilers there are three sizing options:

- Base load sizing provides the minimum required heat load with additional requirements being met by a second fossil (such as gas) fuel boiler.
- Peak load sizing provides the capability to meet the full heating demand through the biomass boiler.
- Optimum sizing provides a combination of both methods.

Optimum sizing is generally the most common system, providing 80 – 90% of heating demands from the biomass boiler with peak demand met by a conventional fossil fuel boiler. This reduces the capital expenditure and allows the biomass boiler to run constantly, as is the preferred method of operation without wasting heat.

Biomass boilers are typically fuelled by wood chips or wood pellets. Wood chips are cheaper but have a lower effective calorific value than pellets. Pellets are higher in cost but require smaller storage areas and handling systems. Fuel costs decrease as the demand increases with the economies of scale on fuel processing and delivery.

Biomass heating is usually sized at approximately 50W/m2 for new dwellings with capacities for automatically fed boilers ranging from approximately 8kW up. None of the dwellings will have a large enough heating requirement to warrant a biomass boiler, except the flats depending upon the size of the apartment block. This will be decided in the detailed design stage and it has therefore not been possible to assess the suitability of biomass boilers for them. New non-residential buildings have a typical biomass heating benchmark of 60W/m2 and significantly larger floor areas which would warrant the installation of a biomass boiler.

Installing biomass boilers in all the non-residential properties could generate 5,269 MWh/yr, equivalent to 10% of the developments energy requirement.

At this stage it is considered more practical to implement community heating for the non-residential properties within the New Lubbesthorpe development rather than implement small biomass plants in individual buildings. This technology has not been carried forward into the Energy Scenarios.

Community Heat and Power

Large scale combined heat and power (CHP) generation is well suited to mix-used developments such as New Lubbesthorpe as there is annual heating demand from the non-residential buildings which warrants the operation of the plant during the summer months when residential heating demand drops off. While a plant designed to meet the energy demands of the whole site could provide significant CO2 savings over building integrated solutions, installing a large generation plant within a mixed use development has several limitations (such as the impact of the plant itself) and remains uncommon at a community scale.

There are two basic technology options for producing electricity from biomass: boilers and steam turbines or gasification/pyrolysis systems coupled to gas engines or gas turbines. Boilers and steam turbines are a well-proven bankable technology but are relatively inefficient (e.g. 20% electrical efficiency) at small scale up to 10MW. This may not be an issue if heat demand is the critical factor. They also have poor economies of scale at this size, e.g. a 1MWe plant will have similar costs to a 3MWe plant. The waste heat they produce is at relatively low temperatures circa 90°C and therefore not suitable for some process heat applications but is suitable for district heating. Finally they are much more tolerant of feedstock quality variations and moisture content making operations and maintenance less of a problem.

Modern gasification and pyrolysis technologies are now available that make biomass CHP clean, efficient and sustainable at relatively small scales. The most common gasification systems are wood fuelled and coupled to a spark ignition (gas) engine. This technology

typically has an electrical efficiency of around 30%, implying some 70% of the energy in the fuel would be available as waste heat. It is not possible to recover all of this heat and there will be losses in the heat distribution systems, however, 50%-60% could be made available for heating purposes. CHP can supply high grade heat for industrial use (circa 450°C) or low grade heat for domestic use. Whilst gasification technology is more efficient than traditional steam turbines, they have yet to gain a commercial track record.

Biomass CHP

A boiler and steam turbine biomass boiler plant would be the most suitable CHP option at this stage of development. However, as discussed above, in order to achieve an efficient and economic generation plant, a critical mass must be achieved. The most efficient approach for CHP in the New Lubbesthorpe community would be a single biomass CHP plant. In order to avoid excessive waste heat, the plant must be sized appropriately to the energy demand of the development. This is particularly difficult to achieve for a phased development where

the demand will increase as the development is built and a decision must be taken as to when the demand is large enough to warrant the installation of the biomass CHP plant. If this cannot be achieved from the start then alternative energy sources may need to be employed until the biomass CHP can be brought on line.

A biomass CHP plant could be included within the development as part of the long term energy strategy for the New Lubbesthorpe development. This will be dependent on the final site design, the development phasing and the timing and form of the bridge link between the northern and southern areas of the site. The most suitable location for a biomass CHP plant would be in the SES in on land close to the M69. This would reduce the overall impact on the Scheduled Monument and Air Quality Management zone both located in the north of the site. In order to accommodate the phasing schedule, the CHP plant could be sized to meet the needs of the non-residential component and a proportion of the residential properties. A single 2.8MWe biomass CHP plant could meet the demands of all the non-residential and two thirds of the residential developments. Although this will not meet the needs of all the residential properties, a plant of this size would achieve substantial CO2 savings and help reach the carbon compliance levels.

In order to provide sustainable power, the biomass CHP plant will need to be fuelled by locally sourced woody biomass. For a plant big enough to supply base load heat for the whole of the development this would be approximately 35,000 dte (dry tonnes equivalent) per annum or 70,000 tpa assuming a moisture content of 50%. If grown as energy crops, eg Miscanthus, this would require some 3,000ha of land. A study of renewable energy resources in Leicestershire by IT Power in 2008 revealed that there was a limited amount of woody biomass available in the Blaby district. Consequently wood fuel may need to be sourced from the surrounding districts. Alternatively uncontaminated waste wood could be utilised as fuel. Fuel sources should not be further than 40km from the development. This will need to be explored further to ensure a sustainable fuel stream is available.

The potential for a single CHP plant presents an opportunity to provide a community system. As the technology improves, it may also be possible to implement biomass plants on a smaller scale for localised areas of the site. Planning permission for such plants would be sought when the suitability, scale and technology for such a system is known. Key inputs to determining the scale and role of these plants will revolve around the timing of residential buid-out, the implementation of major buildings, such as the secondary school, the implementation of the new bridge over the M69 and the uses and energy requirements at the SES.

This technology is considered as an option within the Energy Scenarios for the New Lubbesthorpe community.

Energy Scenarios for New Lubbesthorpe

The biggest difficulty when assessing how to achieve the carbon compliance level for New Lubbesthorpe is predicting how energy demand will change and particularly renewable energy technologies will advance over the project lifetime. A single large community like New Lubbesthorpe provides the greatest opportunity to implement a wide variety of energy systems and hence best meet the needs of the community. It is apparent that the carbon compliance level identified and the 10% on-site renewables requirement can be met from a number of building integrated renewable energy technologies or a community heat and power plant or a combination of both.

Table 4.3 demonstrates how a mix of technologies could be applied to the first phase of the development planned for 2013. This phase will comprise of 300 residential units and will need to meet the 2013 carbon compliance level. This could be achieved through deploying solar hot water systems in all the properties coupled with solar PV systems on 80 of the detached properties. This mix is suggested as the detached properties will have a greater roof area and should be able to house this both solar thermal and PV.

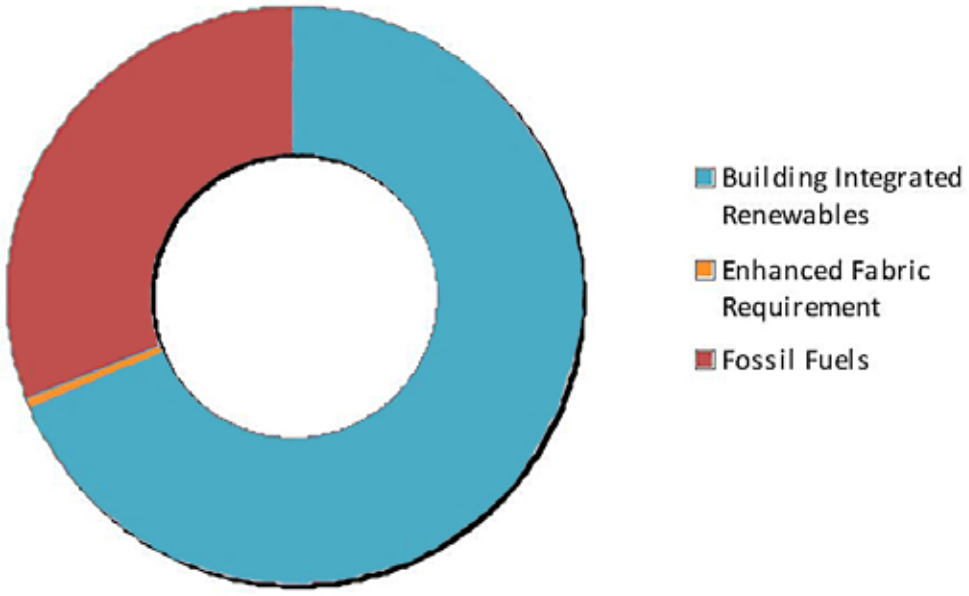
Table 4.3: Example Phase 1 Technology Option

Technology Option	Generation MWh/yr	CO^2 saving tCO^2	Towards Residential Carbon Compliance 2013	Demand met by Renewable Energy
Solar Thermal on all dwellings	820	186	40%	32%
Solar PV on 80 detached dwellings	435	280	61%	17%

The following scenarios provide indicative examples of how the New Lubbesthorpe community could achieve the 2016 carbon compliance levels and utilise renewable energy technologies for the whole development.

Scenario 1: Enhanced Energy Efficiency and BIR technologies

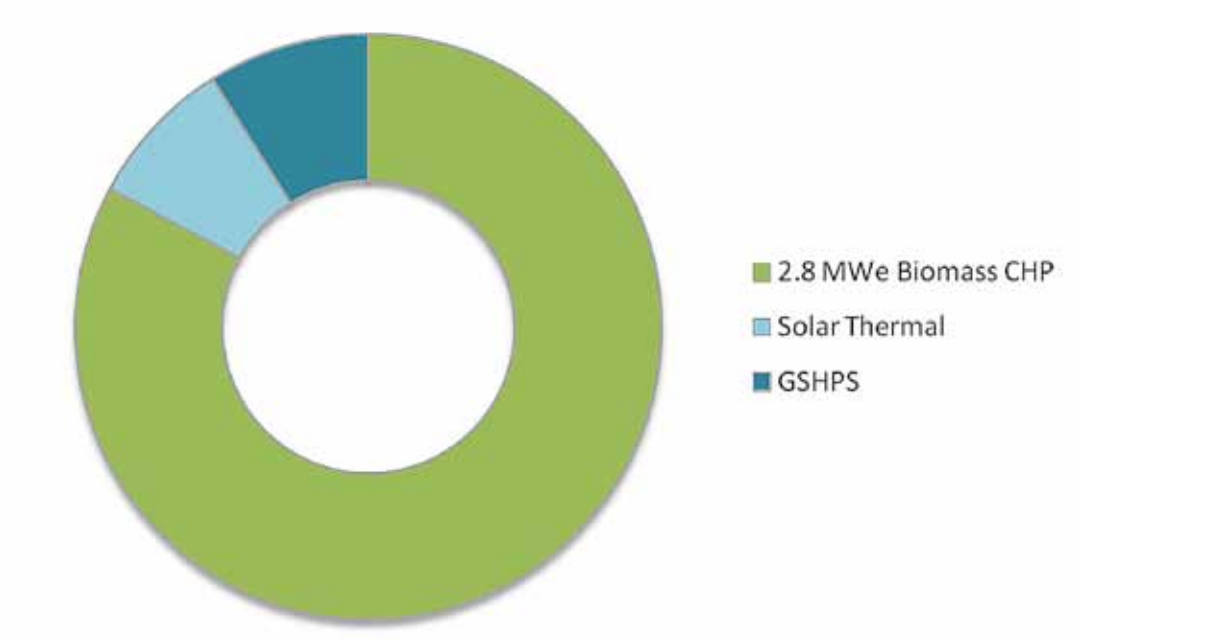
Example Technology Options All Residential, Schools and Employment (Scenario 1)					
Technology Option	Generation MWh/yr		CO^2 Saving tCO^2	Towards Residential Carbon compliance 2016	Demand met by Renewable Energy
	Electricity	Heat			
Solar Thermal on all eligible dwellings	0	6955	1578	21.1%	13.7%
Solar PV on 1273 Dwellings	6258	0	3297	44.0%	12.3%
Ground Source Heat Pumps	0	15082	1223	16%	29.7%
Biomass in Schools and Offices	0	628	131	-	1.24%
Biomass in Employment Area	0	277	58	-	0.55%
Solar PV in Employment Areas	5605	0	2954	-	11.03%
Building Integrated Renewables	11863	22942	9243	81%	68%
Enhanced Fabric Requirement	0	-315	1388	19%	
Fossil Fuel Requirment	3,615	12,084			



4.1 Representation of Scenario 1 Technology Options

Scenario 2: Biomass CHP and BIR technologies

Example Technology Options Whole Site (Scenario 2)					
Technology Option	Generation MWh/yr	CO2 Saving tCO^2	Towards Residential Carbon compliance 2016	Demand met by Renewable Energy	
2.8 MWe Biomass CHP	Electricity	Heat	16,118	105%	92%
	20750	25915			
Solar Thermal	0	4636	1052	14%	9.1%
GSHPS	0	5032	408	5%	9.9%
Total	20750	35583	1461	124%	111%



4.2 Representation of Scenario 2 Technology Options

Developing the Strategy

The New Lubbesthorpe community will be developed over 15 years and it is impossible to predict how low carbon and renewable energy technologies will advance over this period and become more suited to this form of development. The technologies presented here show what is currently technically and commercially viable. However in 10 years' time advances in technology and/or financial incentives may make these options obsolete. Likewise, improvements in fabric efficiency and consumer behaviour may reduce energy consumption reducing the overall need for these technologies.

The regulatory and financial frameworks for renewable energy are also likely to change over the coming years. Although it is clear that there are national commitments, how these are to be translated to local areas and individual developments is less clear. Recent changes in the structure of financial incentives for biomass and photovoltaic systems has illustrated the sensitivity of the market for and take-up of energy generation technologies, which will ultimately be a major consideration in the commercial viability of these options.

The detailed selection of the technology or combinations of technologies will depend on a number of factors, including detailed site design, building orientations, build timing, availability of equipment, cost effectiveness, levels of government subsidies, preference of each house builder and commercial developer and attractiveness to potential occupants. Maintaining flexibility throughout the life of the development will be important to ensure that proposals can best respond to these influences. The final technology mix will therefore need to be determined on a phase by phase basis, with the proposals being put forward by the developer in consultation with the local planning authority. Energy strategies can be prepared to accompany the Design Code/briefs for each discrete phase of the development to describe how the standards are to be achieved and which technologies will be applied.

This report demonstrates that several options exist for meeting the existing policy requirements and showing how the proposals can respond to increasing requirements through the carbon compliance standard. The New Lubbesthorpe community will be able to deliver energy efficiency measures alongside low and zero carbon technologies to meet these requirements.