

Low Carbon Energy Opportunities and Heat Mapping for Local Planning Areas Across the East Midlands: Final Report

Prepared for East Midlands Councils
by
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Appendix 5.1 also contains heat maps for all of the local authorities (and joint planning authorities) in the East Midlands.

ABBREVIATIONS

AD – Anaerobic Digestion
AONB – Area of Outstanding Natural Beauty
BREEAM – Building Research Establishment Environmental Assessment Method
CAA – Civil Aviation Authority
CAD – Centralised Anaerobic Digester
CCHP – Combined cooling heat and power
CHP – Combined heat and power
CLG – Communities and Local Government
CSE – Centre for Sustainable Energy
CSH – Code for Sustainable Homes
DECC – Department for Energy and Climate Change
DEFRA – Department for Environment, Food and Rural Affairs
DNO – District Network Operator
EA – Environment Agency
EMC – East Midlands Councils
EU – European Union
EIA – Environmental Impact Assessment
ESCOs – Energy Service Companies
FIT – Feed In Tariff
GAEI2 Land – Agricultural land which is not in agricultural production
GSHP – Ground Source Heat Pump
GW/h – Gigawatt hours
HGV – Heavy goods vehicle

IIPC – Integrated Pollution Prevention and Control
IPC – Infrastructure Planning Commission
kW - kilowatt
LAPC – Local Air Pollution Control
LDP – Local Development Plan
LPA – Local Planning Authority
LUC – Land Use Consultants
MoD – Ministry of Defence
MW - Megawatt
MSW – Municipal and Solid Waste
NATS – National Air Traffic Services
NE – Natural England
NNR – National Nature Reserve
NPA – National Park Authority
NPS – National Policy Statement
PrOW – Public Rights of Way
PPS – Planning Policy Statement
PV – Photovoltaics
RESTATS – Renewable Energy Statistics Database for the UK
SAC – Special Area of Conservation
SEA – Strategic Environmental Assessment
SHW – Solar Hot Water
SHLAA – Strategic Housing Land Availability Assessment
SPA – Special Protection Area
SPG – Supplementary Planning Guidance
SSA – Strategic Search Area
SSSI – Site of Special Scientific Interest

EXECUTIVE SUMMARY

Study Aims and Objectives

This report sets out an evidence base of the technical potential for renewable and low carbon energy technologies within the East Midlands. It aims to assist local planning authorities across the East Midlands in developing well-founded policies and strategies that support low carbon energy deployment up to 2030.

The four key objectives of the project were:

1. To identify and map low carbon and renewable energy resources and opportunities across the East Midlands, following the methodology published by the Department of Climate Change (DECC)/ Department for Communities and Local Government (CLG) - '*Renewable and Low Carbon energy Capacity Methodology: For the English Regions*' (2010)¹.
2. To prepare heat maps for each local authority area within the East Midlands illustrating local heat demand and supply.
3. To provide recommendations on locations with a high potential for district heating and the use of waste heat and more detailed heat mapping for these locations.
4. To provide generic guidance and specific examples of how the renewable and low carbon resources and opportunities identified can be used to formulate local planning policies.

¹ <http://www.info4local.gov.uk/documents/publications/1497400>

Background

The UK Renewable Energy Strategy (2009) outlines out the Government proposals for achieving the national renewable energy target agreed under the EU Renewable Energy Directive (2009). The overall target is for 15% of all energy used (including electricity, transport and heat) in the UK to be supplied from renewable energy sources by 2020. In order to meet these targets, concerted action will be required to coordinate the delivery of renewable and low carbon energy infrastructure and ensure that the planning system at the local authority level is geared up to deliver the capacity required.

In 2010, the Department of Energy and Climate Change (DECC) asked the English regions to revisit their resource assessments to understand how the regions could contribute to achieving the national targets and to inform the preparation of renewable energy targets within Regional Spatial Strategies. Since then, Central Government has confirmed its intention to abolish Regional Spatial Strategies. There does however remains a strong imperative for strategic planning – to ensure that the approach to increasing the supply of renewable and low carbon energy is consistent, efficient and effective across local authority boundaries. Understanding the potential supply of renewables in a local area is an important starting point in considering the opportunities to move to low carbon communities. Identifying and mapping the resource available in an area enables local planning authorities to plan strategically for the development and delivery of renewable and low carbon energy.

Project Scope

The project focuses on land-based renewable electricity and heat technologies, including both commercial scale renewables and microgeneration (on-site and building-integrated renewables). It does not cover offshore or marine (wave and tidal) renewable energy sources. It does however go beyond the requirements of the DECC methodology and includes a comprehensive assessment of the potential for district heating and the use of waste heat within the East Midlands.

The renewable energy resource assessment has been disaggregated down to a county and local authority level. This report also disaggregates the results for each renewable energy technology by Housing Market Area (HMAs). **The project does not provide guidance on the development of specific sites.** Further detailed site based studies and assessments would be required to assess the suitability or otherwise of specific sites.

It is also important to note that the assessment of renewable energy potential presented in this report represents the **'technical potential'** – i.e. the total amount of potential that is theoretically available. It does not consider the **'deployable potential'** – i.e. what could be practically achieved and delivered within the local authority areas. Further assumptions and scenario testing will be needed to refine the results presented in the report to calculate the deployable potential – i.e. considering local transmission, supply chain and planning, landscape constraints and opportunities. Further guidance is provided in **Chapter 6** of the report on how local planning authorities could undertake their own assessments of 'deployable potential'.

Results of the Renewable Energy Resource Assessment

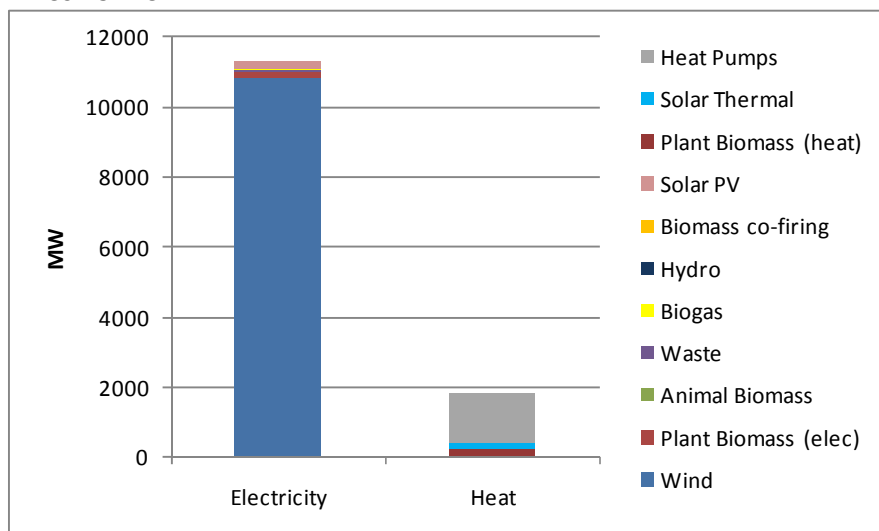
The assessment of the technical renewable energy resource has been undertaken in accordance with the DECC methodology, supplemented by additional data and assumptions where required to make the assessment more relevant at the local authority level. The assessment approach is described in detail in **Chapter 3** and **Appendix 3.2** and the results are presented in **Chapter 4**.

Careful consideration was given to the issue of the protected landscapes of the Peak District National Park and the Lincolnshire Wolds AONB in the assessment approach.

The following section provides a brief discussion of the renewable energy assessment results by county. The report provides detailed tables, charts and maps to illustrate the findings in detail.

Lincolnshire

Summary of Technical Potential for Renewable Energy within Lincolnshire



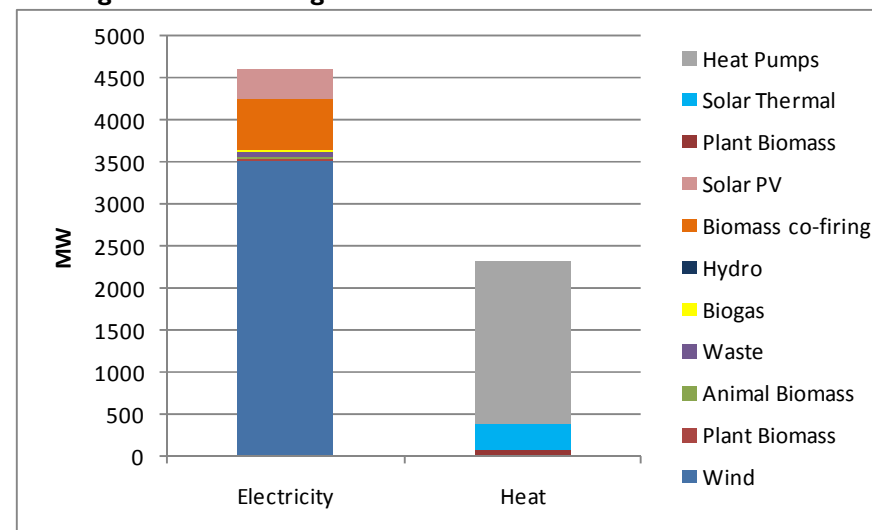
The study indicates that with the exception of Lincoln, onshore wind forms the greatest technical resource potential for all the local authorities in the Lincolnshire, although heat pumps are also identified as having significant potential. Wind energy potential is more constrained within the districts of South Holland and Boston due to the presence of the Wash and areas sensitive to birds. It is noted that wind still has considerable potential within the county even if development within the AONB is ruled out.

As the county is largely rural, there are significant opportunities for energy from biomass, in particular energy crops grown on land no

longer needed for food production and from agricultural arisings. The districts of East Lindsey, North Kesteven, South Holland, South Kesteven and West Lindsey have significant potential for the use plant biomass. There is limited potential for hydropower within the county and the sites identified by the Environment Agency hydropower study are almost solely limited to the district of South Kesteven with a few isolated sites in West Lindsey, North Kesteven and East Lindsey. Urban areas also offer potential for building-integrated solar energy and there is considerable potential for small scale wind linked to community, government and tourism related buildings throughout the rural areas of the county.

Nottingham and Nottinghamshire

Summary of Technical Potential for Renewable Energy within Nottingham and Nottinghamshire



The local authority results show all authorities within Nottinghamshire have considerable potential for microgeneration – in particular heat pumps, solar thermal and solar PV. The districts of Bassetlaw, Newark and Sherwood and Rushcliffe (those authorities to the East with the greatest land areas in the county) also have considerable commercial wind energy potential. These three districts also have notable potential for the generation of energy from biomass, in particular from energy crops, managed woodland and agricultural arisings. Whilst districts such as Ashfield, Mansfield, Gedling etc have good average wind speeds their potential is limited by constraints relating to the presence of existing infrastructure, properties and bird sensitivity issues.

Although major power stations are of national significance, it is noted that the three large power stations in the East Midlands are all located within Nottinghamshire – Cottam, West Burton and Ratcliffe and there is a lot of potential for co-firing biomass at these sites. The Nottingham Sustainable Energy Partnership have however raised concerns about realising this potential as it may involve the large-scale importation of energy crops and the distortion of local market prices for crops so that local users with modern boiler plant capable of far greater heat efficiency are priced out. There is also concern about the longer term loss of good quality land from agricultural production.

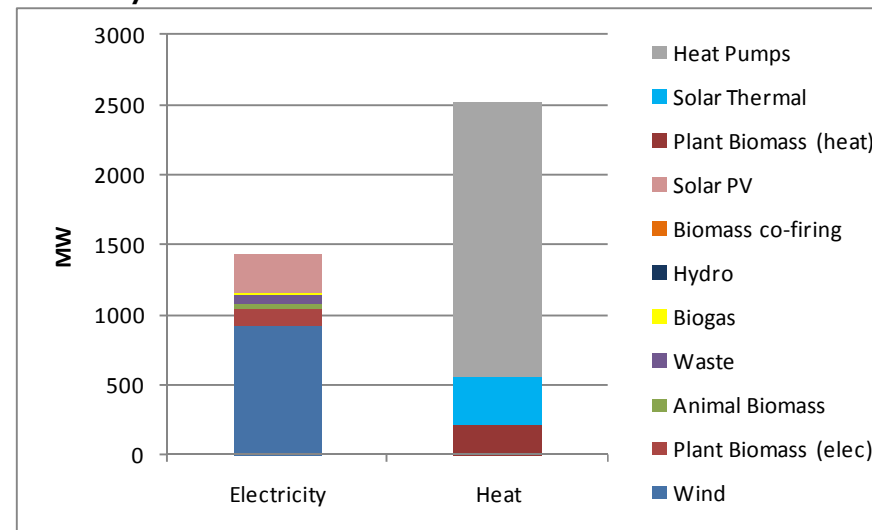
Other significant sources of renewable energy include the generation of energy from waste (MSW and C and I) in the urban unitary authority of Nottingham, although much of this potential has already been realised and the remaining potential is limited.

Nottingham also has one of the highest technical potentials for the use of waste wood in the East Midlands.

There is limited potential for small scale hydro, although Newark and Sherwood has the highest potential for hydro in the whole of the East Midlands. The potential for this district is still however small and equates to a total *technical* resource of 3.18 MW.

Derby and Derbyshire

Summary of Technical Potential for Renewable Energy within Derby and Derbyshire



The findings indicate that all local authorities within Derbyshire have considerable potential for microgeneration – in particular heat pumps, solar thermal and solar PV. The districts of Amber Valley, Bolsover, North East Derbyshire and South East Derbyshire also

have considerable commercial wind energy potential. The potential for commercial scale wind within the Derbyshire Dales, High Peak and to a more limited extent North East Derbyshire is heavily constrained by legislation to conserve and enhance the National Park and the need to protect its special qualities. The high quality landscapes outside the Park also result in reducing the potential for wind technology within the wider Peak Sub Region.

The results for the Peak District National Park are reported separately in the report for wind, managed woodland, energy crops, hydropower, solar and heat pumps. These results have been based on the findings of the Peak Sub-regional Climate Change Study (2009) which included a landscape sensitivity study (see **Appendix 3.1**).

The results of the Peak Sub-region Climate Change Study indicate that the area of the Derbyshire Dales outside of the National Park has significant potential for biomass and in particular energy crops. It must be noted however that the assumptions used to generate this assessment of technical potential do differ from the assumptions used for this East Midlands Assessment. Whilst the East Midlands study has not looked at deployable potential, the Peak Sub-region report goes on to state that only 5% of the potential for energy crops may be viable (ie deployable potential) as the change in traditional farming to energy crops is likely to be slow to take place.

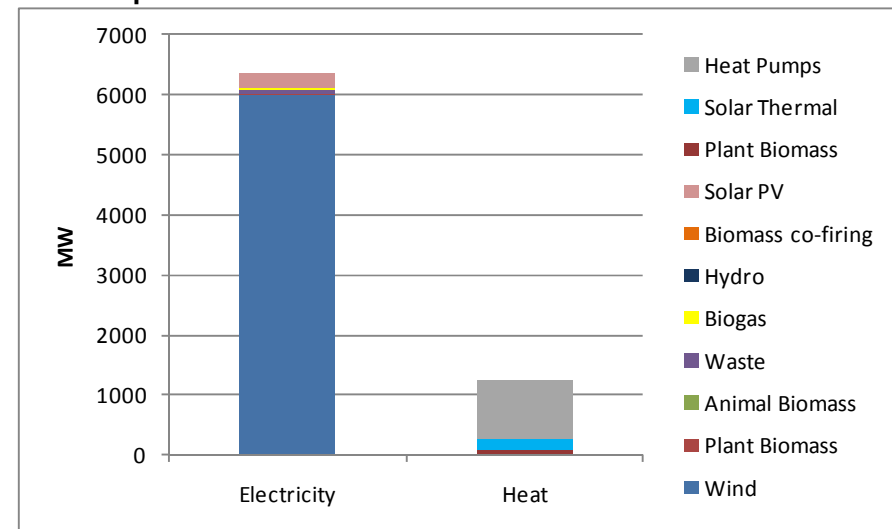
Aside from the Derbyshire Dales, North Derbyshire and South East Derbyshire also have notable potential for the growing of

energy crops. The districts of Amber Valley, Derbyshire Dales, High Peak, North East Derbyshire and South East Derbyshire also have notable potential for the generation of energy from animal biomass using anaerobic digestion.

As an urban authority, Derby has significant potential for the use of energy from waste (MSW and C & I) and waste wood.

Northamptonshire

Summary of Technical Potential for Renewable Energy within Northamptonshire



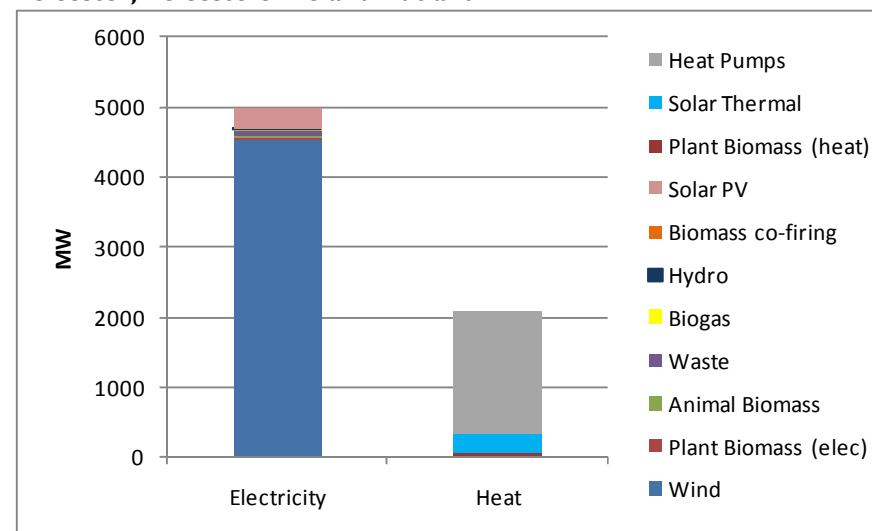
The results indicate that with the exception of Northampton, onshore wind forms the greatest technical resource potential for all the local authorities in the county, although heat pumps, solar PV and solar thermal also have significant potential. The greatest wind energy potential is found within Daventry, East Northamptonshire, Kettering and South Northamptonshire.

Daventry, South Northamptonshire, Kettering and East Northamptonshire also have notable potential for the generation of energy from plant biomass in particular from energy crops and agricultural arisings. As an urban authority, Northampton has significant potential for the use of energy from waste (MSW and C & I), sewage gas and waste wood.

There are many sites which have the potential for small scale hydro power generation in the county, particularly in East Northamptonshire, although the combined potential is relatively small compared to other technologies.

Leicester, Leicestershire and Rutland

Summary of Technical Potential for Renewable Energy within Leicester, Leicestershire and Rutland



The results indicate that with commercial scale wind forms the greatest technical resource potential for all the local authorities with the exception of Leicester and Oadby and Wigston. Heat pumps, solar PV and solar thermal also have significant potential, particularly in the more urban authorities such as Leicester. The greatest wind energy potential is found within Harborough, Melton and Rutland. Rutland does however have significant constraints in relation to bird sensitivity issues – as defined by the Natural England/RSPB bird sensitivity study. There is considerable potential for small scale wind linked to community, government and tourism related buildings, particularly within these rural authorities.

Harborough has notable potential for the generation of energy from energy crops although this potential is still relatively small when compared with onshore wind. As more urban authorities, Leicester and Charnwood have potential for the use of energy from waste (MSW and C & I), and waste wood. Charnwood also has the second highest potential for the generation of energy from sewage gas within the East Midlands. Blaby also has notable potential for landfill gas although it is understood that much of this has already been realised. Whilst there are a number of sites which have potential for hydropower within the county, the technical generation capacity of these schemes is limited.

Heat Mapping

District heating is the infrastructure for delivering heat and hot water to several buildings, using a central heat source and a network of pipes. This is a more efficient way of generating and delivering heat than the use of individual heating systems in every building. In 2010 there were few district heating systems in use in the UK, although it is generally believed that nationally there is significant potential for district heating. Notably, in the East Midlands there are district heating systems in Nottingham and Mansfield.

One of the main constraints to district heating is the need to identify a sufficient heat demand density. CSE and Geofutures have developed a methodology to geographically model existing heat demand. Heat demand was modelled for the East Midlands region, with actual demand data being integrated where possible. Data

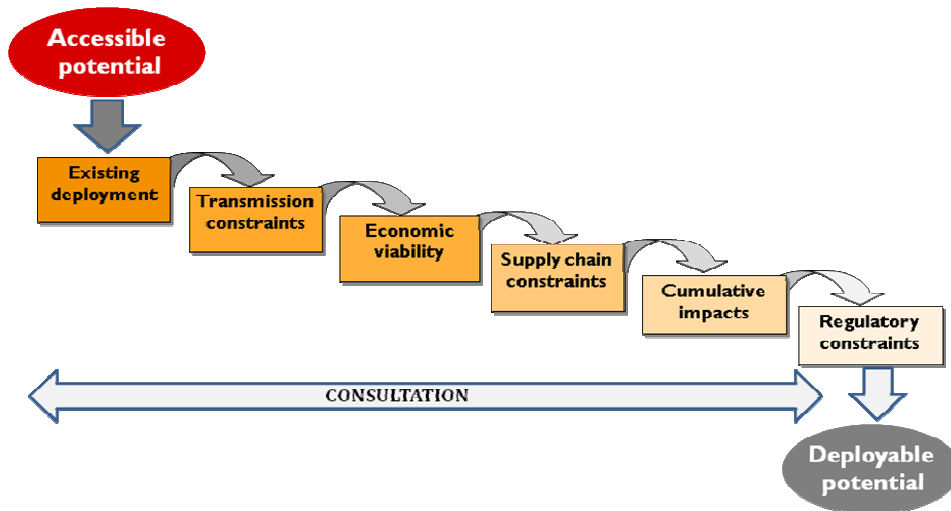
from this 'heat map' was combined with information obtained from local authorities about future potential heat demand and potential sources of waste heat to identify eleven 'priority areas' for district heating in the region.

Priority areas for district heating were identified where there was high existing heat demand, a significant heat demand from 'anchor load' sites, and potential for future heat demand. Approximately 200 sites were identified which met these criteria, and the best of these were selected, looking at size and level of existing and future heat demand, and allocating priority areas so that each county and unitary authority had at least one. This resulted in priority areas being identified within the following local authority areas: Corby, Derby, Leicester, Lincoln, Mansfield, and Nottingham, High Peak, Harborough, and Rutland. These have been mapped in **Chapter 5**.

Policy Guidance

This report provides guidance for local planning authorities on what further assumptions and scenario testing could be used to refine the results of the technical renewable energy potential to calculate the deployable potential – i.e. considering transmission, supply chain and planning constraints and opportunities as summarised in the figure below.

Key renewable/low carbon energy deployment constraints



Guidance is also provided on how local planning authorities within the East Midlands can play a proactive role in facilitating renewable and low carbon energy development through the establishment of a positive planning policy framework and the types of policy approaches that could be incorporated within Development Plans. Four broad categories of energy policy are considered in the report including:

- **General policies** setting out the criteria for the assessment of renewable energy applications and the integration of renewable and low carbon energy targets.
- Policies identifying **suitable locations for standalone and low carbon energy developments.**

- Policies relating to the **integration of suitable energy within built developments.**
- Policies providing support for **community wide infrastructure.**

Next Steps

The report concludes with a summary of the next steps that are needed to take forward the findings of the study. In relation to the **renewable energy assessment**, Local authorities are asked to consider undertaking the following key tasks:

- 1) **Review the data sources and assumptions** contained in this report to ascertain if any amendments/refinements need to be made to better reflect local circumstances or to incorporate local data sources.
- 2) **Refine the assessment of technical renewable energy potential** to calculate the level of deployable potential within their local authority, or update existing studies where appropriate in light of the findings in this report.
- 3) **Develop and test any scenarios with stakeholders** to enable a preferred scenario to be identified. This may well be a combination of, or modified version of the original scenarios. This approach will enable stakeholders to discuss the scenarios and understand the key assumptions and parameters that will affect the level of deployment for

each technology. This in turn should improve the robustness of assumptions.

- 4) **Refine and select preferred scenario** setting a clear target/ ambition for the delivery of renewables within the local authority area.
- 5) **Ensure proposed ambition is reflected in supportive planning policy and is incorporated within the Development Plan or equivalent.** The policy should then be tested with wider stakeholders as part of the standard development plan consultation and approval process.

In relation to **heat mapping**, the role for a local authority varies depending on the nature of the opportunity for district heating. Where the opportunity is based around *new development* which of itself will have a sufficient potential heat demand to make district heating feasible, the local authority's role is around setting policies which influence developers to set up district heating networks.

Where the opportunity is based around a *public sector anchor load* (a publically-owned building with a high, relatively steady heat demand), the local authority can take the role of project developer, with support from engineering consultants or an energy service company. It could alternatively take the role of customer and contract an energy services company to drive the development of the project.

The stages of district heating project development are as follows:

1. **Data gathering.** The heat map provides a good starting point, but actual (rather than modelled) demand data will be required to provide information about the load profiles of the candidate buildings, in order to size the system correctly.
2. **Project definition.** At this stage the scale and extent of the project must be defined, and required partners brought on board.
3. **Options appraisal.** At this stage the most suitable technology is identified.
4. **Detailed feasibility study.** Here network layout and local topography are considered.
5. **Financial and business modelling.** Here the financial feasibility of the project is tested and the legal structure of the project is defined.

The report concludes that in developing a target or ambition for the development of renewable energy or low carbon developments within an area, it is important that consideration is given to how it is going to be realised. Setting out a clear action plan and/or strategy for the delivery of renewable and low carbon energy, in conjunction with other key partners is critical to ensure that targets and ambitions in the development plans are delivered on the ground.

1 Introduction

1.1 Land Use Consultants (LUC), the Centre for Sustainable Energy (CSE) and SQW were commissioned in September 2010 to assess the potential for renewable and low carbon energy within the East Midlands. This final report provides a comprehensive evidence base identifying the technical potential for renewable and low carbon energy technologies within the region. It will assist local planning authorities across the East Midlands in developing well-founded policies and strategies that support low carbon energy deployment up to 2030.

1.2 The four key objectives of the project were:

1. To identify and map low carbon and renewable energy resources and opportunities across the East Midlands, following the methodology published by the Department of Climate Change (DECC)/ Department for Communities and Local Government (CLG) - *'Renewable and Low Carbon energy Capacity Methodology: For the English Regions'* (2010)².
2. To prepare heat maps for each local authority area within the East Midlands illustrating local heat demand and supply.

3. To provide recommendations on locations with a high potential for district heating and the use of waste heat and more detailed heat mapping for these locations.
4. To provide generic guidance and specific examples of how the renewable and low carbon resources and opportunities identified can be used to formulate local planning policies.

1.3 The project specifically sought to ensure that the renewable energy evidence base gathered was consistent with national guidance and other local activities. This was achieved by building on previous/ongoing studies in the East Midlands and applying the methodology published by DECC and CLG³.

1.4 It is important to note that when the DECC methodology was originally published it had two key aims:

- to help regions assess the potential for renewable energy in their area in a consistent way;
- for each regional assessment to underpin the evidence base for setting ambitious targets for renewable energy and a clear strategy to support their delivery in the Regional Strategy.

² <http://www.info4local.gov.uk/documents/publications/1497400>

³ DECC/CLG, 2010: "Renewable and Low carbon Energy Capacity Methodology: Methodology for the English Regions"

I.5 Whilst the first aim is still relevant, Central Government has since confirmed its intention to abolish Regional Spatial Strategies. Despite this fundamental change there remains a strong imperative for strategic planning – to ensure that the approach to increasing the supply of renewable and low carbon energy is consistent, efficient and effective across local authority boundaries.

PROJECT SCOPE

Technologies

I.6 The project focuses on land-based renewable electricity and heat technologies, including both commercial scale renewables and microgeneration (on-site and building-integrated renewables). A summary of the technologies covered by this study is provided in **Table I.1**.

I.7 The project does not cover offshore or marine (wave and tidal) renewable energy sources because these technologies are not controlled by the local planning regime as they are governed by other frameworks (e.g. the Crown Estate’s licensing arrangements and the new marine planning system). Other energy sources including nuclear and fossil fuel sources are also excluded from this study. It is fully recognised that there are close links between the technologies covered by the project and those that are excluded. For example, in the way that energy demand and carbon reduction targets are met and in terms of the industrial and supply chain opportunities.

Table I.1: Technologies covered in study

Technology	Sub-category 1	Sub-category 2
Wind (on-shore)	Commercial scale	Large, medium and small commercial scale wind turbines
	Small scale (<6kW)	
Biomass	Plant biomass	Managed woodlands
		Energy Crops
		Waste wood
		Agricultural arising (straw)
		Co-firing
	Animal biomass	Wet organic waste
		Poultry litter
Waste	Municipal Solid Waste (MSW)	
	Commercial and industrial	
Biogas	Landfill gas	
	Sewage gas	
Hydro	Small – scale	
Micro-generation	Solar	Solar Photovoltaics (PV)
		Solar Water heating (SWH)
	Heat pumps	

I.8 Large scale solar ground mounted PV arrays (otherwise known as solar PV farms) were not included in the scope of this project although it is acknowledged that there are an increasing number of applications and enquiries coming forward for projects of this nature within the East Midlands. It is likely that the Government's amendments to the Feed in Tariff that allows such projects to qualify for generation grants will dramatically curtail the number coming forward. Due to the nature of these projects it is also inherently difficult to identify the technical resource potential for this form of development. Further guidance on the issues that would need to be considered to identify the potential for these types of development is included in **Chapter 3**.

I.9 A brief description of the renewable energy technologies outlined in **Table I.1** and considered in this report is provided in **Appendix I.1**.

Heat mapping

I.10 This project goes beyond the requirements of the DECC methodology and includes a comprehensive assessment of the potential for district heating and the use of waste heat within the East Midlands. This important piece of work on heat mapping will provide a sound evidence for local authorities seeking to take forward district heating and Combined Heat and Power (CHP) schemes within their local areas.

Timescale

I.11 Where relevant, the assessments of renewable energy potential were undertaken with reference to two timeframes, 2020 and 2030. The 2020 timescale is linked to the Government's target to deliver 15% of our energy from renewables by 2020, in line with the EU Directive. The 2030 timescale is related to general timeframe of emerging core strategies in the East Midlands (although there are significant variations between local authorities). For some technologies, the total accessible potential is not linked to a specific timeframe (e.g. 2020, 2030) as either the total resource is available over any timeframe (e.g. onshore wind, hydro) or it was not possible to predict with any degree of accuracy the change in arisings between 2020 and 2030 (e.g. for resources such as managed woodland, poultry litter and agricultural arisings etc). For this reason, for some technologies the results tables in **Chapter 4** do not indicate any difference in potential between 2020 and 2030.

Geographical coverage

I.12 The study covers the whole of the East Midlands and those parts of the Peak District National Park that fall outside the East Midlands as illustrated on **Map I.1**. The whole of the Peak District National Park is included in the study as the National Park Authority forms the statutory planning authority for the whole of the Park.

I.13 The renewable energy resource assessment has been disaggregated down to a county and local authority level.

Appendix 4.1 of this report also disaggregates the results for each renewable energy technology by Housing Market Area (HMAs). **Map 1.2** shows the reporting boundaries for the Housing Market Areas. It is important to note that the report provides an assessment of renewable energy potential disaggregated down to a county and local authority level. **It is not intended to provide guidance for the assessment and development of specific sites.** Further detailed site based studies and assessments would be required to assess the suitability or otherwise of specific sites.

- I.14 The heat mapping study has been disaggregated down to address level detail.

ASSESSMENT OF TECHNICAL AS OPPOSED TO DEPLOYABLE POTENTIAL

- I.15 The assessment of renewable energy potential presented in **Chapter 4** of this report represents the ‘**technical potential**’ – i.e. the total amount of potential that is theoretically available. It does not consider the ‘**deployable potential**’ – i.e. what could be practically achieved and delivered within the local authority areas. This is in line with Stages 1-4 of the DECC methodology which is outlined in more detail in **Chapter 2**. Further assumptions and scenario testing will be needed to refine the results presented in **Chapter 4** to calculate the deployable potential – i.e. considering transmission, supply chain and planning, landscape constraints and opportunities. **Chapter 6** of this report provides further guidance on how the

assessment of ‘technical potential’ could be used by local planning authorities to inform their own assessments of ‘deployable potential’.

STAKEHOLDER ENGAGEMENT

- I.16 East Midlands Councils considered it essential that key stakeholders were engaged in the process of the study, to enable the project team to capture up to date data sources and to give the stakeholders an opportunity to comment on the assumptions used and key findings.
- I.17 Three main streams of consultation were undertaken.
1. At the outset of the project all the key holders of information were contacted by telephone and by face-to-face meetings to obtain any relevant information/ data sources that could be used to inform the assessment. (e.g. Forestry Commission, Environment Agency, DEFRA, Natural England, Ministry of Defence etc)
 2. Regular discussions took place between the project team and steering group via steering group meetings and ongoing liaison.
 3. The steering group were sent copies of the scoping, interim, draft and final report for comment. These comments were taken on board in the preparation of the final outputs.

- I.18 The steering group was made up of the following organisations and we would like to thank them for their valued input and assistance with this study.

Steering Group Representatives

- East Midlands Councils
- Government Office for the East Midlands (GOEM)
- East Midlands Development Agency (emda)
- Peak District National Park Authority
- Central Lincolnshire JPU: the Joint Planning Unit for City of Lincoln, North Kesteven District and West Lindsey District
- Nottinghamshire County Council
- Nottinghamshire Sustainable Energy Planning Partnership
- Northamptonshire County Council
- Derbyshire County Council
- Leicester City Council
- Mansfield District Council
- City of Lincoln
- Natural England
- Environment Agency

REPORT STRUCTURE

- I.19 The remainder of this report is structured as follows:

Chapter 2: provides a brief overview of the policy context for the study and existing renewable energy studies that have been undertaken in the East Midlands to date.

Chapter 3: sets out the key assumptions and data sources used to undertake the assessments of renewable energy potential.

Chapter 4: presents the findings of the technical renewable energy resource assessment disaggregated by county and district authorities.

Chapter 5: presents the findings heat mapping assessment.

Chapter 6: provides planning guidance on how the information set out this report could be used by local planning authorities to inform their own assessments of deployable potential and formulate robust planning policies for renewable and low carbon energy.

Chapter 7: outlines the next steps for taking forward the findings of the study.

2 CONTEXT

INTRODUCTION

- 2.1 This chapter summarises the planning and energy policy context for the study. A more detailed policy review is contained within **Appendix 2.1**. A short overview of the DECC methodology is set out in addition to a summary of the approach which has been used to calculate the potential for renewable energy within the protected landscapes within the East Midlands. The chapter concludes with a brief review of other renewable energy studies which have already been completed within the East Midlands.

POLICY CONTEXT

Planning Policy

- 2.2 The Coalition Government has announced a programme of radical reforms to the planning system which aim to devolve more power to councils and neighbourhoods. The 'localism' agenda was set out in the **Open Source Planning Green Paper** and has been taken forward in the **Decentralisation and Localism Bill**. Key changes include the Government's intention to abolish regional strategies, establish neighbourhood plans and transfer of the Infrastructure Planning Commission's (IPC) responsibilities to the Major Infrastructure Planning Unit (with ultimate responsibility for decisions resting with the Secretary of

State). **The Natural Environment White Paper** is also due to be published in 2011 which will be a source of additional guidance that will need to be taken into account when considering the impact of energy proposals on the natural environment.

- 2.3 Existing national planning policy and guidance on low carbon and renewable energy includes **Planning Policy Statement 22: Renewable Energy** (PPS22) and its **Companion Guide** which offer strong support for development of renewable energy, as does the **Supplement to PPS1: Planning and Climate Change**. PPS 22: (para 1 (ii)) urges that local planning authorities should recognise the full range of renewable energy sources, their differing characteristics, locational requirements and the potential for exploiting them subject to appropriate environmental safeguards.
- 2.4 The PPS 1 supplement also states that Planning authorities should have an evidence-based understanding of the local feasibility and potential for renewable and low carbon technologies, including microgeneration, to supply new development in their area. This may require them, working closely with industry and drawing in other appropriate expertise, to make their own assessments (para 26).
- 2.5 A draft PPS intended to replace the PPS1 supplement and PPS22 was published for consultation by the previous government but this will not now be taken forward. A revised draft **National Policy Statement (NPS)** on

renewable energy infrastructure (EN-3) is expected to be published in Spring 2011. NPSs will be used by ministers and the Major Infrastructure Planning Unit to be set up within the Planning Inspectorate when they make decisions on applications for development consent for nationally significant energy infrastructure.

- 2.6 Although regional spatial strategies (RSSs) will be revoked once the Decentralisation and Localism Bill passes into law, a court case by CALA Homes in November 2010 re-established RSSs as part of the development plan for the time being. A subsequent high court challenge in February 2011 by CALA Homes to halt planners and planning inspectors using the intended revocation of the RSS as a 'material consideration' when making planning decisions was however lost by the developer. The **East Midlands Regional Plan** sets a target for CHP/district heating, supports development of a distributed low carbon energy network and appropriate low carbon energy proposals and lists key considerations for Local Planning Authorities when establishing criteria for renewable and low carbon energy development.

Energy policy

- 2.7 The **Climate Change Act 2008** commits the UK to cutting greenhouse gas emissions by 26% below 1990 levels by 2020 and 80% by 2050. The **UK Renewable Energy Strategy** published by the former Government set out how development of low carbon and renewable energy would contribute to greenhouse gas reductions.

- 2.8 As part of its **Spending Review** in 2010 the Government confirmed its commitment to invest in a transition to a low carbon economy, with DECC the only department to see its capital budget rise over the review period. DECC's business plan for 2011-2015 takes forward the policy direction in the Spending Review. Specific initiatives including the following. The **Green Deal** supports implementation of energy efficiency measures by households and businesses without needing to incur upfront costs. **Feed-in Tariffs** pay individuals and businesses who install renewable and low carbon energy systems for each unit of electricity they generate with a further payment for any surplus electricity exported to the national grid.

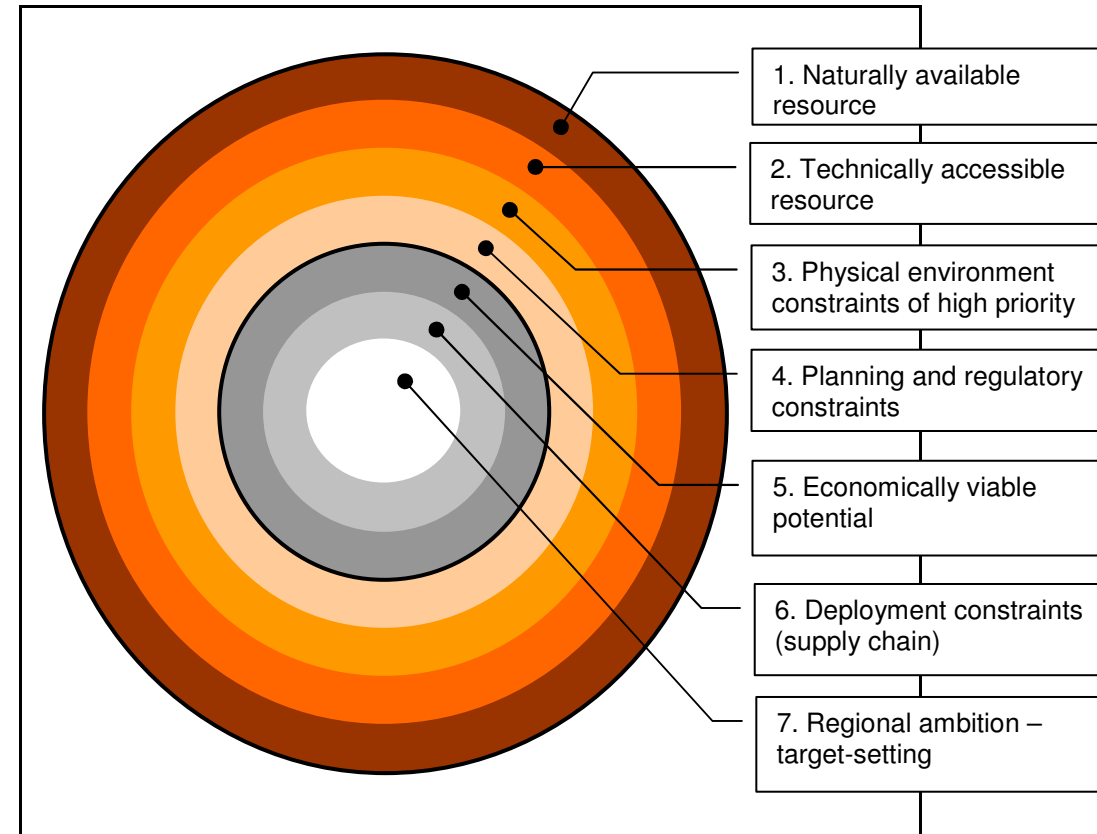
- 2.9 The **Renewable Heat Incentive** will establish a similar scheme to Feed-in Tariffs in respect of renewable heat technologies. The Spending Review allocated £200m of support for the development of **offshore wind technology** and manufacturing and other renewables at UK port sites. It also committed £1 billion public funding for a **Green Investment Bank** to unlock private investment in low carbon infrastructure projects and £1 billion to support a commercial scale **carbon capture and storage** demonstration plant. The Carbon Reduction Commitment (CRC), a mandatory energy efficiency and carbon emission reduction scheme for the UK largest emitters of carbon, will be reformed and re-launched as the **CRC Energy Efficiency Scheme**.

2.10 The **Energy Bill** passing through Parliament will implement the Green Deal, reform the offshore electricity transmission regime and give investors in new nuclear energy generation increased certainty over their obligations.

OVERVIEW OF DECC METHODOLOGY

2.11 In March 2010, DECC published a methodology for quantifying the opportunities and constraints to deploying renewables and local low carbon energy in the English regions⁴. The purpose of this methodology was to ensure that a consistent approach was used for the assessment of resource potential across the English regions. **Figure 2.1** sets out the key stages which the methodology identifies are required to develop a comprehensive evidence base for setting regional renewable energy targets. The DECC/ CLG methodology provides guidance on how to undertake the Stages 1 to 4 of this process. This involves identifying the **technical renewable energy potential** as opposed to the amount of renewable energy that could **realistically be deployed**. The methodology does not cover stages 5 to 7, which relate to assessing the deployable potential and ultimately lead to target-setting.

Figure 2.1: Stages for developing a comprehensive evidence base for renewable energy potential



Source: Renewable and Low Carbon Energy Capacity Methodology: Methodology for the English Regions (2010)

⁴ DECC/CLG. (2010). Renewable and Low carbon Energy Capacity Methodology: Methodology for the English Regions.

2.12 In broad terms, Stages 1 and 2 represent the opportunity for harnessing the renewable energy resource on the basis of what is naturally available within the context of the limitations of existing technology solutions. Stages 3 and 4 address the constraints to the deployment of technologies in relation to the physical environment and planning/regulatory limitations. **Table 1.2** provides a summary of the assessment process which the regions are required to use to gather the evidence for Stages 1 to 4.

Table 1.2: DECC/ CLG Methodology - Assessment process summary

Main element	Stage and description
Opportunity analysis	
Stage 1. Naturally available resource	Regions need to explore and quantify the naturally available renewable energy resource within their geographical boundary. This will be based on data and information analysis including resource maps and inventories.
Stage 2. Technically accessible resource	Regions need to estimate how much of the natural resource can be harnessed using commercialised technology (currently available or expected to reach the market by 2020). This will be based on applying parameters regarding the deployment of technology. The entire area of the region needs to be taken into account.

Main element	Stage and description
Constraints analysis	
Stage 3. Physical environment constraints	Regions need to explore the physical barriers to deployment such as areas where renewables schemes cannot practically be built – e.g. large scale wind turbines on roads and rivers etc. This layer of constraints will reduce the overall deployment opportunity. The analysis will be based on GIS maps and various relevant regional inventories.
Stage 4. Planning and regulatory constraints	Regions need to apply a set of constraints relevant to each renewable technology that reflects the current planning and regulatory framework, such as excluding from the assessment areas and resources which cannot be developed due to e.g. health & safety, air/water quality, environmental protection, etc.

- 2.13 For both the opportunity and constraints analyses, the methodology sets out a list of parameters and relevant data sources which must be used. Unfortunately it has not been possible to adhere to the guidance set out in the DECC methodology for some of the technology assessments as the data sources suggested within the guidance have not been obtainable. Some of the parameters proposed have also been questioned and where necessary these have been amended as appropriate.
- 2.14 It is also important to note that the DECC methodology was designed to identify the potential for renewable energy at a regional level as opposed to at a local authority level, therefore, some of the data sources and assumptions

proposed within the DECC methodology have had to be amended/ refined to take account of the requirements of this project and the need to disaggregate the results down to a local level.

- 2.15 In order to ensure that the assessment methodology and parameters used are fully documented and transparent, **Chapter 2** of this report sets out the full range of assumptions and data sources used. **Appendix 3.2** also provides detailed information on where there has been any divergence from the DECC methodology and the reasons for any change.

Designated Areas

- 2.16 The DECC methodology – *Renewable and Low Carbon Capacity Assessment Methodology: the English Regions (2010)* includes a requirement that separate assessments should be undertaken of the potential for renewable energy deployment within international and national landscape and nature conservation designations. More specifically the DECC methodology states that a five step approach should be applied. The five steps include:

- **Step 1:** Identify the purposes of the landscape/ nature conservation area (reasons for designation)
- **Step 2:** Identify which technologies might affect these purposes/ integrity of the designation
- **Step 3:** Identify how each technology might affect the purposes/ integrity

- **Step 4:** Identify the type and level of renewable and low carbon infrastructure that could be accommodated without compromising the purposes/ integrity of the designations
- **Step 5:** Provide guidance on how to integrate renewable/ low carbon energy without compromising the purposes/integrity

- 2.17 The DECC methodology suggests that the regions should undertake the assessment of potential within the designated areas in parallel with the general regional assessment (i.e. covering non-designated areas), with the findings feeding into the overall regional evidence base at a later stage.

- 2.18 Historically, designated areas have been excluded from the regional assessments of renewable energy potential within the East Midlands⁵. In the preparation of the DECC guidance and this report, Natural England advised that the technical potential for renewable energy within **designated landscapes** should be assessed as part of the regional study, not to set targets for designated landscapes, but to give an estimate of the contributions to the regional potential. Natural England also advised that designated **nature conservation areas** should be excluded from the assessment as due to the large number of sites, it is not possible, or appropriate within the scope of regional studies

⁵ For example - Viewpoints on Sustainable Energy in the East Midlands (2001) EMRA

to assess the technical potential of these areas for renewable energy on a site by site basis.

- 2.19 In line with the DECC methodology, sites of heritage interest have been excluded where relevant for the various technical assessments. Further details on the exclusions applied are contained in **Chapter 3** and **Appendix 3.2**. Please note that Greenbelt has not been included as a constraint to development⁶.
- 2.20 Within the East Midlands there two national landscape designations, the Peak District National Park and the Lincolnshire Wolds AONB - See **Map 1.1**. Various discussions took place with Natural England, the Peak District National Park Authority and relevant local planning authorities as part of the preparation of this report to agree how the assessments of potential for these areas should be undertaken. The following approaches were agreed:

The Peak District National Park

- 2.21 An assessment of renewable energy potential the Peak District National Park has already been undertaken as part of the *Peak Sub-Region Climate Change Study* (July 2010). This study involved a detailed assessment of the potential for renewable energy within the Peak District National Park, Derbyshire Dales and High Peak. This included the

identification of the total potential for renewable energy including the setting of targets for 2026 of what could realistically be deployed including the estimated contribution from the National Park area where a different legislative approach and national policy considerations apply. A detailed landscape sensitivity study was used to inform the assessment of potential (see **Appendix 3.1**). A similar study is also in the process of being completed by North East Derbyshire District Council. It was intended that the findings of this study would also be fed into the results of this study, however the report was not published in time for inclusion in this report. The assessment for North East Derbyshire has therefore been undertaken in line with the methodology used for the other East Midlands authorities.

- 2.22 The East Midlands Councils and LUC agreed with the Peak District National Park, Derbyshire Dales District, and High Peak Borough Council that the results of the Peak Sub-region Climate Change Study should feed directly into this report and the assessment of potential contained herein. Although the studies go beyond the boundaries of the National Park, it has been assumed that those areas outside of the National Park that fall within districts of Derbyshire Dales, and High Peak form part of the setting for the National Park in the context of this renewable energy resource assessment. It was agreed that these constituent authorities differ from other local authorities in that they have duties as relevant bodies under the National Parks and Access to the Countryside Act (1949) as amended by the Environment Act 1995 (section 62 (2)) to have regard to

⁶ Table A-2 of the DECC methodology states that "there is an established precedent for wind farms being approved within green belt designations as they were not deemed to affect the 'openness' of the designation. The guidance in this broad regional methodology therefore states that green belts should not be considered as a constraint to wind energy developments."

National Park purposes. These duties are set out in their saved Local Plan Policies and are explained in the English National Parks and the Broads UK Government Vision and Circular 2010⁷.

- 2.23 Please note that the Peak Sub-Region Climate Change Study did not include an assessment of potential for all of the renewable energy technologies covered in this report. Agricultural arisings, waste wood, poultry litter, wet organic waste, municipal and solid waste, commercial and industrial waste, landfill and sewage gas were not specifically included in the Peak Sub-Regional Climate Change Study (2009).
- 2.24 In summary, it was agreed that a new assessment of potential should not be undertaken for the Peak District National Park, Derbyshire Dales District, and High Peak Borough Council. The results of the assessments of potential from the existing studies for these areas have therefore been incorporated into the findings set out in **Chapter 4**. Please note that the assumptions which have been used to undertake the assessment of technical potential do differ between the Peak Sub-Region Climate Change study and this study. Some minor adjustments have also been made to the results to ensure compatibility with the timescales being considered in this study which run to 2020 and 2030.

⁷ <http://www.defra.gov.uk/rural/documents/national-parks/vision-circular2010.pdf>

Lincolnshire Wolds AONB

- 2.25 As outlined in paragraph 3.15 the proposed five step approach set out within the DECC methodology requires an assessment of the extent to which renewable and low carbon energy can be accommodated within designated areas, without compromising the purposes/ integrity of the designations. Whilst this has already been undertaken for the Peak District National Park as part the landscape sensitivity assessment for the *Peak Sub-Region Climate Change Study* (July 2010), a similar study has not been undertaken for the Lincolnshire Wolds AONB. Within the constraints of this study, it was not possible to undertake a detailed assessment of potential relating to the purposes/ integrity of the AONB. Instead the following approach was agreed and used:
- If a renewable energy technology was not considered to have the potential to have significant effects on the purposes/ special qualities of AONB, then the standard methodology as set out in **Chapter 3** of this report was used to calculate the technical potential within the AONB.
 - For those technologies which could potentially have a significant effect on the purposes/ special qualities of the AONB such as commercial and small scale wind, an assessment of potential within the AONB was undertaken using revised assumptions which were agreed with Natural England and Lincolnshire County Council. A

summary of which assumptions were agreed are set out in **Chapter 3** of this report.

- 2.26 Whilst it was not possible within the scope of this study to undertake a detailed assessment of the extent to which renewable and low carbon energy can be accommodated within the AONB without compromising the purposes/ integrity of the designation, it is recommended that such a study incorporating a landscape sensitivity assessment is undertaken in the future.

PREVIOUS STUDIES UNDERTAKEN IN THE EAST MIDLANDS

- 2.27 The assessment of potential for renewable energy within the East Midlands has been undertaken in line with the DECC methodology, however, it has also taken account of (where appropriate) previous/ ongoing studies that have been carried out by local authorities in the area.
- 2.28 An extensive array of studies has been completed in the East Midlands to date at a regional, sub-regional and local scale. The existing studies reviewed are summarised in **Table 2.2** below. A separate Scoping Report⁸ provides a systematic review of these studies and assesses the extent to which these studies are consistent (or otherwise) with

⁸ *Low Carbon Energy Opportunities and Heat Mapping for Local Planning Areas across the East Midlands – Scoping Report*, (October 2010), Land Use Consultants, CSE and SQW.

the method (based on the DECC methodology) used for this study.

Table 2.2: East Midlands Renewable Energy Studies

Commissioning authority, date	Study
North East Derbyshire	North East Derbyshire have commissioned a study to identify the technical and deployable potential within their district, This study is due to be published shortly.
Nottingham City Council - on behalf of Nottinghamshire Sustainable Energy Partnership, April 2010	Nottingham Energy Strategy 2010-2020 The Strategy provides an overarching framework for the City's plans, programmes and initiatives relating to sustainable energy supply and use to 2020: cutting emissions, maintaining energy security, maximising economic opportunities, and protecting the most vulnerable. The Strategy and the associated action plan will ensure that Nottingham accelerates the development, use and value of its energy resource and energy efficiency potential. http://www.nottenergy.com/renewable-energy/the-nottingham-2020-sustainable-energy-strategy
Nottinghamshire County Council, November, 2009	Nottinghamshire Sustainable Energy Policy Framework The Study entitled 'Towards a Sustainable Energy Policy for Nottinghamshire' was carried out (2008-09) by a combined district/ city/county planning authority grouping known as the Nottinghamshire Sustainable Energy Planning Partnership assisted by consultants on modelling and report drafting. The Policy Framework aims to inform local development planning by providing evidence for the case for higher energy performance standards in new development across the county. http://www.nottinghamshire.gov.uk/home/environment/greenissues/energy/sustainableenergypolicyframework.htm

Commissioning authority, date	Study
Friends of the Peak District, March 2010	<p>Peak Power: Developing Micro Hydro Power in the Peak District</p> <p>This study aimed to produce a comprehensive survey of micro hydro power potential in the Peak District National Park (PDNP) area and its immediate surroundings.</p> <p>Specific objectives included:</p> <ul style="list-style-type: none"> To review provide an overview of available hydro power technology and to review opportunities and constraints to its introduction in the Peak District To set out the policy and legal frameworks associated with gaining permission to develop a micro hydro scheme To give practical advice on dealing with site issues such as the water environment, ecology, archaeology, landscape impact, access for civil works, electrical connection etc To encourage and facilitate the assessment of potential hydro power sites <p>http://www.friendsofthepeak.org.uk/download/files/HYDRO/PEAKPOWERMainreportAppA.pdf</p>
Bassetlaw District Council, February 2010	<p>Bassetlaw Renewable and Low Carbon Energy Study</p> <p>AECOM were commissioned by the planning department of Bassetlaw District Council to undertake a Renewable and Low Carbon Energy Study, in order to support the reduction of carbon dioxide emissions from residential and non-domestic buildings and an increase in the supply of renewable and low carbon energy in the district. The detailed objectives of the study were to identify:</p> <ul style="list-style-type: none"> The distribution and extent (with mapping) of existing and potential renewable energy resources

Commissioning authority, date	Study
	<p>(e.g. wind, biomass, hydro, solar, ground/air source and hydrogen fuel cells) within Bassetlaw and how they can be exploited, in relation to specific new developments and larger scale heat and power generation.</p> <ul style="list-style-type: none"> Feasibility and viability of setting a target percentage contribution from decentralised renewable and low carbon energy sources in new development. Potential policies for inclusion in the Core Strategy, set in the context of future requirements of the Code for Sustainable Homes and BREEAM measures for non-domestic buildings. How Bassetlaw District Council can implement and monitor the recommended approach, including an assessment of the feasibility of establishing an Energy Service Company, guidance on the development control process for planners, and guidance for developers. <p>http://www.bassetlaw.gov.uk/pdf/BDC%20Renewable%20&%20Low%20Carbon%20Energy%20Study.pdf</p>
Derby HMA & Erewash BC, December 2009	<p>Cleaner, Greener Energy Study: Report 1 – LDF Evidence Base</p> <p>This study was commissioned by the local authorities of Amber Valley, Derby City, Erewash and South Derbyshire to provide an evidence base for their LDFs by establishing the potential for decentralised or low carbon sources of energy and recommending carbon standards for future development. The assessment of renewable energy potential focuses on major opportunities for standalone wind and biomass development and opportunities in both new and existing</p>

Commissioning authority, date	Study
	<p>buildings. For each assessment, the report sets out the methodology, analysis results and the overall potential under two scenarios reflecting future policy options. Results are presented for each local authority and in total for the study area, expressed in a range of ways including energy generated, percentage of heat and power that could be met from renewable sources and amount of CO₂ that could be abated.</p> <p>http://www.derby.gov.uk/NR/rdonlyres/14B41450-009E-4715-9DEB-35B3F70F2F97/0/2010cleanergreenerenergy.pdf</p>
EMRA, June 2009	<p>Reviewing Renewable Energy and Energy Efficiency Targets for the East Midlands</p> <p>This report by Faber Maunsell/AECOM uses a top down and bottom up approach to examine potential uptakes of low and zero carbon technologies in the region. The top down approach assesses the potential for independently driven renewables, based on updating previous projections made in a number of reports commissioned by the region. Independently driven technologies are those which arise from their own merits, for example commercial energy generation, and are not connected with other mechanisms. The bottom up approach simulates the uptake of technologies which are stimulated by regional growth, for example low and zero carbon technologies (LZCs) required to meet future building regulations. In addition, the report assesses the potential for reducing energy and CO₂ emissions through energy efficiency.</p> <p>http://www.emregionalstrategy.co.uk/write//Reviewing-Renewable-Energy-Efficiency-targets-June2009.pdf</p>

Commissioning authority, date	Study
EMRA, 2006	<p>East Midlands Regional Targets and Scenarios for Renewable Energy</p> <p>Best Foot Forward were commissioned by EMRA to review 2010 targets as given in the 2001 document Viewpoints on Sustainable Energy in the East Midlands; comment on progress to date, technology changes and any improved data; update the 2010 targets to 2020 and, if possible, to 2050; use these updated targets and commentary to inform a series of future scenarios. The study provides top-down updates of the 2001 'Viewpoints' resource calculations rather than providing a new, detailed resource assessment.</p> <p>http://www.northamptonshireobservatory.org.uk/publications/document.asp?documentid=710</p>
Peak Sub-region, 2009	<p>Peak Sub-region Climate Change Study – Focussing on the Capacity and Potential for Renewable & Low Carbon Technologies</p> <p>In response to the issue of climate change and the need to reduce carbon emissions, this research was commissioned from the National Energy Foundation (NEF) and LUC to:</p> <ul style="list-style-type: none"> • Assess the capacity and potential for decentralised energy supply by optimising renewables and low carbon technologies across the Peak Sub-region. • Offer spatial planning options for the best means of achieving any identified potential by specific technology type. • Clarify the scope for targets for standalone technology, development integrated technology and micro-generation. <p>http://www.derbyshiredales.gov.uk/Images/Renewable%20PeaksFinalReport_tcm19-109883.pdf</p>

Commissioning authority, date	Study
Chesterfield Renewable and Low Carbon Energy Study, 2010	<p>Chesterfield Renewable and Low Carbon Energy Study In 2009 Chesterfield Borough Council commissioned energy specialist consultants to conduct a borough wide study into the potential for Renewable and Low Carbon Energy. The final report was approved by the Council in July 2010 and is available as part of the evidence base for the LDF.</p> <p>This study provides the evidence base for setting targets for the CO2 performance of new developments in Chesterfield borough. It includes an assessment of the local context in terms of development plans and existing policies, and an opportunity assessment for decentralised, renewable and low carbon technologies. These assessments include an analysis of the technical feasibility and economic implications of low carbon development in Chesterfield borough. http://www.chesterfield.gov.uk/default.aspx?CATID=887</p>
Blaby District Council in conjunction with the neighbouring authorities of North West Leicestershire, Hinckley and Bosworth, Oadby and Wigston, Melton and Harborough District , May 2008	<p>IT Power was commissioned to undertake a Renewable Energy and Climate Change Study in 2008. The study examines the climate change implications of a number of development options in the District of Blaby; the implications of improving energy efficiency in new dwellings; and potential opportunities for new renewable energy facilities. The study has three main outputs:</p> <ul style="list-style-type: none"> • Climate Change Assessment of Development Options • Energy Efficiency Recommendations for New Buildings • Renewable Energy Assessment <p>http://idocs.blaby.gov.uk/external/planning-building/planning/ldf-climate-change-assess.pdf</p>

Commissioning authority, date	Study
Natural England, 2007	<p>Regional Biomass Active Demand Mapping Project In October 2007, J H Walter was commissioned by Natural England to conduct a Regional Biomass Active Demand Mapping Project across the East Midlands to identify current and future demand. The project aimed to help to identify and understand potential land use issues and support the delivery of the Rural Development Programme for England 2007-2013. Specific project objectives were:</p> <ul style="list-style-type: none"> • Identify current public and private sector end users. • Identify future public and private sector end users. • Identify current supply and demand issues and possible strategies to improve the supply chain. • Produce a contact database. <p>http://www.naturalengland.org.uk/Images/regionalbiomassactiveemandmapping_tcm6-3281.pdf</p>
EMRA, 2001	<p>Viewpoints on Sustainable Energy in the East Midlands Land Use Consultants and IT Power were commissioned to produce this study which comprised six main elements:</p> <ol style="list-style-type: none"> 1. Review of the national and regional policy and institutional context. 2. Calculation of the energy supply and demand profile of the East Midlands. 3. Survey of local authorities in the Region to obtain information on existing renewable energy schemes and the perceived barriers and opportunities associated with pursuing sustainable energy solutions. 4. Detailed resource assessments and definition of targets for energy efficiency, CHP and renewable energy. 5. Stakeholder participation workshops. 6. Identification of general and specific actions required to meet the targets.

3 Assessment of Renewable Resource Potential

INTRODUCTION

- 3.1 This chapter provides a summary of the assessment approach that has been used to calculate the resource potential for each renewable energy technology type. This includes a detailed description of the key parameters, assumptions and data sources used in the assessments.
- 3.2 Information is also provided on the assumptions which have been used to undertake the assessments of potential for the protected landscapes. As noted in **Chapter 2**, it was agreed that the Peak Sub-Regional Climate Change Study (2009) would be used for the assessment of the Peak District National Park as well as the areas of Derbyshire Dales and High Peak that are outside the National Park. For North East Derbyshire, it was hoped that the results of the North East Derbyshire Renewable Energy Study could be used for this district but the study was not completed in time for inclusion in this report so the assessment for North East Derbyshire has been undertaken in line with the methodology used for the other East Midlands authorities.
- 3.3 As outlined in **Chapter 2**, the assumptions used in the assessment have been informed by the DECC

methodology⁹, although some refinements have been made to take account of the requirements of this study and the need to disaggregate the results down to local level. A detailed table of the assumptions used to undertake the assessments is provided in **Appendix 3.2** – this includes a clear explanation of where the assumptions used have diverged from the DECC methodology.

ONSHORE WIND COMMERCIAL

Assessment approach

General method

- 3.4 The methodology for assessing the resource potential for commercial wind takes into account the available wind speeds and the size and density of turbines that could theoretically be deployed. This is followed by the removal of a series of constraints relating to physical features e.g. roads, railways, rivers, environmental protection (e.g. nature conservation designations) and aviation constraints. The assessment was undertaken using GIS datasets and analysis. The analysis examined the potential for small, medium and large turbines (defined below) and where potential existed for more than one size of turbine, it was assumed that the larger turbines would take precedence.

⁹ <http://www.info4local.gov.uk/documents/publications/I497400>

Protected Landscapes

- 3.5 The findings of the Peak Sub-regional Climate Change Study (2009) have been used to identify the technical potential for renewable energy within the Peak District National Park and the plan areas of Derbyshire Dales and High Peak i.e. the parts of the borough or district lying outside the park boundary. It is important to note that the turbine sizes assessed in the Peak Sub-Regional study are not directly comparable to the turbine sizes used in this study. The turbine sizes assessed in the Peak Sub-Region study are:
- Large: 65m-125m (equates to medium and large in this study)
 - Medium: 15-65m (equates to small turbines in this study)
 - Small: up to 15m (included in small-scale (<6kW))
- 3.6 In line with the DECC methodology and Natural England advice, the assessment of technical potential for the Peak Sub-regional Climate Change Study (2009) involved a landscape sensitivity assessment for wind. This identifies the sensitivity of each landscape character area within the Peak District National Park and the remaining areas (ie outside of the National Park) of High Peak and Derbyshire Dales to wind developments. The results of this assessment are provided in **Appendix 3.1**. The study did not cover the area within North East Derbyshire outside of the National Park.
- 3.7 For the Lincolnshire Wolds, it was agreed that an opportunities and constraints analysis would be taken in line

with the standard methodology for onshore commercial wind, however, the assumptions regarding the density of turbines the landscape could accommodate would be revised downwards to zero turbines per km² – i.e. there is no potential for commercial scale wind. In order to take account of the setting of the AONB, in the absence of a more detailed sensitivity assessment, it was assumed that there is zero capacity for wind within 2km of the AONB. The same assumption was applied to the area that falls within 2km of the Peak District National Park in North East Derbyshire.

Summary of Assumptions

- 3.8 **Table 3.1** summarises the assumptions and data sources used to undertake the assessment. See **Appendix 3.2** for detailed information about each of the assumptions and the reasons (if any) for deviating from the DECC methodology.

Table 3.1: Summary of assumptions used for commercial scale wind energy assessment

Parameter	Assumption	Data Source
Opportunities		
Wind Speed (see Map 3.1)	All areas with wind speed 5 m/s at 45m above ground level (agl)	<ul style="list-style-type: none"> NOABL
Wind turbine size	<p>Considered three turbine sizes:</p> <ul style="list-style-type: none"> large-scale turbines (dimensions: tip height 135m, rotor diameter 100m, hub height 85m, 2.5MW) medium-scale turbines (dimensions: tip height 90m, rotor diameter 60m, 1MW) small-scale turbines (dimensions: tip height 65m, rotor diameter 43m, 0.5MW) 	<ul style="list-style-type: none"> DECC suggested size for large-scale turbines Research into turbine dimensions for medium-scale Steering Group suggested revised height for small-scale turbine (in line with medium scale turbines for Peak Sub-Region Study)
Wind turbine Density (see Map 3.2)	<p><i>General assumption:</i></p> <ul style="list-style-type: none"> Large: 4 turbines per km² Medium: 10 turbines per km² Small: 20 turbines per km² <p><i>High Bird Sensitive Areas:</i></p> <ul style="list-style-type: none"> 50% reduction of above <p><i>Medium Bird Sensitive Areas:</i></p>	<ul style="list-style-type: none"> DECC methodology Discussions with Steering Group/Protected Landscape Officers RSPB/Natural England

Parameter	Assumption	Data Source
	<ul style="list-style-type: none"> 25% reduction of above <p><i>Protected Landscapes assumption:</i></p> <ul style="list-style-type: none"> Zero turbines per km² within protected landscapes and 2km area around protected landscape. 	
Constraints		
Non accessible areas (see Map 3.3)	<ul style="list-style-type: none"> Roads Railways Inland waters Airports MOD training sites Major overhead transmission lines 	<ul style="list-style-type: none"> Ordnance Survey Strategi, Meridian2 CAA MOD National Grid
Exclusion areas (see Map 3.4)	<ul style="list-style-type: none"> Ancient Woodland National and international nature conservation designations* Sites of historic interest - Scheduled Monuments, Registered Parks and Gardens, World Heritage Sites (and associated buffers), Battlefields, Listed Buildings 5km buffer around airfields and airports 	<ul style="list-style-type: none"> Natural England English Heritage CAA Safeguarding Maps NATS/NERL Ordnance Survey Strategi, Meridian2 Ordnance Survey Address Layer 2 (property buffers)

Parameter	Assumption	Data Source
	<ul style="list-style-type: none"> • Civil Air Traffic Control constraints • Buffer around rail and roads related to topple distance of small, medium and large turbines • Built-up areas (property buffers related to type of property and size of turbine) 	<ul style="list-style-type: none"> • MOD
MOD constraints (see Map 3.3)	<ul style="list-style-type: none"> • Explosive Safeguarding Areas • MOD danger areas 	<ul style="list-style-type: none"> • MOD

* This includes SACs, SPAs, Ramsar Sites and SSSIs. Please note that the Steering Group considered issues arising from the potential for an area in Sherwood Forest to be designated a pSPA/SPA. On the advice of Natural England this area was not treated as an exclusion area in the assessment, as it is not currently an pSPA or SPA and the study had to be based upon current mappable evidence. Natural England instead advised use of the published RSPB/NE Bird Sensitivity Mapping which covers some of the Sherwood Forest Area (Mapped and Written Guidance in Relation to Birds and Onshore Wind Energy Development in England, (2009) - http://www.rspb.org.uk/Images/EnglishSensitivityMap_tcm9-237359.pdf). This mapping data was used to reduce the density of potential turbines within high and medium bird sensitive areas as set out in **Table 3.1**.

3.9 NATS/NERL were consulted regarding and other areas that would need to be excluded and it was noted that although there are other restricting factors such as radar that could be considered, they would need to be consulted on a site by

site basis to determine whether wind development in a particular area would be detrimental to existing radar/communications systems and no 'blanket' advice can be given at the regional level.

3.10 In line with the guidance provided in the DECC methodology, landscape sensitivity was not included as a constraint to the technical resource potential but is a key factor that should be considered when assessing the deployable potential for wind energy – as detailed in **Chapter 6** of this report. Landscape sensitivity was however taken into account in the Peak Sub-regional Climate Change Study (2009) as outlined in **Appendix 3.1**.

SMALL-SCALE WIND (<6KW)

Assessment Approach

General method

3.11 This assessment was GIS-based and involved identifying the number of residential and non residential properties within an area and assuming that a 6kW machine would be installed on all sites which have a wind speed above 4.5m/s. A wind speed scaling factor was applied to take account of the potential for obstructions in built up areas to reduce the average wind speeds and therefore the number of suitable properties. Whilst it was suggested that properties within Conservation Areas should be excluded, comprehensive data were not available to map these areas.

Protected Landscapes

- 3.12 The findings of the Peak Sub-Regional Climate Change Study (2009) have been used to identify the technical potential for renewable energy within the Peak District National Park (and for the Derbyshire Dales and High Peak districts as a whole). The results presented for this technology for the Peak Sub-Regional study area include both small-scale and micro-scale wind.
- 3.13 For the Lincolnshire Wolds, it was agreed that the standard DECC methodology would be applied, but the results would be reported separately. Whilst the standard methodology has been applied, it must be noted that the deployable potential within the Wolds is likely to be significantly less due to the need to take account of its sensitive landscape.

Summary of assumptions

- 3.14 **Table 3.2** summarises the assumptions and data sources used to undertake the assessment. See **Appendix 3.2** for detailed information about each of the assumptions and the reasons (if any) for deviating from the DECC methodology.

Table 3.2: Summary of assumptions used for Small-scale wind (<6kW) energy assessment

Parameter	Assumption	Data Source
Opportunities		
Address Points	<ul style="list-style-type: none"> Total number of residential properties as well as those which have potential for community schemes. See Appendix 3.3 for information on how properties have been categorised. 	<ul style="list-style-type: none"> Ordnance Survey Address Layer 2
Wind Speed (see Map 3.5)	<ul style="list-style-type: none"> All areas with wind speed 4.5 m/s at 10m above ground level (agl) 	<ul style="list-style-type: none"> NOABL
Wind turbine size	<ul style="list-style-type: none"> 6kW per address point 	<ul style="list-style-type: none"> DECC
Constraints		
Mean wind speed scaling factor (see Map 3.6)	<ul style="list-style-type: none"> Wind scaling factor of 56% for urban, 67% for suburban, 100% for rural 	<ul style="list-style-type: none"> DEFRA Rural-Definition (Lower Super Output Area level)

- 3.15 **Appendix 3.2** details how the Address Layer2 data was classified into address types and identifies the proportion of properties that have been identified as ‘community’ type properties.

PLANT BIOMASS – MANAGED WOODLAND

Assessment Approach

General method

- 3.16 The DECC methodology recommends the use of the Forestry Commission Woodfuel Resource Tool. The data are not disaggregated at a fine enough level of detail to generate results at a Local Authority level. In light of this, two approaches were used.
- 3.17 The first was a ‘top down’ approach which used the regional results from the Woodfuel Resource Tool and used GIS data for woodland types and locations to disaggregate the regional data to Local Authority level based on proportions of woodland type per authority. The second approach was a ‘bottom-up’ assessment. Using GIS data on woodland types and assumptions about current management, a spatial picture of opportunities for woodfuel was generated. Constraints in terms of competition from alternative markets and economic constraints were applied.

Protected Landscapes

- 3.18 The findings of the Peak Sub-Regional Climate Change Study (2009) have been used to identify the technical potential for managed woodland within the Peak District

National Park (and for the Derbyshire Dales and High Peak districts as a whole).

- 3.19 For the Lincolnshire Wolds, it was agreed that the standard DECC methodology would be applied, but the results would be reported separately.

Summary of assumptions

- 3.20 **Table 3.3** summarises the assumptions and data sources used to undertake the assessment. See **Appendix 3.2** for detailed information about each of the assumptions and the reasons (if any) for deviating from the DECC methodology.

Table 3.3: Summary of assumptions used for managed woodland assessment

Parameter	Assumption	Data Source
Opportunities		
Existing and potential feedstock (Maps 3.7 and 3.8)	<i>‘Top down’ approach</i>	<ul style="list-style-type: none"> Forestry Commission
	<ul style="list-style-type: none"> Used regional data from FC woodfuel resource tool and disaggregate to Local Authority level based on the percentage split of woodland types as defined by the NIWT dataset. 	
	<i>‘Bottom up’ approach</i>	

Parameter	Assumption	Data Source
	<ul style="list-style-type: none"> Used NIWT dataset to calculate the amount of woodland (by type and management) per Local Authority. 	
Fuel requirement – odt/MW	<i>Electricity</i> <ul style="list-style-type: none"> 6000odt/year = 1MW <i>Heat</i> <ul style="list-style-type: none"> 18GJ/odt Plant conversion efficiency: 80%. Plant conversion factor: 45%. 	<ul style="list-style-type: none"> DECC (Electricity) DECC and Energy Savings Trust
Constraints		
Exclusions of woodfuel potential	<ul style="list-style-type: none"> Woodfuel that is uneconomic to harvest Woodfuel that will or could go to alternative markets (such as paper, construction etc) 	<ul style="list-style-type: none"> Discussions with Forestry Commission Forestry Commission Statistics

3.21 The results of the ‘bottom up’ method are presented in **Chapter 4** and the results of the ‘top down’ assessment are presented in **Appendix 4.2**.

PLANT BIOMASS – ENERGY CROPS

Assessment Approach

General method

- 3.22 The DECC methodology requires the generation of estimates for heat and electricity from biomass energy crops under three scenarios - high, medium and low as follows:
- **High** – Assumes that all available arable land and pasture will be planted with energy crops;
 - **Medium** – Assumes that all abandoned land and pasture will be planted with energy crops; and
 - **Low** – Assumes that new crops will only be planted to the extent of submitted applications to the Energy Crop Scheme.
- 3.23 The high scenario, as defined in the DECC methodology, is acknowledged to be neither possible nor desirable due to other uses of the land that are not considered within the assessment (such as food production). This scenario is entirely theoretical.
- 3.24 Data for the high scenario were provided by Natural England due to restrictions in access to the Rural Land Register database. Natural England provided a GIS dataset including all arable and temporary grassland with Public Rights of Way removed. Using this dataset, an assessment of the high scenario was undertaken.

- 3.25 This data for calculating the medium scenario are not available in GIS, so it has been assumed (and agreed with the Steering Group) that the extent of all abandoned arable land and pasture is best approximated by the amount of GAEC12 land in the DEFRA Agricultural and Horticultural Census. The results of calculating the medium scenario are presented in this report.
- 3.26 Mapped data were not available for the low scenario. However, Natural England was able to provide an overall area of SRC and Miscanthus for the East Midlands as a whole, based on applications to the Energy Crop Scheme for 2010.
- 3.27 The results of the medium scenario are reported in **Chapter 4** and the results of the high and low scenarios can be found in **Appendix 4.2**

Protected Landscapes

- 3.28 The findings of the Peak Sub-Regional Climate Change Study (2009) have been used to identify the technical potential for energy crops within the Peak District National Park (and for the Derbyshire Dales and High Peak districts as a whole). This study assumed there was zero potential for energy crops within the National Park.
- 3.29 In line with the DECC methodology and Natural England advice, the assessment of technical potential for the Peak Sub-regional Climate Change Study (2009) involved a landscape sensitivity assessment for energy crops. This identifies the sensitivity of each landscape character area

within the Peak District National Park and the remaining areas (ie outside of the National Park) of High Peak and Derbyshire Dales to energy crop developments. The results of this assessment are provided in **Appendix 3.1**. The study did not cover the area within North East Derbyshire outside of the National Park.

- 3.30 For the Lincolnshire Wolds, it was agreed that the standard DECC methodology would be applied, but the results would be reported separately. Whilst the standard methodology has been applied, it must be noted that the deployable potential within the Wolds is likely to be significantly less due to the need to take account of its sensitive landscape.

Summary of assumptions

- 3.31 **Table 3.4** summarises the assumptions and data sources used to undertake the assessment. See **Appendix 3.2** for detailed information about each of the assumptions and the reasons (if any) for deviating from the DECC methodology.

Table 3.4: Summary of assumptions used for energy crop assessment

Parameter	Assumption	Data Source
Opportunities		
Existing resource	<ul style="list-style-type: none"> Existing energy crop schemes 	<ul style="list-style-type: none"> Natural England
Available land (Map 3.9)	<p><i>High</i></p> <ul style="list-style-type: none"> Assumed all available arable land and pasture will be planted with energy crops 	<ul style="list-style-type: none"> Rural Land Register (via Natural England) DEFRA Energy Crop Opportunity maps DEFRA Agricultural and Horticultural Census Natural England
	<p><i>Medium</i></p> <ul style="list-style-type: none"> Assumed that energy crops are planted only on land no longer needed for food production (i.e. all abandoned land and pasture) 	
	<p><i>Low</i></p> <ul style="list-style-type: none"> Assumed new crops will be planted to the extent of submitted applications to the ECS for 2010. 	

Parameter	Assumption	Data Source
Yield	<p>2010:</p> <ul style="list-style-type: none"> 10odt/ha SRC 15 odt/ha miscanthus <p>2020:</p> <ul style="list-style-type: none"> 11odt/ha SRC 16.5 odt/ha miscanthus <p>2030:</p> <ul style="list-style-type: none"> 12.1odt/ha SRC 18.15 odt/ha miscanthus 	<ul style="list-style-type: none"> DECC methodology
	<p><i>Electricity</i></p> <ul style="list-style-type: none"> 6000odt/year = 1MW <p><i>Heat</i></p> <ul style="list-style-type: none"> Miscanthus: 17GJ/odt SRC: 18GJ/odt Plant conversion efficiency: 80%. Plant conversion factor: 45%. 	<ul style="list-style-type: none"> DECC methodology Natural England: Planting and Growing miscanthus Best Practice Guidelines July 2007 Energy Savings Trust
	Constraints*	
Exclusion areas (Map 3.9)	<ul style="list-style-type: none"> Excluded Common Land, SAC, SPA, Ramsar, SSSI, NNR, Ancient Woodland, World Heritage Sites, Listed Buildings, Scheduled Monuments, Battlefields, Parks and Gardens. 	<ul style="list-style-type: none"> Natural England English Heritage

Parameter	Assumption	Data Source
	<ul style="list-style-type: none"> Permanent grassland: Rural Land Register extract for high scenario excluded permanent grassland. It was not possible to exclude permanent grassland from the medium scenario as the data were not available spatially Potentially only grades 3 and 4 ALC would be suitable/available for energy crops, therefore Grades 1 and 2 should be excluded (high scenario only). PROW and buffers (high scenario only); 	
Environmental impacts (Map 3.9)	<ul style="list-style-type: none"> A map showing the location of water stressed areas was provided by the Environment Agency. Due to lack of spatial data for the medium scenario, this information has not been incorporated in the results. NE were consulted with regards to protected landscapes and other biodiversity impacts. It was requested that all UK BAP habitats be removed from the high scenario as a constraint. It was not possible to exclude these areas from the medium scenario due to lack of spatial 	<ul style="list-style-type: none"> Environment Agency Natural England

Parameter	Assumption	Data Source
	<p>data.</p> <ul style="list-style-type: none"> Protected landscapes have been reported separately, but same assumptions have been applied. 	

3.32 The technical assessment and assumptions outlined above do not take into account all the wider biodiversity impacts that may have implications for the appropriate siting of energy crops. Natural England advises that when assessing the deployable potential (as detailed in **Chapter 6**) the following should be avoided, in addition to exclusion areas outlined in the table above.

- Sites where BAP priority species are known or are likely to be present
- Non-designated sites such as Sites of Importance for Nature Conservation (SINC), Local Nature Reserves and other sites managed by local authorities, non-government organisations (NGOs) and communities.

3.33 The potential loss of ridge and furrow earthworks is another consideration highlighted by English Heritage. The report *Turning the Plough (English Heritage and Northamptonshire Heritage)* covers Northamptonshire and Leicestershire, but ridge and furrow is also a feature in parts of Nottinghamshire and Lincolnshire. Parts of Derbyshire also have remnants of older field systems. Ridge and furrow is a region-wide feature, which is being

eroded by the reversion of pasture to arable and being ploughed out or being lost to development.

PLANT BIOMASS – WASTE WOOD

Assessment Approach

General method

- 3.34 The potential for wood waste was assessed assuming direct combustion of the resource as this is seen as the most economically viable approach to conversion to useful energy.
- 3.35 The first step was to assess the amount of commercial and industrial wood waste arisings within the East Midlands, as set out in a WRAP waste wood market report. Local authority arisings were then calculated on the basis of employee numbers in East Midlands. Due to competing uses of waste wood, such as for the manufacturing of wood panels using co-product, an assumption that only 50 per cent will be available for biomass was applied. It was assumed that waste wood quantities would rise by one per cent per annum.

Protected Landscapes

- 3.36 The Peak Sub-Regional Climate Change Study (2009) did not identify the potential for renewable energy generation from waste wood. As part of this study, we have identified the potential for waste wood within High Peak, Derbyshire Dales and North East Derbyshire but due to the format of

the data available, it was not possible to disaggregate the figures for the National Park from the district results,

- 3.37 Again for the Lincolnshire Wolds AONB, it was not possible to disaggregate the figures for the Lincolnshire Wolds AONB from the district results for East and West Lindsey.

Summary of Assumptions

Table 3.5: Summary of assumptions used for the waste wood assessment

Parameter	Assumption	Data Source
Opportunities		
Existing and potential new feedstock	All wood waste (apart from MSW which is assessed separately) was disaggregated on the basis of employee numbers in each local area. Potential new feedstock was calculated by increasing existing feedstock by 1% per year	WRAP (2009) Wood Waste Market in the UK
Fuel requirement	For electricity: used benchmark of 6,000 odt/year per 1MW For heat apply standard calorific values (plant assumed to be available 60% of the time and with a conversion efficiency of 80%)	Biomass Energy Centre
Constraints		
Available	Assumed 50% of resource is	N/A

Parameter	Assumption	Data Source
feedstock	available	

PLANT BIOMASS – AGRICULTURAL ARISINGS (STRAW)

Assessment Approach

General method

- 3.38 The potential for agricultural arisings (straw) was again assessed assuming direct combustion of the resource.
- 3.39 To assess the amount of wheat and oilseed rape straw available, data was drawn from the Agricultural and Horticultural Census. A reduction in the quantity of feedstock available was then applied to take account of the demand for straw for cattle bedding. It was assumed that the area farmed for straw will remain constant to 2030.

Protected Landscapes

- 3.40 The Peak Sub-Regional Climate Change Study (2009) did not identify the potential for renewable energy generation from agricultural arisings. As part of this study, we have identified the potential for agricultural arisings within High Peak, Derbyshire Dales and North East Derbyshire but due to the format of the data available, it was not possible to disaggregate the figures for the National Park from the district results,

- 3.41 Again for the Lincolnshire Wolds AONB, it was not possible to disaggregate the potential for the Lincolnshire Wolds AONB from the district results for East and West Lindsey.

Summary of Assumptions

Table 3.6: Summary of assumptions used for the agricultural arisings assessment

Parameter	Assumption	Data Source
Opportunities		
Existing feedstock	Used data of existing feedstock of all wheat and oil seed rape straw only Assumed 3.5 tonnes per ha of wheat and 1.5 tonnes per ha of oil seed rape Assumed area farmed for straw will remain constant to 2030	Defra (2010) June Census of Agriculture and Horticulture – England
Fuel requirement	Benchmark of 6,000 odt of baled straw per IMW capacity applied	N/A
Constraints		
Available feedstock	Applied 1.5 tonnes of straw per annum per head of cattle in the region – excluded this amount, or 50% depending on which is lower as per DECC methodology	Defra (2010) June Census of Agriculture and Horticulture – England

ANIMAL BIOMASS – WET ORGANIC WASTE

Assessment Approach

General method

- 3.42 The potential for wet organic waste (manure and slurry) was assessed based on the energy generated through anaerobic digestion, due to its moisture content which makes this type of conversion most suitable.
- 3.43 Wet organic waste was assessed by gathering data on the number of livestock (cattle and pigs) and waste from the food and drink sector. It was assumed that animal numbers will stay constant to 2030. A benchmark of 37,000 tonnes of wet organic waste required per 1 MW capacity per year was then applied. The resource was constrained because of difficulties in extracting the resource and competing uses of food and drink waste (e.g. bi-products, fertiliser and compost).

Protected Landscapes

- 3.44 The Peak Sub-Regional Climate Change Study (2009) did not separately identify the potential for renewable energy generation from wet organic waste. As part of this study, we have identified the potential for wet organic waste within High Peak, Derbyshire Dales and North East Derbyshire but due to the format of the data available, it

was not possible to disaggregate the figures for the National Park from the district results,

- 3.45 Again for the Lincolnshire Wolds AONB, it was not possible to disaggregate the potential for the Lincolnshire Wolds AONB from the district results for East and West Lindsey.

Summary of Assumptions

Table 3.7: Summary of assumptions used for the wet organic waste assessment

Parameter	Assumption	Data Source
Opportunities		
Existing feedstock	For manure and slurry: used data on livestock numbers multiplied by a manure factor For food and drink waste: used data for food, drink and tobacco and retail and wholesale sectors (animal and vegetable and non-metallic waste only) Assumed that animal numbers stay constant to 2030	For livestock data: Defra (2010) June Census of Agriculture and Horticulture – England For manure factor: Biomass Energy Centre For food and drink waste: ADAS (2009) National Study into Commercial and Industrial Waste Arisings
Biogas yield	Assumed biogas yields of 25m ³ /t for cattle, 26m ³ /t for pigs and 46m ³ /t for food and drink	UK National Non-Food Crops Centre (NNFCC)

Feedstock requirements	Applied benchmark of 37,000 tonnes of wet organic waste required per IMW capacity per year	N/A
Constraints		
Limits to extraction	Assumed 80% of the resources can be collected	N/A
Competing uses	For manure and slurry: assumed 100% of total resource is available for energy For food and drink: assumed 50% of total resources is available for energy	N/A

ANIMAL BIOMASS – POULTRY LITTER

Assessment Approach

General method

- 3.46 The potential for poultry litter was assessed based on the energy generated from direct combustion.
- 3.47 For poultry the assessment used data on poultry numbers and an excreta factor for head of poultry (from Defra) to calculate the total resource produced per year. A benchmark of 11,000 tonnes of poultry litter required for IMW capacity per annum was then applied and poultry number were assumed to be constant to 2030. No

competing uses were assumed to constrain the resource, although the litter can potentially be used as high-grade mushroom compost.

Protected Landscapes

- 3.48 The Peak Sub-Regional Climate Change Study (2009) did not identify the potential for renewable energy generation from poultry litter. As part of this study, we have identified the potential for poultry litter within High Peak, Derbyshire Dales and North East Derbyshire but due to the format of the data available, it was not possible to disaggregate the figures for the National Park from the district results,
- 3.49 Again for the Lincolnshire Wolds AONB, it was not possible to disaggregate the potential for the Lincolnshire Wolds AONB from the district results for East and West Lindsey.

Summary of Assumptions

Table 3.8: Summary of assumptions used for the poultry litter assessment

Parameter	Assumption	Data Source
Opportunities		
Existing and potential new feedstock	Assumed that per 1,000 birds, 16.5 tonnes of litter is typically produced per annum (Biomass Energy Centre)	Defra (2010) June Census of Agriculture and Horticulture – England

Parameter	Assumption	Data Source
	Assumed that animal numbers stay constant to 2030	
Feedstock requirements	Applied benchmark of 11,000 tonnes of poultry litter required for 1MW capacity per annum	N/A
Constraints		
Available feedstock	Assumed 100% of the resource is available for energy	N/A

MUNICIPAL SOLID WASTE

Assessment Approach

General method

- 3.50 The potential for MSW waste was assessed assuming direct combustion of the resource.
- 3.51 Municipal Solid Waste was assessed by accessing local authority data from Defra waste data flow for the latest available year (2008/09). To calculate the increase of MSW to 2030, a forecast of household numbers in the East Midlands as a whole was applied. It was assumed that MSW per household would remain constant due to policies to reduce waste. A benchmark of 10 kilo tonnes of MSW required for 1 MW capacity per annum was then applied.

Protected Landscapes

- 3.52 The Peak Sub-Regional Climate Change Study (2009) did not identify the potential for renewable energy generation from MSW. As part of this study, we have identified the potential for MSW within High Peak, Derbyshire Dales and North East Derbyshire but due to the format of the data available, it was not possible to disaggregate the figures for the National Park from the district results,
- 3.53 Again for the Lincolnshire Wolds AONB, it was not possible to disaggregate the potential for the Lincolnshire Wolds AONB from the district results for East and West Lindsey.

Summary of Assumptions

Table 3.9: Summary of assumptions used for the municipal solid waste resource assessment

Parameter	Assumption	Data Source
Opportunities		
Existing and potential new feedstock	Used local authority municipal and household waste statistics 2008/09 data available from Defra Increases in the use of the capacity to 2030 were based on changes in household numbers in the East Midlands as a whole, from CLG data. It was assumed that MSW per household would remain constant due to policies to reduce waste.	Defra (2009) Local Authority Municipal Waste Statistics

Parameter	Assumption	Data Source
Feedstock requirement	Applied a benchmark of 10 kilo tonnes of MSW required for 1 MW capacity per annum.	N/A
Constraints		
N/A	No significant constraint parameters were identified	N/A

COMMERCIAL AND INDUSTRIAL WASTE

Assessment Approach

General method

- 3.54 The potential for Commercial and Industrial (C&I) waste was again assessed assuming direct combustion of the resource.
- 3.55 To assess the C&I waste arisings, data was drawn from the ADAS (2009) National Study. Animal and vegetable waste and non-metallic waste were included but food, drink and tobacco; retail and wholesale were excluded to avoid double counting (included in the wet organic waste assessment). Future C&I waste was based on future employee number projections (a UK benchmark of 0.05 per cent per annum, according to UKCES), although given current economic uncertainties this forecast may now be overly optimistic. A benchmark of 10 kilo tonnes required for 1 MW capacity per annum was then applied.

Protected Landscapes

- 3.56 The Peak Sub-Regional Climate Change Study (2009) did not identify the potential for renewable energy generation from commercial and industrial waste. As part of this study, we have identified the potential for poultry litter within High Peak, Derbyshire Dales and North East Derbyshire but due to the format of the data available, it was not possible to disaggregate the figures for the National Park from the district results,
- 3.57 Again for the Lincolnshire Wolds AONB, it was not possible to disaggregate the potential for the Lincolnshire Wolds AONB from the district results for East and West Lindsey.

Table 3.10: Summary of assumptions used for the commercial and industrial waste resource assessment

Parameter	Assumption	Data Source
Opportunities		
Existing and potential new feedstock	<p>Included animal and vegetable waste and non-metallic waste only from the ADAS Study Excluded sectors covered elsewhere (food, drink and tobacco; retail and wholesale)</p> <p>Future C&I waste was based on future employee number projections (a UK benchmark of 0.05% per annum, according to UKCES)</p>	ADAS (2009) National Study into Commercial and Industrial Waste Arisings

Parameter	Assumption	Data Source
Feedstock requirement	Applied a benchmark of 10 kilo tonnes required for 1 MW capacity per annum	N/A
Constraints		
N/A	No significant constraints were identified	N/A

BIOGAS – LANDFILL

Assessment Approach

- 3.58 To assess the biogas available from landfill, the OFGEM Renewables Obligation inventory of landfill sites was used to get a capacity figure. This enabled the calculation of total available biogas resource. It was assumed that the present day capacity will continue flat for five years to 2015, then steadily reduce until 2030 when there will be 20 per cent of today's capacity due to EU landfill targets.

Protected Landscapes

- 3.59 The Peak Sub-Regional Climate Change Study (2009) did not identify the potential for renewable energy generation from landfill gas. As part of this study, we have identified the potential for landfill gas within High Peak, Derbyshire Dales and North East Derbyshire but due to the format of the data available, it was not possible to disaggregate the figures for the National Park from the district results,

- 3.60 Again for the Lincolnshire Wolds AONB, it was not possible to disaggregate the potential for the Lincolnshire Wolds AONB from the district results for East and West Lindsey.

Summary of Assumptions

Table 3.1 I: Summary of assumptions used for the landfill gas assessment

Parameter	Assumption	Data Source
Opportunities		
Available resource	All current landfill sites in the East Midlands from the OFGEM RO register	OFGEM RO Register
Lifetime of resource	Assumed that the present day capacity will continue flat for five years to 2015, then straight line reduction until the capacity in 2030 is 20% of today's capacity	BERR landfill gas forecast
Constraints		
N/A	No significant constraints were identified	N/A

BIOGAS – SEWAGE GAS

Assessment Approach

General method

- 3.61 To assess the sewage gas available, data from the inventory of sewage treatment sites of capacity were used to calculate the total available resource. A 50 per cent increase in capacity based on more efficient technology and smaller units becoming viable was then applied. Population growth projections of 7.5 per cent increase from 2020 to 2030 for the East Midlands were used to determine the future available resource, based on the latest 2008-based subnational population projections from the Office of National Statistics (published 2010).

Protected Landscapes

- 3.62 The Peak Sub-Regional Climate Change Study (2009) did not identify the potential for renewable energy generation from sewage gas. As part of this study, we have identified the potential for sewage gas within High Peak, Derbyshire Dales and North East Derbyshire but due to the format of the data available, it was not possible to disaggregate the figures for the National Park from the district results,
- 3.63 Again for the Lincolnshire Wolds AONB, it was not possible to disaggregate the potential for the Lincolnshire Wolds AONB from the district results for East and West Lindsey.

Table 3.12: Summary of assumptions used for the sewage gas resource assessment

Parameter	Assumption	Data Source
Opportunities		
Available resource	Identified all current sewage gas sites in the East Midlands from the OFGEM RO register	OFGEM RO Register
Potential new resource	Assumed a 50% increase in capacity from 2010 to 2020 based on more efficient technology and smaller units becoming more economically viable, hence being able to be deployed at smaller treatment works. Population growth projections for the East Midlands were also used to determine the future available resource.	ONS Population projections
Constraints		
N/A	No significant constraints were identified	N/A

CO-FIRING

Assessment approach

General method

- 3.64 The potential for generating energy from the combustion of biomass with a fossil fuel was assessed separately to the other biomass resource assessments. This is because most of the biomass is likely to be imported from outside of the East Midlands due to the significant quantities involved.
- 3.65 The assessment methodology drew on data from DECC on the capacity of coal and oil-fired (including gas oil) power stations and applied a benchmark of 10 per cent of combusted fuel to be from biomass. The benchmark was based on the typical proportion of biomass which is co-fired in most plants (the technical potential is 15 per cent). It was assumed that all the coal (Cottam, West Burton and Ratcliffe) and gas oil power stations (West Burton GT and Ratcliffe GT) will remain open in 2020 but be closed by 2030 as they will have reached the end of their operational life. The coal-fired power stations at Cottam, West Burton and Ratcliffe are not likely to close in 2016 due to the European Large Combustion Plant Directive (LCPD) because they have all fitted Flue Gas Desulphurisation (FGD) technology to at least some of their capacity.

Summary of Assumptions

Table 3.13: Summary of assumptions used for the biomass co-firing assessment

Parameter	Assumption	Data Source
Opportunities		
Available resource	Estimated total coal and oil-fired plant capacity in 2011 and 2030 (taking into account plants that are scheduled for closure as a result of the Large Combustion Plant Directive and the Industrial Emissions Directive, depending on data availability)	DECC Digest of UK Energy Statistics 2010 edition (DUKES)
Co-firing threshold of plant	Applied a benchmark of 10% of combusted fuel to be from biomass	N/A
Constraints		
Policy framework	Assumed that co-firing of biomass will still be an attractive option in 2020 and 2030 (RO has been extended to 2037 for new projects)	N/A

SMALL-SCALE HYDROPOWER

Assessment Approach

General method

- 3.66 The analysis drew on the GIS outputs from the Environment Agency (EA) hydropower study ‘Mapping Hydropower Opportunities in England and Wales’ (2009)¹⁰. GIS was used to disaggregate the regional results to Local Authority level. Opportunities identified in the EA study were given a power rating and classified according to an environmental sensitivity-hydropower potential matrix. The sensitivity of the barrier was based on presence of certain fish species and whether a barrier was located within an SAC. Whilst the study identified all barriers, a subset of these barriers were classified as ‘win-wins’. Win-wins are defined in the EA study as being barriers that have a potential greater than 10kW and are located within a heavily modified water body. Results are presented for ‘all barriers’ in **Appendix 4.2** and those identified as ‘win-wins’ in the EA study are reported on in **Chapter 4**.

Protected Landscapes

- 3.67 The findings of the Peak Sub-Regional Climate Change Study (2009) have been used to identify the technical potential for hydropower within the Peak District National

Park (and for the Derbyshire Dales and High Peak districts as a whole).

- 3.68 For the Lincolnshire Wolds, it was agreed that the standard DECC methodology would be applied, but the results would be reported separately. Whilst the standard methodology has been applied, it must be noted that the deployable potential within the Wolds is likely to be lower due to the need to take account of its sensitive landscape.

Summary of assumptions

- 3.69 **Table 3.14** summarises the assumptions and data sources used to undertake the assessment. See **Appendix 3.2** for detailed information about each of the assumptions and the reasons (if any) for deviating from the DECC methodology.

Table 3.14: Summary of assumptions used for hydropower assessment

Parameter	Assumption	Data Source
Opportunities		
Barriers (see Map 3.10 Map 3.11 and Map 3.12)	<ul style="list-style-type: none"> Disaggregated hydropower opportunities as defined by the EA hydropower study by HMA, County and Local Authority. 	<ul style="list-style-type: none"> ‘Mapping Hydropower Opportunities in England and Wales’ (2009)
Constraints		
N/A	<ul style="list-style-type: none"> No significant constraint parameters identified 	<ul style="list-style-type: none"> N/A

¹⁰ <http://www.environment-agency.gov.uk/shell/hydropowerswf.html>

3.70 The national hydropower mapping identified hotspot areas in England and Wales with the potential for hydropower but the Environment Agency advise that caution is applied when using this data at a Local Authority level as the study did not exclude factors such as:

- flood risk;
- consideration of the Water Framework Directive;
- certain biodiversity designations (e.g. SSSI's);
- looking at fish species other than salmonids; and
- cumulative environmental impacts.

3.71 These issues would need to be considered in more detailed studies and mean that the deployable resource potential will be considerably less than the technical potential highlighted in **Chapter 4**.

SOLAR ENERGY

Assessment Approach

General method

3.72 The study assessed the potential for solar PV (ie used for the generation of electricity) and solar thermal (used for the generation of hot water). This assessment used GIS address location data to calculate the potential roof space suitable for solar panels based on property type and location. Wherever possible, potential for community schemes was identified by identifying suitable address types (such as schools, community halls etc).

3.73 The assessment of the technical potential for solar PV and solar thermal is likely to be an overestimate, particularly in urban areas, as the assessment methodology does not take account of roof aspect, shading and other micro-siting factors that are likely influence the technical potential. More detailed datasets such as the Solar Energy Mapping from The Geoinformation Group (which evaluates potential at a property scale) could be used to refine the assessment to a finer grain of detail but it was not possible to undertake such a detailed analysis (of each roof) for a regional wide study.

3.74 The study did not assess the potential for large scale solar PV arrays. There has been a significant increase in the number of applications being submitted for solar PV arrays within the UK, including the East Midlands over the past year. This reflects the considerable financial support offered to arrays of up to 5MW capacity by the Feed-in Tariff. Since commercial scale solar PV arrays are an emerging renewable technology in the UK, there is limited information available on how to assess their technical potential. At present there is great deal of uncertainty regarding the future of large scale solar arrays in the UK as the Government has commissioned a review of the FIT for these developments¹¹.

¹¹

http://www.decc.gov.uk/en/content/cms/news/fits_rev_wms/fits_revs_wms.aspx

3.75 Although no standard methodology exists to examine Solar PV array potential, an opportunity and constraints assessment could be undertaken to inform such an assessment incorporating information on the following (amongst others):

- Solar irradiation
- Aspect
- Agricultural Land
- Flood risk
- Slope
- Shading

Protected Landscapes

3.76 The findings of the Peak Sub-Regional Climate Change Study (2009) have been used to identify the technical potential for solar power (PV and thermal) within the Peak District National Park (and for the Derbyshire Dales and High Peak districts as a whole).

3.77 For the Lincolnshire Wolds, it was agreed that the standard DECC methodology would be applied, but the results would be reported separately. Whilst the standard methodology has been applied, it must be noted that the deployable potential within the Wolds is likely to be less due to the need to take account of its sensitive landscape.

Summary of assumptions

3.78 **Table 3.15** summarises the assumptions and data sources used to undertake the assessment. See **Appendix 3.2** for detailed information about each of the assumptions and the reasons (if any) for deviating from the DECC methodology.

Table 3.15: Summary of assumptions used for solar energy assessment

Parameter	Assumption	Data Source
Opportunities		
Existing roof space	<i>Solar PV</i>	<ul style="list-style-type: none"> • Ordnance Survey Address Layer 2
	<ul style="list-style-type: none"> • 25% of all domestic properties including flats; • 40% of commercial properties; • 80% of industrial buildings. 	
Potential new roof space	<i>Solar thermal</i>	<ul style="list-style-type: none"> • Local Authority housing allocations (supplied by EMC)
	<ul style="list-style-type: none"> • 25% of all domestic properties including flats; • 10% of the commercial properties suitable for Solar PV (4% of total commercial properties) 	
System capacity	<i>For all suitable address points:</i>	<ul style="list-style-type: none"> • DECC

Parameter	Assumption	Data Source
	<ul style="list-style-type: none"> Domestic properties: 2kW Commercial: 5kW Industrial: 10kW 	<ul style="list-style-type: none"> methodology Research (industrial system capacity)
Constraints		
N/A	<ul style="list-style-type: none"> No significant constraint parameters identified 	<ul style="list-style-type: none"> N/A

HEAT PUMPS

Assessment Approach

General method

- 3.79 This assessment used GIS address location data to calculate the potential for heat pumps based on property type and location. Wherever possible, the potential for community schemes was identified by identifying suitable address types (such as schools, community halls etc).

Protected Landscapes

- 3.80 The findings of the Peak Sub-Regional Climate Change Study (2009) have been used to identify the technical potential for heat pumps within the Peak District National Park (and for the Derbyshire Dales and High Peak districts as a whole).

- 3.81 For the Lincolnshire Wolds, it was agreed that the standard DECC methodology would be applied, but the results would be reported separately.

Summary of assumptions

- 3.82 **Table 3.16** summarises the assumptions and data sources used to undertake the assessment. See **Appendix 3.2** for detailed information about each of the assumptions and the reasons (if any) for deviating from the DECC methodology.

Table 3.16: Summary of assumptions used for heat pump assessment

Parameter	Assumption	Data Source
Opportunities		
Existing building stock	<i>Domestic</i>	<ul style="list-style-type: none"> Ordnance Survey Address Layer 2 Office of National Statistics Rural fuel poverty data from Centre for Sustainable Energy
	<ul style="list-style-type: none"> 100% of all off-grid properties 75% detached and semi-detached properties 50% of terraced properties 25% of flats 	
	<i>Commercial</i>	
	<ul style="list-style-type: none"> 10% of commercial properties 	

Parameter	Assumption	Data Source
Suitable new buildings	<ul style="list-style-type: none"> • 50% of all new domestic properties 	<ul style="list-style-type: none"> • Local Authority housing allocations (supplied by EMC)
System capacity	<ul style="list-style-type: none"> • Domestic 5kW • Commercial 100kW 	<ul style="list-style-type: none"> • DECC methodology
Constraints		
N/A	<ul style="list-style-type: none"> • No significant constraints 	<ul style="list-style-type: none"> • N/A

4 Renewable Energy Technical Resource Assessment Results

INTRODUCTION

- 4.1 This chapter presents the results of the assessment of technical potential for each form of renewable energy technology. The results have been disaggregated to a county and district authority level. A summary of the renewable energy potential for the whole of the East Midlands is presented at the end of this Chapter. **Appendix 4.1** also summarises the results for each Housing Market Area (HMA) within the East Midlands.
- 4.2 **It is important to note that the results presented in this chapter represent the ‘technical potential’ – i.e. the total amount of potential that is theoretically available. They do not represent the ‘deployable potential’ – i.e. what could be practically achieved and delivered within the East Midlands. Further assumptions and scenario testing would need to be undertaken to refine the results to calculate the deployable potential – i.e. considering transmission, supply chain and planning, landscape constraints and opportunities.**
- 4.3 **Chapter 6** of this report provides further guidance on how the assessment of ‘technical potential’ could be used by local planning authorities to inform their own assessments of ‘deployable potential’. The potential figures presented in this chapter therefore will represent a considerable

overestimate of what could be practically delivered, particularly in relation to onshore wind power as the assessment does not take cumulative impacts into account and assumes that all unconstrained land will be developed for wind energy.

- 4.4 The results set out in this chapter have been presented in terms of:
- installed capacity (MW);
 - generation capacity (GW/h) for electricity and heat (as appropriate).
- 4.5 A summary of the results in terms of potential carbon savings (0000 tonnes of CO₂) is also provided in **Appendix 4.3**.
- 4.6 The conversion factors which have been used to calculate the generation capacities and potential carbon savings are set out in **Appendix 4.4**.
- 4.7 As outlined in **Chapter I**, the assessments of potential were undertaken using two timeframes 2020 (linked to the Government’s 15% renewable energy target) and 2030 (relating to general timetable of Core Strategies within the East Midlands). **For some technologies, such as onshore wind, hydro etc. the total accessible potential is not linked to a specific timeframe (e.g. 2020, 2030) as the total resource is available over any timeframe (e.g. onshore wind, hydro) or it was not possible to predict with any degree of accuracy the change in arisings between 2020 and 2030 (e.g. for resources such as managed woodland, poultry**

litter and agricultural arisings etc). For this reason, for these technologies the results tables in this chapter do not indicate any difference in potential between 2020 and 2030.

- 4.8 For some technologies e.g. hydro, the results indicate that there is zero potential in some local authority areas. This should be interpreted that there is negligible as opposed to no potential.

EXISTING DEPLOYMENT OF RENEWABLES

- 4.9 In order to understand the amount of existing renewable energy deployment in the East Midlands, a rapid review of the DECC Renewable Energy Planning Database (REPD) was undertaken. This database records the name, location, installed capacity and planning/construction status of renewable energy projects over 0.01MW. An extract from the database was taken in January 2011 and the results are presented in **Table 4.1a and Table 4.1b** and illustrated in **Map 4.1.**

Table 4.1a: Existing Renewable Energy Schemes (MW by LPA)

County	Local Authority	Operational	Under Construction	Awaiting Construction	Application Submitted
Derbyshire	Amber Valley	0.02			
	Bolsover	3.1			7.5
	Chesterfield	0.2		2.12	
	Derby				4
	Erewash	0.17			
	South Derbyshire	2.45			
Derbyshire Total		5.94	0	2.12	11.5
Peak District Study Area	Derbyshire Dales			10	
	High Peak	0.7		3.09	
	Staffordshire				
	Moorlands (In				0
Peak District Study Area Total		0.7	0	13.09	0
Leicestershire	Blaby	9.44			
	Charnwood	1.58		4	12.7
	Harborough	2.3		12	
	Hinckley and	2.47			
	Melton				7.2
	North West Leicestershire	1.07		0.9	0.3
	Rutland			0.01	
Leicestershire Total		16.86	0	16.91	20.2
Lincolnshire	Boston	27.27	0.03		
	East Lindsey	34.66			31.1
	North Kesteven	2.93		52.3	104.4
	South Holland	24			20.8
	South Kesteven	2.61			
Lincolnshire Total		91.47	0.03	52.3	156.3
Lincolnshire Wolds AONB	East Lindsey	0.63			
Lincolnshire Wolds AONB Total		0.63	0	0	0
Northamptonshire	Corby	4		18.25	
	Daventry	5.37		21	59.1
	East			4.6	
	Kettering	22.09		39.6	
	South	4			15
	Wellingborough	3.75			9
Northamptonshire Total		39.21	0	83.45	83.1
Nottinghamshire	Ashfield	3			
	Bassetlaw	2			1.6
	Gedling	2.76	2		3.42
	Newark and	16.22		1.6	6
	Nottin gham	1.66			
	Rushcliffe				0.08
Nottinghamshire Total		25.64	2	1.6	11.1
East Midlands Total		180.45	2.03	169.47	282.2

Table 4.1b: Existing Renewable Energy Schemes (MW)

Technology	Operational	Under Construction	Awaiting Construction	Application Submitted	Total
Biomass - Dedicated			68.25	40	108.25
Hydro	2.53			0.38	2.91
Landfill Gas	56.58	2	8.51	3	70.09
Municipal and Industrial Waste			4	1.6	5.6
Photovoltaics	0.06	0.03		1	1.09
Wind Onshore	121.28		88.71	236.22	446.21
Total	180.45	2.03	169.47	282.2	634.15

4.10 Please note that the data on existing schemes as obtained from the REPD is unlikely to be accurate and therefore should only be considered as indicative of the existing renewable energy schemes within the local authorities.

SUMMARY OF TECHNICAL POTENTIAL BY COUNTY

4.11 The results of the technical resource assessment are presented in four formats in this section:

- 1) **Tabular:** The results are presented in terms of installed capacity (MW) and generation capacity (GWh) for 2020 and 2030 for each local authority. A summary of the results in terms of potential carbon savings (0000 tonnes of CO₂) is provided in **Appendix 4.3**.
- 2) **Chart:** For each county, a summary chart shows the overall contributions in terms of electricity and heat for

each technology and local authority area. The figures presented in these charts represent the installed capacity in terms of MW (MWe or MWth) at 2020. The technologies have been broadly grouped in line with the categories in the DECC methodology.

- 3) **Pie charts:** For each county, the potential is summarised in a map with pie charts reflecting the relative contribution of each local authority for both electricity and heat.
 - 4) **Wind Energy Opportunity Map:** An energy opportunity map has been generated for each county. The map shows the opportunities for wind of all scales. Existing renewable energy schemes are also shown on these maps.
- 4.12 A Wind Energy Opportunity Map for each Local Authority is provided in **Appendix 4.5**.
- 4.13 The results for the Peak District National Park and Lincolnshire Wolds AONB are reported separately in **Table 4.7** for the following technologies - wind, managed woodland, energy crops, hydropower, solar and heat pumps. It was not possible to disaggregate the results for the protected landscapes for the remaining technologies as the data is only available on a district wide basis. The district wide results for these technologies are therefore included in **Tables 4.2** (East and West Lindsey - which includes the Lincolnshire AONB) and **Table 4.4** (Derbyshire Dales, High Peak and North East Derbyshire - Peak District National Park).

LINCOLNSHIRE

Table 4.2: Technical Renewable Energy Resource Potential for Lincolnshire for 2020 and 2030 in MW and GWh

Technology	Boston				East Lindsey*				Lincoln			
	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	215.69	340.10	215.69	340.10	1,325.11	2,089.43	1,325.11	2,089.43	4.36	6.87	4.36	6.87
Medium Wind	2.54	4.01	2.54	4.01	8.70	13.71	8.70	13.71	0.44	0.69	0.44	0.69
Small Wind	143.83	226.79	143.83	226.79	816.08	1,286.79	816.08	1,286.79	5.73	9.04	5.73	9.04
Small Scale Wind <6kW	41.37	57.98	41.37	57.98	131.20	183.89	131.20	183.89	0.00	0.00	0.00	0.00
Managed Woodland (heat)	0.07	0.28	0.07	0.28	4.32	17.03	4.32	17.03	0.18	0.71	0.18	0.71
Managed Woodland (elec)	0.01	0.08	0.01	0.08	0.71	5.35	0.71	5.35	0.03	0.23	0.03	0.23
Energy Crops (heat) Medium	7.78	30.67	8.56	33.74	47.77	188.31	52.55	207.15	7.78	30.67	8.56	33.74
Energy Crops (elec) Medium	1.34	10.10	1.47	11.07	8.21	61.85	9.04	68.10	1.34	10.10	1.47	11.07
Agricultural Arisings	4.43	23.31	4.43	23.31	28.19	148.15	28.19	148.15	0.04	0.24	0.04	0.24
Waste Wood (heat)	0.34	1.78	0.37	1.96	0.51	2.70	0.57	2.99	0.67	3.54	0.74	3.91
Waste Wood (elec)	0.39	2.08	0.44	2.29	0.60	3.16	0.66	3.49	0.79	4.14	0.87	4.57
Poultry Litter	0.31	1.61	0.31	1.61	4.34	22.82	4.34	22.82	0.00	0.00	0.00	0.00
Wet Organic Waste	1.21	6.37	1.21	6.37	10.48	55.06	10.48	55.06	0.29	1.52	0.29	1.52
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	1.91	10.04	2.10	11.04	4.67	24.52	5.13	26.98	2.95	15.51	3.25	17.06
Commercial and Industrial	1.77	9.32	1.86	9.79	2.69	14.16	2.83	14.89	3.53	18.56	3.71	19.51
Landfill Gas	0.00	0.00	0.00	0.00	1.51	7.92	0.41	2.16	0.00	0.00	0.00	0.00
Sewage Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro	0.00	0.00	0.00	0.00	0.01	0.05	0.01	0.05	0.00	0.00	0.00	0.00
Solar PV	18.12	14.29	19.33	15.24	41.06	32.37	42.93	33.85	35.00	27.59	43.48	34.28
Solar Thermal	15.58	6.82	16.79	7.35	33.17	14.53	35.04	15.35	30.57	13.39	39.04	17.10
Heat Pumps	117.91	268.55	120.92	275.41	274.14	624.38	278.82	635.04	173.39	394.91	194.58	443.18
Total (electricity)	432.93	706.06	434.60	709.69	2,383.54	3,949.24	2,385.82	3,954.71	54.50	94.49	63.67	105.08
Total (heat)	141.68	308.10	146.71	318.75	359.91	846.95	371.30	877.56	212.59	443.22	243.10	498.64

Table 4.2: Technical Renewable Energy Resource Potential for Lincolnshire for 2020 and 2030 in MW and GWh (cont)

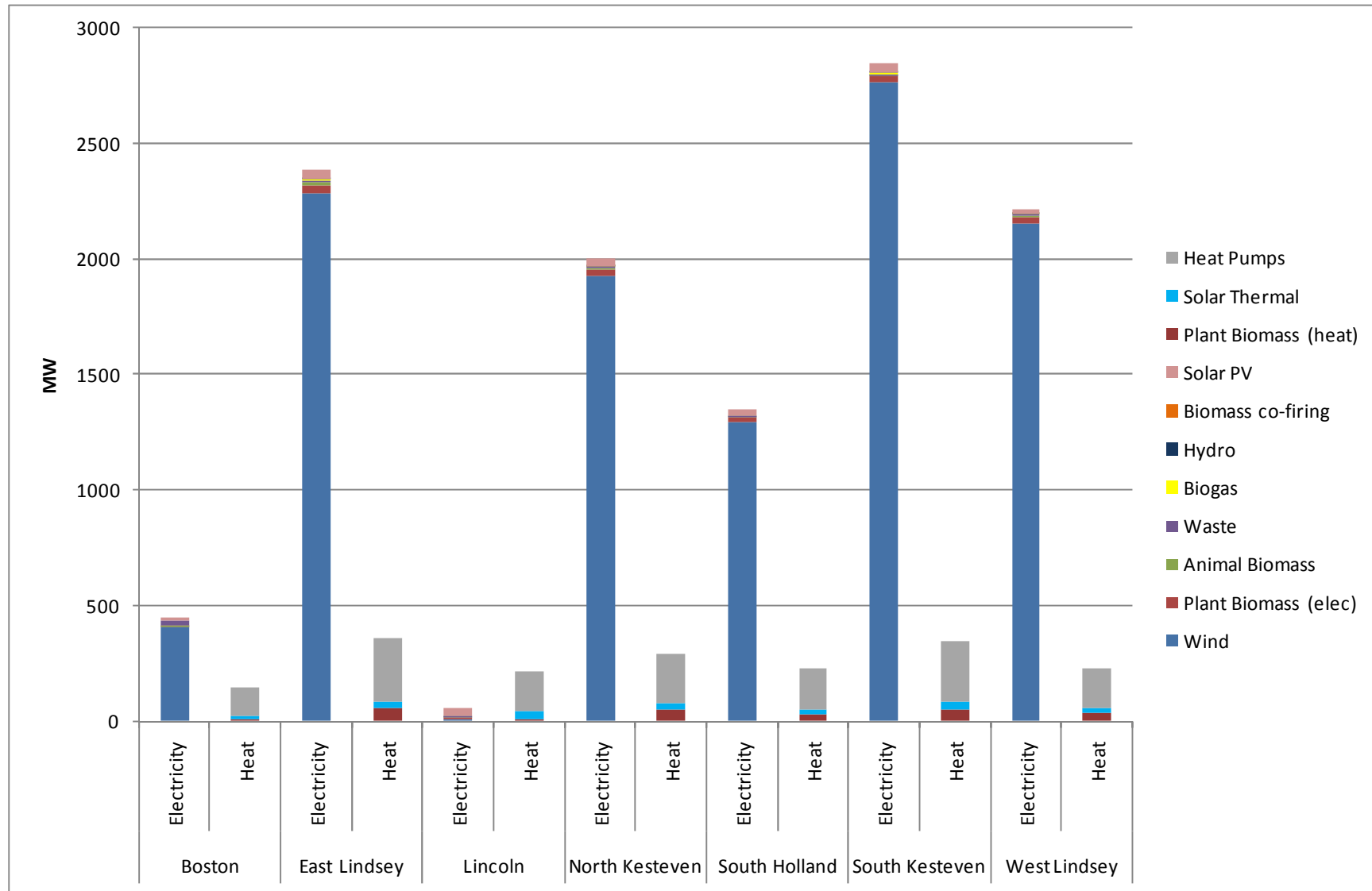
Technology	North Kesteven				South Holland				South Kesteven			
	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	1,215.21	1,916.15	1,215.21	1,916.15	765.63	1,207.25	765.63	1,207.25	1,802.90	2,842.81	1,802.90	2,842.81
Medium Wind	25.29	39.88	25.29	39.88	11.45	18.05	11.45	18.05	41.16	64.90	41.16	64.90
Small Wind	603.38	951.41	603.38	951.41	432.13	681.38	432.13	681.38	833.80	1,314.73	833.80	1,314.73
Small Scale Wind <6kW	81.33	113.99	81.33	113.99	86.42	121.13	86.42	121.13	88.14	123.54	88.14	123.54
Managed Woodland (heat)	4.25	16.75	4.25	16.75	0.04	0.16	0.04	0.16	4.08	16.08	4.08	16.08
Managed Woodland (elec)	0.70	5.27	0.70	5.27	0.01	0.08	0.01	0.08	0.67	5.05	0.67	5.05
Energy Crops (heat) Medium	41.86	165.01	46.05	181.53	24.99	98.51	27.48	108.33	42.78	168.64	47.05	185.47
Energy Crops (elec) Medium	7.20	54.24	7.92	59.67	4.30	32.39	4.73	35.63	7.35	55.37	8.09	60.95
Agricultural Arisings	17.37	91.28	17.37	91.28	15.24	80.08	15.24	80.08	15.23	80.06	15.23	80.06
Waste Wood (heat)	0.40	2.12	0.45	2.34	0.39	2.04	0.43	2.25	0.64	3.39	0.71	3.74
Waste Wood (elec)	0.47	2.47	0.52	2.73	0.45	2.38	0.50	2.63	0.75	3.95	0.83	4.37
Poultry Litter	3.83	20.11	3.83	20.11	0.18	0.96	0.18	0.96	0.23	1.23	0.23	1.23
Wet Organic Waste	2.59	13.62	2.59	13.62	0.85	4.48	0.85	4.48	3.10	16.30	3.10	16.30
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	3.81	20.02	4.19	22.02	2.35	12.33	2.58	13.56	3.95	20.74	4.34	22.81
Commercial and Industrial	2.11	11.10	2.22	11.67	2.03	10.69	2.14	11.24	3.37	17.74	3.55	18.64
Landfill Gas	2.28	12.01	0.62	3.27	0.00	0.00	0.00	0.00	2.25	11.84	0.61	3.23
Sewage Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro	0.04	0.21	0.04	0.21	0.00	0.00	0.00	0.00	0.49	2.53	0.49	2.53
Solar PV	31.69	24.98	35.60	28.07	26.49	20.88	30.10	23.73	43.70	34.45	51.65	40.72
Solar Thermal	27.84	12.19	31.75	13.91	23.00	10.07	26.61	11.66	38.08	16.68	46.02	20.16
Heat Pumps	213.42	486.09	223.21	508.38	177.89	405.16	186.91	425.71	262.19	597.16	282.05	642.40
Total (electricity)	1,997.30	3,276.75	2,000.81	3,279.35	1,347.53	2,192.08	1,351.96	2,200.20	2,847.09	4,595.24	2,854.79	4,601.87
Total (heat)	287.77	682.16	305.71	722.91	226.31	515.95	241.47	548.10	347.77	801.95	379.91	867.85

Table 4.2: Technical Renewable Energy Resource Potential for Lincolnshire for 2020 and 2030 in MW and GWh (cont)

West Lindsey*				
Technology	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	1,308.04	2,062.52	1,308.04	2,062.52
Medium Wind	25.60	40.36	25.60	40.36
Small Wind	723.78	1,141.26	723.78	1,141.26
Small Scale Wind <6kW	95.24	133.49	95.24	133.49
Managed Woodland (heat)	5.52	21.76	5.52	21.76
Managed Woodland (elec)	0.91	6.86	0.91	6.86
Energy Crops (heat) Medium	29.26	115.34	32.18	126.85
Energy Crops (elec) Medium	5.03	37.89	5.53	41.66
Agricultural Arisings	19.45	102.24	19.45	102.24
Waste Wood (heat)	0.30	1.57	0.33	1.73
Waste Wood (elec)	0.35	1.83	0.38	2.02
Poultry Litter	3.21	16.88	3.21	16.88
Wet Organic Waste	5.69	29.90	5.69	29.90
Biomass Co-firing	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	2.87	15.07	3.15	16.58
Commercial and Industrial	1.56	8.22	1.64	8.64
Landfill Gas	0.24	1.27	0.07	0.35
Sewage Gas	0.15	0.66	0.16	0.71
Hydro	0.10	0.52	0.10	0.52
Solar PV	25.86	20.39	28.16	22.20
Solar Thermal	22.22	9.73	24.52	10.74
Heat Pumps	169.69	386.49	175.43	399.56
Total (electricity)	2,218.08	3,619.35	2,221.12	3,626.17
Total (heat)	226.99	534.89	237.98	560.65

*Results are for the area outside the AONB with the exception of Agricultural Arisings, Waste Wood, Poultry Litter, Wet Organic Waste, Biomass Co-firing, MSW, C&I, Landfill Gas and Sewage Gas.

Figure 4.1: Technical Renewable Energy Resource Potential for Electricity and Heat in Lincolnshire for 2020 in MW



DISCUSSION OF LINCOLNSHIRE RESULTS

- 4.14 The results of the technical renewable energy potential for Lincolnshire are set out **Table 4.2** and **Figure 4.1**. **Maps 4.2** and **4.3** show the relative technical resource potential for each local planning authority in Lincolnshire in terms of electricity and heat. The results indicate that with the exception of Lincoln, onshore wind forms the greatest technical resource potential for all the local authorities in the county, although heat pumps are also identified as having significant potential. Wind energy potential is more constrained within the districts of South Holland and Boston due to the presence of the Wash and areas sensitive to birds. **Map 4.4** shows the potential commercial wind energy resource excluding the Lincolnshire Wolds and a 2km area around the AONB. This demonstrates that wind still has considerable potential within the county even if development within the AONB is ruled out.
- 4.15 As the county is largely rural, there are significant opportunities for energy from biomass, in particular energy crops grown on land no longer needed for food production and from agricultural arisings. The districts of East Lindsey, North Kesteven, South Holland, South Kesteven and West Lindsey have significant potential for the use plant biomass.
- 4.16 There is limited potential for hydropower within the county and the sites identified by the Environment Agency hydropower study are almost solely limited to the district of South Kesteven with a few isolated sites in West Lindsey, North Kesteven and East Lindsey. The viability of this limited resource may be further constrained by distance from the electricity distribution network or lack of local demand for the off-grid power generation.
- 4.17 Urban areas also offer potential for building-integrated solar energy and there is considerable potential for small scale wind linked to community, government and tourism related buildings throughout the rural areas of the county.
- 4.18 The results for the Lincolnshire Wolds AONB are reported separately in **Table 4.7** for wind, managed woodland, energy crops, hydropower, solar and heat pumps. Whilst the standard methodology has been applied for the assessment of managed woodland, energy crops, hydropower, solar and heat pumps agricultural arisings, waste wood, poultry litter, wet organic waste, MSW, C&I, landfill gas and sewage gas within the Lincolnshire Wolds AONB, it must be noted that the realistic deployable potential within AONB is likely to be significantly limited due its sensitive landscape.

NOTTINGHAM AND NOTTINGHAMSHIRE

Table 4.3: Technical Renewable Energy Resource Potential for Nottingham and Nottinghamshire for 2020 and 2030 in MW and GWh

Technology	Ashfield				Bassetlaw				Broxtowe			
	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	15.34	24.18	15.34	24.18	805.00	1,269.32	805.00	1,269.32	6.59	10.40	6.59	10.40
Medium Wind	2.69	4.24	2.69	4.24	42.84	67.55	42.84	67.55	0.95	1.49	0.95	1.49
Small Wind	32.94	51.93	32.94	51.93	410.94	647.98	410.94	647.98	12.33	19.44	12.33	19.44
Small Scale Wind <6kW	0.00	0.00	0.00	0.00	70.41	98.69	70.41	98.69	0.00	0.00	0.00	0.00
Managed Woodland (heat)	0.91	3.59	0.91	3.59	7.08	27.91	7.08	27.91	0.35	1.38	0.35	1.38
Managed Woodland (elec)	0.15	1.13	0.15	1.13	1.16	8.74	1.16	8.74	0.06	0.45	0.06	0.45
Energy Crops (heat) Medium	0.42	1.66	0.46	1.81	25.22	99.42	27.74	109.35	1.83	7.21	2.01	7.92
Energy Crops (elec) Medium	0.07	0.53	0.08	0.60	4.34	32.70	4.77	35.94	0.31	2.34	0.35	2.64
Agricultural Arisings	0.25	1.33	0.25	1.33	6.38	33.55	6.38	33.55	0.30	1.56	0.30	1.56
Waste Wood (heat)	0.58	3.05	0.64	3.37	0.53	2.81	0.59	3.10	0.46	2.43	0.51	2.68
Waste Wood (elec)	0.68	3.56	0.75	3.93	0.62	3.28	0.69	3.62	0.54	2.83	0.60	3.13
Poultry Litter	0.00	0.00	0.00	0.00	0.73	3.86	0.73	3.86	0.00	0.00	0.00	0.00
Wet Organic Waste	0.58	3.06	0.58	3.06	3.05	16.01	3.05	16.01	0.48	2.51	0.48	2.51
Biomass Co-firing	0.00	0.00	0.00	0.00	406.00	3,200.90	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	3.53	18.54	3.88	20.39	3.53	18.56	3.88	20.42	3.24	17.02	3.56	18.72
Commercial and Industrial	2.86	15.04	3.01	15.81	2.63	13.84	2.77	14.55	2.28	11.97	2.39	12.58
Landfill Gas	2.21	11.63	0.60	3.17	2.51	13.22	0.69	3.60	0.00	0.00	0.00	0.00
Sewage Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.02	4.47	1.10	4.80
Hydro	0.00	0.00	0.00	0.00	0.08	0.41	0.08	0.41	1.46	7.55	1.46	7.55
Solar PV	33.36	26.30	36.24	28.57	33.92	26.74	37.46	29.53	32.47	25.60	36.01	28.39
Solar Thermal	29.41	12.88	32.29	14.14	28.82	12.62	32.36	14.17	28.45	12.46	31.99	14.01
Heat Pumps	204.34	465.40	211.54	481.80	213.71	486.75	222.56	506.90	194.84	443.77	203.69	463.92
Total (electricity)	94.66	161.48	96.51	158.36	1,794.16	5,455.34	1,390.85	2,253.76	62.02	107.62	66.17	113.66
Total (heat)	235.66	486.58	245.84	504.72	275.36	629.50	290.33	661.44	225.93	467.25	238.55	489.92

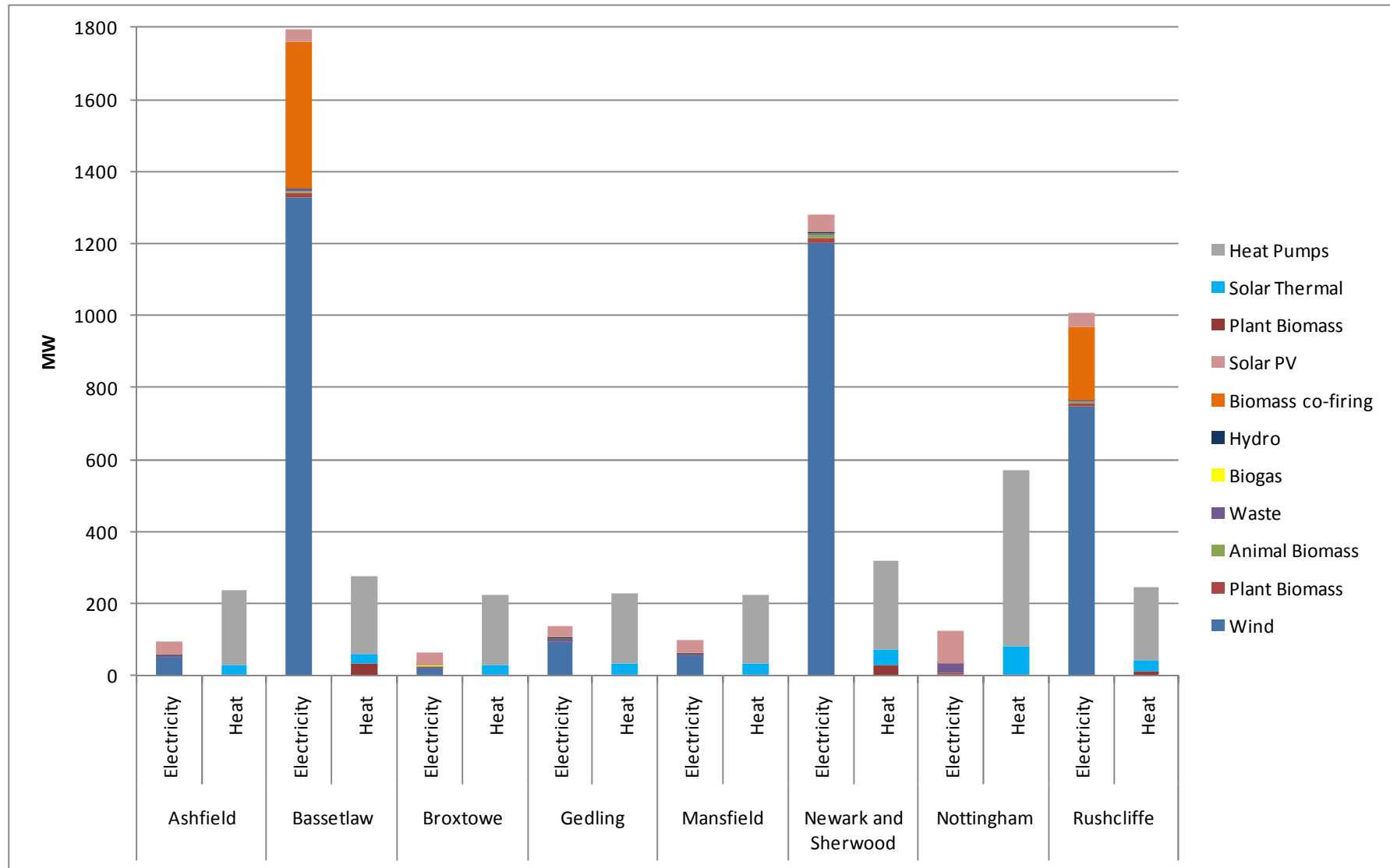
Table 4.3: Technical Renewable Energy Resource Potential for Nottingham and Nottinghamshire for 2020 and 2030 in MW and GWh (cont)

Technology	Gedling				Mansfield				Newark and Sherwood			
	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	32.34	50.99	32.34	50.99	34.50	54.40	34.50	54.40	675.02	1,064.37	675.02	1,064.37
Medium Wind	1.23	1.94	1.23	1.94	1.08	1.70	1.08	1.70	27.73	43.73	27.73	43.73
Small Wind	40.13	63.28	40.13	63.28	19.95	31.46	19.95	31.46	437.89	690.47	437.89	690.47
Small Scale Wind <6kW	19.66	27.56	19.66	27.56	0.00	0.00	0.00	0.00	63.08	88.41	63.08	88.41
Managed Woodland (heat)	1.52	5.99	1.52	5.99	0.65	2.56	0.65	2.56	7.06	27.83	7.06	27.83
Managed Woodland (elec)	0.25	1.88	0.25	1.88	0.11	0.83	0.11	0.83	1.16	8.74	1.16	8.74
Energy Crops (heat) Medium	1.31	5.16	1.44	5.68	0.90	3.55	0.99	3.90	21.94	86.49	24.14	95.16
Energy Crops (elec) Medium	0.23	1.73	0.25	1.88	0.16	1.21	0.17	1.28	3.77	28.40	4.15	31.26
Agricultural Arisings	0.54	2.81	0.54	2.81	0.16	0.84	0.16	0.84	5.98	31.44	5.98	31.44
Waste Wood (heat)	0.41	2.13	0.45	2.36	0.48	2.53	0.53	2.80	0.53	2.78	0.58	3.07
Waste Wood (elec)	0.47	2.49	0.52	2.75	0.56	2.96	0.62	3.27	0.62	3.24	0.68	3.58
Poultry Litter	0.04	0.22	0.04	0.22	0.00	0.00	0.00	0.00	2.32	12.21	2.32	12.21
Wet Organic Waste	0.64	3.38	0.64	3.38	0.30	1.59	0.30	1.59	4.49	23.62	4.49	23.62
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	3.48	18.31	3.83	20.14	3.63	19.06	3.99	20.96	3.65	19.17	4.01	21.09
Commercial and Industrial	2.00	10.51	2.10	11.05	2.38	12.49	2.50	13.12	2.60	13.68	2.74	14.38
Landfill Gas	4.22	22.16	1.15	6.04	0.00	0.00	0.00	0.00	1.42	7.48	0.39	2.04
Sewage Gas	0.00	0.00	0.00	0.00	0.60	2.63	0.65	2.83	0.00	0.00	0.00	0.00
Hydro	0.75	3.88	0.75	3.88	0.00	0.00	0.00	0.00	3.18	16.44	3.18	16.44
Solar PV	31.84	25.10	34.64	27.31	33.54	26.44	39.35	31.02	46.90	36.98	62.89	49.58
Solar Thermal	28.49	12.48	31.28	13.70	29.87	13.08	35.68	15.63	41.96	18.38	57.94	25.38
Heat Pumps	197.36	449.51	204.36	465.45	194.44	442.86	208.97	475.95	246.27	560.90	286.23	651.92
Total (electricity)	137.83	236.25	138.08	225.13	96.96	155.59	103.37	163.29	1,279.83	2,088.38	1,295.72	2,101.37
Total (heat)	229.09	475.27	239.05	493.18	226.34	464.58	246.82	500.84	317.76	696.38	375.95	803.35

Table 4.3: Technical Renewable Energy Resource Potential for Nottinghamshire for 2020 and 2030 in MW and GWh (cont)

Technology	Nottingham				Rushcliffe			
	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	3.01	4.75	3.01	4.75	415.54	655.22	415.54	655.22
Medium Wind	0.05	0.08	0.05	0.08	10.28	16.22	10.28	16.22
Small Wind	2.51	3.95	2.51	3.95	277.62	437.75	277.62	437.75
Small Scale Wind <6kW	0.00	0.00	0.00	0.00	45.88	64.31	45.88	64.31
Managed Woodland (heat)	0.20	0.79	0.20	0.79	1.97	7.77	1.97	7.77
Managed Woodland (elec)	0.03	0.23	0.03	0.23	0.32	2.41	0.32	2.41
Energy Crops (heat) Medium	0.00	0.00	0.00	0.00	9.51	37.49	10.47	41.27
Energy Crops (elec) Medium	0.00	0.00	0.00	0.00	1.64	12.36	1.80	13.56
Agricultural Arisings	0.03	0.15	0.03	0.15	4.09	21.50	4.09	21.50
Waste Wood (heat)	2.26	11.90	2.50	13.15	0.49	2.59	0.54	2.86
Waste Wood (elec)	2.64	13.89	2.92	15.35	0.58	3.03	0.64	3.34
Poultry Litter	0.00	0.00	0.00	0.00	0.26	1.37	0.26	1.37
Wet Organic Waste	0.30	1.58	0.30	1.58	3.14	16.53	3.14	16.53
Biomass Co-firing	0.00	0.00	0.00	0.00	203.40	1,603.61	0.00	0.00
Municipal Solid Waste (MSW)	12.25	64.39	13.48	70.83	3.66	19.24	4.03	21.16
Commercial and Industrial	11.29	59.32	11.86	62.35	2.43	12.78	2.56	13.43
Landfill Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sewage Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro	0.63	3.26	0.63	3.26	1.29	6.67	1.29	6.67
Solar PV	92.72	73.10	102.38	80.72	35.57	28.04	43.57	34.35
Solar Thermal	78.13	34.22	87.80	38.46	31.87	13.96	39.87	17.46
Heat Pumps	490.62	1,117.44	514.77	1,172.44	203.05	462.47	223.04	508.00
Total (electricity)	125.46	224.71	137.20	243.25	1,005.71	2,901.02	811.02	1,307.82
Total (heat)	571.21	1,164.35	605.27	1,224.84	246.89	524.27	275.89	577.36

Figure 4.2: Technical Renewable Energy Resource Potential for Nottinghamshire for 2020 in MW



DISCUSSION OF NOTTINGHAM AND NOTTINGHAMSHIRE RESULTS

- 4.19 The results of the technical renewable energy potential for Nottingham and Nottinghamshire are set out **Table 4.3** and **Figure 4.2**. **Maps 4.5** and **4.6** show the relative technical resource potential for each local planning authority in the county, in terms of electricity and heat. The results indicate that all local authorities within the county have considerable potential for microgeneration – in particular heat pumps, solar thermal and solar PV.
- 4.20 The high technical potential for solar PV and solar thermal is however deemed to be an overestimate as the assessment methodology does not take account of roof aspect, shading and other micro-siting factors that are likely to influence the technical potential. As noted in **Chapter 3**, more detailed datasets such as the Solar Energy Mapping from The Geoinformation Group (which evaluates potential at a property scale) could be used to refine the assessment to a finer grain of detail but it was not feasible to use this for a regional wide study.
- 4.21 The districts of Bassetlaw, Newark and Sherwood and Rushcliffe (those authorities to the East with the greatest land areas in the county) have considerable commercial wind energy potential. These three districts also have notable potential for the generation of energy from biomass, in particular from energy crops, managed woodland and agricultural arisings.
- 4.22 Whilst districts such as Ashfield, Mansfield, Gedling etc have good average wind speeds their potential for commercial scale wind energy developments is limited by constraints relating to the presence of existing infrastructure, properties and bird sensitivity issues. **Map 4.7** shows the technical wind energy resource opportunities within Nottinghamshire.
- 4.23 Although major power stations are of national significance, it is noted that the three large power stations in the East Midlands are all located within Nottinghamshire – Cottam, West Burton and Ratcliffe and there is a lot of potential for co-firing biomass at these sites. The Nottingham Sustainable Energy Partnership have however raised concerns about realising this potential as it may involve the large-scale importation of energy crops and the distortion of local market prices for crops so that local users with modern boiler plant capable of far greater heat efficiency are priced out. There is also concern about the longer term loss of good quality land from agricultural production.
- 4.24 Other significant sources of renewable energy potential include the generation of energy from waste (MSW and C and I) in the urban unitary authority of Nottingham, although much of this potential has already been realised and the remaining potential is limited.
- 4.25 There is limited potential for small scale hydro, although Newark and Sherwood has the highest potential for hydro in the whole of the East Midlands. The potential for this district is still however small and equates to a total *technical* resource potential of 3.18 MW.

DERBY AND DERBYSHIRE

Table 4.4: Technical Renewable Energy Resource Potential for Derby and Derbyshire for 2020 and 2030 in MW and GWh

Technology	Amber Valley				Bolsover				Chesterfield			
	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	49.39	77.88	49.39	77.88	71.96	113.47	71.96	113.47	4.95	7.80	4.95	7.80
Medium Wind	0.78	1.23	0.78	1.23	6.92	10.92	6.92	10.92	0.96	1.52	0.96	1.52
Small Wind	79.01	124.58	79.01	124.58	83.26	131.29	83.26	131.29	14.23	22.43	14.23	22.43
Small Scale Wind <6kW	41.44	58.08	41.44	58.08	15.59	21.85	15.59	21.85	0.65	0.91	0.65	0.91
Managed Woodland (heat)	2.02	7.96	2.02	7.96	1.13	4.45	1.13	4.45	0.34	1.34	0.34	1.34
Managed Woodland (elec)	0.33	2.49	0.33	2.49	0.18	1.36	0.18	1.36	0.06	0.45	0.06	0.45
Energy Crops (heat) Medium	1.77	6.98	1.95	7.69	1.93	7.61	2.12	8.36	0.45	1.77	0.49	1.93
Energy Crops (elec) Medium	0.30	2.26	0.34	2.56	0.33	2.49	0.36	2.71	0.08	0.60	0.08	0.60
Agricultural Arisings	0.36	1.92	0.36	1.92	0.87	4.59	0.87	4.59	0.34	1.80	0.34	1.80
Waste Wood (heat)	0.62	3.24	0.68	3.58	0.33	1.71	0.36	1.89	0.60	3.17	0.67	3.50
Waste Wood (elec)	0.72	3.78	0.80	4.18	0.38	2.00	0.42	2.21	0.70	3.70	0.78	4.09
Poultry Litter	0.08	0.41	0.08	0.41	0.16	0.82	0.16	0.82	0.00	0.00	0.00	0.00
Wet Organic Waste	5.18	27.24	5.18	27.24	1.19	6.26	1.19	6.26	0.27	1.41	0.27	1.41
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	3.50	18.40	3.85	20.24	2.74	14.42	3.02	15.86	3.46	18.18	3.80	19.99
Commercial and Industrial	3.20	16.79	3.36	17.65	1.69	8.87	1.77	9.33	3.12	16.42	3.28	17.26
Landfill Gas	0.00	0.00	0.00	0.00	0.46	2.41	0.13	0.66	5.30	27.84	1.44	7.59
Sewage Gas	0.00	0.00	0.00	0.00	1.29	5.65	1.39	6.07	0.00	0.00	0.00	0.00
Hydro	1.39	7.18	1.39	7.18	0.00	0.00	0.00	0.00	0.04	0.21	0.04	0.21
Solar PV	34.96	27.56	36.81	29.02	24.44	19.27	28.83	22.73	34.46	27.17	38.54	30.38
Solar Thermal	29.66	12.99	31.52	13.81	21.69	9.50	26.09	11.43	28.74	12.59	32.82	14.38
Heat Pumps	230.36	524.67	235.01	535.26	143.18	326.11	154.16	351.11	199.48	454.34	209.68	477.57
Total (electricity)	220.64	369.81	223.12	374.66	211.47	345.66	216.05	350.12	68.62	130.44	69.43	116.45
Total (heat)	264.43	555.84	271.18	568.30	168.26	349.38	183.86	377.25	229.61	473.21	244.00	498.72

Table 4.4: Technical Renewable Energy Resource Potential for Derby and Derbyshire for 2020 and 2030 in MW and GWh

Technology	Derby				Derbyshire Dales*				Erewash			
	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	9.95	15.69	9.95	15.69	0.00	0.00	0.00	0.00	13.31	20.99	13.31	20.98
Medium Wind	0.01	0.02	0.01	0.02	0.00	0.00	0.00	0.00	0.09	0.14	0.09	0.14
Small Wind	8.64	13.62	8.64	13.62	12.68	20.00	12.68	20.00	26.76	42.19	26.76	42.19
Small Scale Wind <6kW	0.00	0.00	0.00	0.00	15.52	21.75	15.52	21.75	9.77	13.69	9.77	13.69
Managed Woodland (heat)	0.12	0.47	0.12	0.47	5.89	23.20	5.89	23.20	0.31	1.22	0.31	1.22
Managed Woodland (elec)	0.02	0.15	0.02	0.15	3.08	23.20	3.08	23.20	0.05	0.38	0.05	0.38
Energy Crops (heat) Medium	0.45	1.77	0.49	1.93	186.45	735.00	186.45	735.00	0.97	3.82	1.07	4.22
Energy Crops (elec) Medium	0.08	0.60	0.08	0.60	97.56	735.00	97.56	735.00	0.17	1.28	0.18	1.36
Agricultural Arisings	0.04	0.19	0.04	0.19	0.56	2.95	0.56	2.95	0.20	1.04	0.20	1.04
Waste Wood (heat)	1.48	7.78	1.63	8.59	0.41	2.18	0.46	2.41	0.47	2.45	0.52	2.71
Waste Wood (elec)	1.73	9.08	1.91	10.03	0.48	2.54	0.53	2.81	0.54	2.86	0.60	3.16
Poultry Litter	0.00	0.00	0.00	0.00	1.18	6.18	1.18	6.18	0.00	0.00	0.00	0.00
Wet Organic Waste	0.11	0.57	0.11	0.57	17.73	93.16	17.73	93.16	1.11	5.82	1.11	5.82
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	9.70	50.98	10.67	56.08	2.67	14.03	2.94	15.43	3.63	19.10	4.00	21.01
Commercial and Industrial	6.49	34.11	6.82	35.85	2.15	11.29	2.26	11.86	2.42	12.71	2.54	13.36
Landfill Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sewage Gas	2.94	12.89	3.16	13.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro	1.20	6.20	1.20	6.20	0.74	3.80	0.74	3.80	0.64	3.31	0.64	3.31
Solar PV	68.87	54.30	73.23	57.73	8.83	6.96	8.83	6.96	34.94	27.55	39.29	30.98
Solar Thermal	58.86	25.78	63.22	27.69	111.87	49.00	111.87	49.00	29.84	13.07	34.20	14.98
Heat Pumps	438.31	998.29	449.19	1,023.08	68.05	155.00	68.05	155.00	210.62	479.71	221.51	504.51
Total (electricity)	109.77	198.39	115.83	210.59	163.17	940.86	163.60	943.10	93.63	151.07	98.53	157.43
Total (heat)	499.22	1,034.10	514.65	1,061.76	372.68	964.38	372.72	964.61	242.21	500.28	257.61	527.64

*The potential within Derbyshire Dales and High Peak for wind, managed woodland, energy crops, hydro, solar and heat pumps has been based on the findings of the Peak Sub-regional Climate Change Study (2009). **Results are for the area outside the National Park with the exception of Agricultural Arisings, Waste Wood, Poultry Litter, Wet Organic Waste, Biomass Co-firing, MSW, C&I, Landfill Gas and Sewage Gas as these are for the district as a whole as they could not be disaggregated for the National Park.

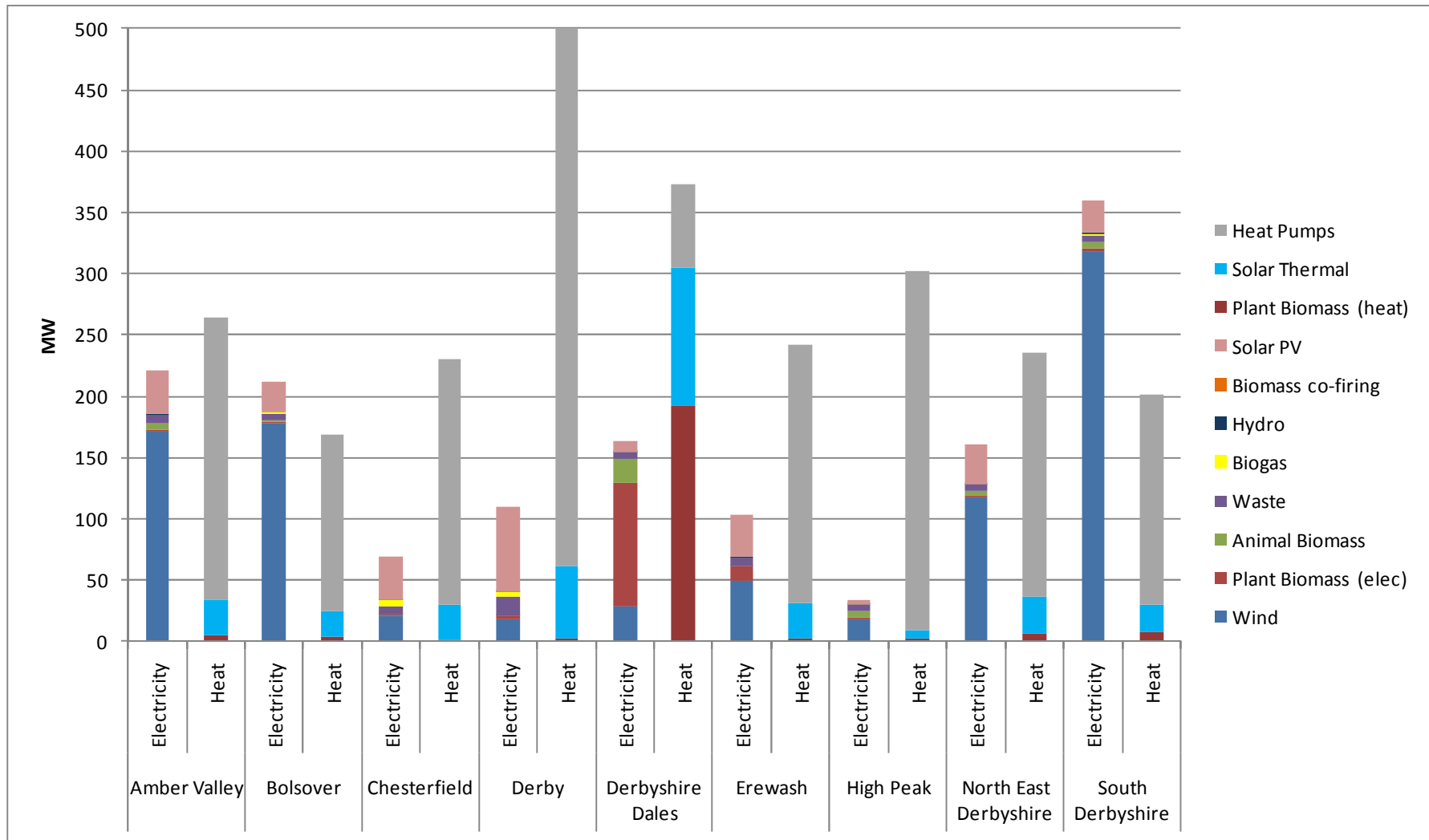
Table 4.4: Technical Renewable Energy Resource Potential for Derby and Derbyshire for 2020 and 2030 in MW and GWh (cont)

Technology	High Peak*				North East Derbyshire**				South Derbyshire			
	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	0.00	0.00	0.00	0.00	25.80	40.68	25.80	40.68	113.13	178.38	113.13	178.38
Medium Wind	0.00	0.00	0.00	0.00	1.88	2.97	1.88	2.97	9.56	15.07	9.56	15.07
Small Wind	0.00	0.00	0.00	0.00	53.38	84.18	53.38	84.18	153.81	242.52	153.81	242.52
Small Scale Wind <6kW	18.53	25.98	18.53	25.98	35.87	50.27	35.87	50.27	40.88	57.30	40.88	57.30
Managed Woodland (heat)	1.50	5.90	1.50	5.90	2.83	11.16	2.83	11.16	2.54	10.01	2.54	10.01
Managed Woodland (elec)	0.78	5.90	0.78	5.90	0.46	3.47	0.46	3.47	0.42	3.16	0.42	3.16
Energy Crops (heat) Medium	0.00	0.00	0.00	0.00	3.72	14.66	4.09	16.12	4.79	18.88	5.27	20.77
Energy Crops (elec) Medium	0.00	0.00	0.00	0.00	0.64	4.82	0.70	5.27	0.82	6.18	0.91	6.86
Agricultural Arisings	0.06	0.31	0.06	0.31	0.62	3.27	0.62	3.27	1.62	8.54	1.62	8.54
Waste Wood (heat)	0.37	1.95	0.41	2.15	0.32	1.67	0.35	1.84	0.35	1.84	0.39	2.03
Waste Wood (elec)	0.43	2.27	0.48	2.51	0.37	1.95	0.41	2.15	0.41	2.14	0.45	2.37
Poultry Litter	0.09	0.49	0.09	0.49	0.16	0.82	0.16	0.82	0.34	1.81	0.34	1.81
Wet Organic Waste	4.28	22.47	4.28	22.47	4.06	21.32	4.06	21.32	5.11	26.86	5.11	26.86
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	3.23	16.97	3.55	18.67	3.32	17.45	3.65	19.19	3.12	16.40	3.43	18.04
Commercial and Industrial	1.92	10.10	2.02	10.61	1.64	8.64	1.73	9.08	1.81	9.52	1.90	10.01
Landfill Gas	0.24	1.27	0.07	0.35	0.00	0.00	0.00	0.00	1.67	8.76	0.45	2.39
Sewage Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro	0.66	3.40	0.66	3.40	0.04	0.21	0.04	0.21	0.68	3.51	0.68	3.51
Solar PV	3.60	2.84	3.60	2.84	32.62	25.72	39.50	31.14	26.20	20.66	28.88	22.77
Solar Thermal	6.85	3.00	6.85	3.00	29.10	12.74	35.98	15.76	22.63	9.91	25.31	11.09
Heat Pumps	293.73	669.00	293.73	669.00	199.79	455.04	216.99	494.21	171.07	389.63	177.77	404.89
Total (electricity)	33.83	91.99	34.12	93.52	160.86	265.74	168.25	274.01	359.58	600.81	361.58	599.58
Total (heat)	302.45	679.85	302.49	680.05	235.75	495.27	260.23	539.09	201.38	430.27	211.28	448.79

*The potential within Derbyshire Dales and High Peak for wind, managed woodland, energy crops, hydro, solar and heat pumps has been based on the findings of the Peak Sub-regional Climate Change Study (2009). The opportunities for many forms of proposal are constrained within the parts of these districts and NE Derbyshire which fall within the Peak District National Park due to the sensitivity of the landscape (also see Table 4.7).

**Results are for the area outside the National Park with the exception of Agricultural Arisings, Waste Wood, Poultry Litter, Wet Organic Waste, Biomass Co-firing, MSW, C&I, Landfill Gas and Sewage Gas as these are for the district as a whole as they could not be disaggregated for the National Park.

Figure 4.3: Technical Renewable Energy Resource Potential for Derby and Derbyshire for 2020 in MW



DISCUSSION OF DERBY AND DERBYSHIRE RESULTS

- 4.26 The results of the technical renewable energy potential for Derby and Derbyshire are set out **Table 4.4** and **Figure 4.3**. **Maps 4.8** and **4.9** show the relative technical resource potential for each local planning authority in the county, in terms of electricity and heat. The findings indicate that all local authorities within the county have considerable potential for microgeneration – in particular heat pumps, solar thermal and solar PV. The districts of Amber Valley, Bolsover, North East Derbyshire and South East Derbyshire also have considerable commercial wind energy potential. **Map 4.10** shows the technical wind energy resource opportunities within Derby and Derbyshire.
- 4.27 The potential for commercial scale wind within the Derbyshire Dales, High Peak and to a more limited extent North East Derbyshire is heavily constrained by legislation to conserve and enhance the National Park and the need to protect its special qualities. The high quality landscapes outside the Park also result in reducing the potential for wind technology within the wider Peak Sub Region. The results for the Peak District National Park are reported separately in **Table 4.7** for wind, managed woodland, energy crops, hydropower, solar and heat pumps. These results have been based on the findings of the Peak Sub-regional Climate Change Study (2009) which included a landscape sensitivity study. The landscape sensitivity maps that were used to inform this assessment are set out in **Appendix 3.1**.
- 4.28 Whilst the standard methodology has been applied for the assessment of agricultural arisings, waste wood, poultry

litter, wet organic waste, MSW, C&I, landfill gas and sewage gas within the Peak District National Park, it must be noted that the realistic deployable potential within National Park and the high quality landscapes outside the Park is likely to be significantly limited due its sensitive landscape. Waste activities will also need to accord with the relevant waste management strategies of the constituent waste management authorities (the Peak District is the only planning authority in the region which is not also a waste management authority).

- 4.29 The results of the Peak Sub-region Climate Change Study indicate that the area of the Derbyshire Dales outside of the National Park has significant potential for biomass and in particular energy crops. It must be noted however that the assumptions used to generate this assessment of technical potential do differ from the assumptions used for this East Midlands Assessment. Whilst the East Midlands study has not looked at deployable potential, the Peak Sub-region report goes on to state that only 5% of the potential for energy crops may be viable (ie deployable potential) as the change in traditional farming to energy crops is likely to be slow to take place. Aside from the Derbyshire Dales, North Derbyshire and South East Derbyshire also have notable potential for the growing of energy crops. The districts of Amber Valley, Derbyshire Dales, High Peak, North East Derbyshire and South East Derbyshire also have notable potential for the generation of energy from animal biomass using anaerobic digestion.
- 4.30 As an urban authority, Derby has significant potential for the use of energy from waste (MSW and C & I) and waste wood.

NORTHAMPTONSHIRE

Table 4.5: Technical Renewable Energy Resource Potential for Northamptonshire for 2020 and 2030 in MW and GWh

Technology	Corby				Daventry				East Northamptonshire			
	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	135.27	213.29	135.27	213.29	1,110.62	1,751.23	1,110.62	1,751.23	1,010.78	1,593.80	1,010.78	1,593.80
Medium Wind	2.99	4.71	2.99	4.71	27.88	43.97	27.88	43.97	11.90	18.77	11.90	18.77
Small Wind	37.67	59.40	37.67	59.40	633.34	998.64	633.34	998.64	402.28	634.32	402.28	634.32
Small Scale Wind <6kW	9.78	13.71	9.78	13.71	67.91	95.18	67.91	95.18	41.35	57.96	41.35	57.96
Managed Woodland (heat)	1.53	6.03	1.53	6.03	3.02	11.90	3.02	11.90	3.85	15.18	3.85	15.18
Managed Woodland (elec)	0.25	1.88	0.25	1.88	0.50	3.77	0.50	3.77	0.63	4.75	0.63	4.75
Energy Crops (heat) Medium	0.83	3.27	0.91	3.59	19.83	78.17	21.81	85.98	15.17	59.80	16.69	65.79
Energy Crops (elec) Medium	0.14	1.05	0.16	1.21	3.41	25.69	3.75	28.25	2.61	19.66	2.87	21.62
Agricultural Arisings	0.89	4.66	0.89	4.66	5.07	26.67	5.07	26.67	7.33	38.51	7.33	38.51
Waste Wood (heat)	0.37	1.94	0.41	2.15	0.46	2.44	0.51	2.70	0.33	1.75	0.37	1.94
Waste Wood (elec)	0.43	2.27	0.48	2.50	0.54	2.85	0.60	3.15	0.39	2.04	0.43	2.26
Poultry Litter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	1.96	0.37	1.96
Wet Organic Waste	0.25	1.30	0.25	1.30	5.15	27.06	5.15	27.06	2.16	11.35	2.16	11.35
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	1.97	10.34	2.16	11.37	2.81	14.79	3.10	16.27	2.37	12.47	2.61	13.72
Commercial and Industrial	2.43	12.75	2.55	13.41	3.05	16.03	3.21	16.85	2.19	11.50	2.30	12.09
Landfill Gas	3.66	19.21	1.00	5.24	2.75	14.47	0.75	3.95	1.13	5.92	0.31	1.61
Sewage Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro	0.06	0.31	0.06	0.31	0.01	0.05	0.01	0.05	2.26	11.68	2.26	11.68
Solar PV	28.66	22.60	41.44	32.67	26.89	21.20	33.53	26.44	27.20	21.44	32.18	25.37
Solar Thermal	26.13	11.44	38.91	17.04	23.31	10.21	29.95	13.12	23.88	10.46	28.86	12.64
Heat Pumps	125.20	285.16	157.15	357.92	157.92	359.68	174.50	397.44	161.21	367.17	173.66	395.53
Total (electricity)	224.43	367.49	234.94	365.66	1,889.94	3,041.61	1,895.42	3,041.47	1,514.96	2,446.15	1,519.77	2,449.78
Total (heat)	154.06	307.85	198.91	386.73	204.54	462.40	229.79	511.14	204.44	454.36	223.43	491.07

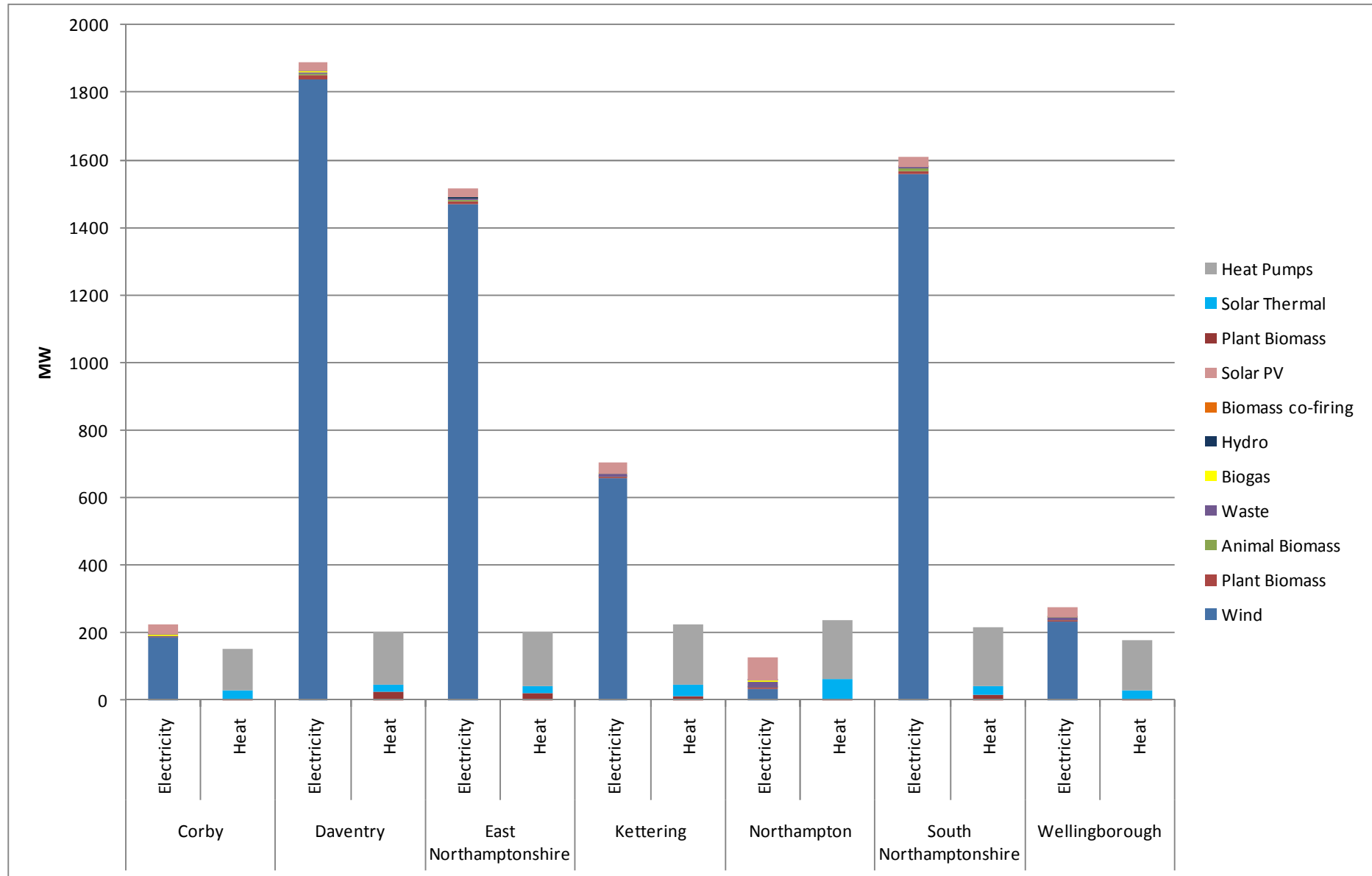
Table 4.5: Technical Renewable Energy Resource Potential for Northamptonshire for 2020 and 2030 in MW and GWh (cont)

Technology	Kettering				Northampton				South Northamptonshire			
	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	412.68	650.71	412.68	650.71	16.12	25.42	16.12	25.42	912.95	1,439.53	912.95	1,439.53
Medium Wind	11.28	17.79	11.28	17.79	0.30	0.47	0.30	0.47	18.88	29.77	18.88	29.77
Small Wind	210.56	332.00	210.56	332.00	11.71	18.47	11.71	18.47	544.51	858.59	544.51	858.59
Small Scale Wind <6kW	21.04	29.49	21.04	29.49	6.34	8.89	6.34	8.89	82.51	115.65	82.51	115.65
Managed Woodland (heat)	1.89	7.45	1.89	7.45	0.12	0.47	0.12	0.47	2.76	10.88	2.76	10.88
Managed Woodland (elec)	0.31	2.34	0.31	2.34	0.02	0.15	0.02	0.15	0.45	3.39	0.45	3.39
Energy Crops (heat) Medium	11.68	46.04	12.85	50.65	0.83	3.27	0.91	3.59	13.30	52.43	14.63	57.67
Energy Crops (elec) Medium	2.01	15.14	2.21	16.65	0.14	1.05	0.16	1.21	2.29	17.25	2.52	18.98
Agricultural Arisings	2.08	10.95	2.08	10.95	0.16	0.84	0.16	0.84	5.69	29.90	5.69	29.90
Waste Wood (heat)	0.46	2.40	0.50	2.65	1.57	8.23	1.73	9.09	0.35	1.82	0.38	2.02
Waste Wood (elec)	0.53	2.80	0.59	3.10	1.83	9.60	2.02	10.61	0.41	2.13	0.45	2.35
Poultry Litter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.34	7.04	1.34	7.04
Wet Organic Waste	1.52	8.01	1.52	8.01	0.34	1.80	0.34	1.80	5.65	29.71	5.65	29.71
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	3.03	15.92	3.33	17.51	6.34	33.32	6.97	36.65	3.04	16.00	3.35	17.60
Commercial and Industrial	3.00	15.77	3.15	16.58	10.28	54.03	10.81	56.79	2.28	11.98	2.40	12.59
Landfill Gas	0.61	3.22	0.17	0.88	0.00	0.00	0.00	0.00	0.34	1.78	0.09	0.49
Sewage Gas	0.00	0.00	0.00	0.00	6.25	27.36	6.71	29.41	0.00	0.00	0.00	0.00
Hydro	0.00	0.00	0.00	0.00	0.18	0.93	0.18	0.93	0.14	0.72	0.14	0.72
Solar PV	33.99	26.80	43.42	34.23	67.59	53.29	78.96	62.25	29.40	23.18	36.58	28.84
Solar Thermal	30.40	13.32	39.84	17.45	58.35	25.56	69.72	30.54	25.50	11.17	32.68	14.31
Heat Pumps	179.81	409.54	203.40	463.26	364.03	829.11	392.46	893.87	174.92	398.40	192.87	439.28
Total (electricity)	702.64	1,130.93	712.34	1,140.22	127.60	235.63	140.81	253.89	1,609.88	2,586.63	1,617.51	2,595.16
Total (heat)	224.24	478.75	258.48	541.47	424.90	866.65	464.94	937.56	216.83	474.70	243.32	524.16

Table 4.5: Technical Renewable Energy Resource Potential for Northamptonshire for 2020 and 2030 in MW and GWh (cont)

Technology	Wellingborough			
	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	135.84	214.19	135.84	214.19
Medium Wind	6.86	10.82	6.86	10.82
Small Wind	80.06	126.24	80.06	126.24
Small Scale Wind <6kW	11.32	15.87	11.32	15.87
Managed Woodland (heat)	0.54	2.13	0.54	2.13
Managed Woodland (elec)	0.09	0.68	0.09	0.68
Energy Crops (heat) Medium	3.73	14.70	4.11	16.20
Energy Crops (elec) Medium	0.64	4.82	0.71	5.35
Agricultural Arisings	2.95	15.49	2.95	15.49
Waste Wood (heat)	0.40	2.09	0.44	1.78
Waste Wood (elec)	0.46	2.44	0.51	2.69
Poultry Litter	0.12	0.62	0.12	0.62
Wet Organic Waste	0.53	2.77	0.53	2.77
Biomass Co-firing	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	2.24	11.77	2.46	12.95
Commercial and Industrial	2.61	13.70	2.74	14.40
Landfill Gas	1.52	7.96	0.41	2.17
Sewage Gas	0.00	0.00	0.00	0.00
Hydro	0.40	2.07	0.40	2.07
Solar PV	29.03	22.89	37.41	29.49
Solar Thermal	25.45	11.15	33.83	14.82
Heat Pumps	149.26	339.95	170.22	387.69
Total (electricity)	274.66	452.33	282.42	455.81
Total (heat)	179.38	370.02	209.14	422.62

Figure 4.4: Technical Renewable Energy Resource Potential for Northamptonshire for 2020 in MW



DISCUSSION OF NORTHAMPTONSHIRE RESULTS

- 4.31 The results of the technical renewable energy potential for Northamptonshire are set out **Table 4.5** and **Figure 4.4**. **Maps 4.11** and **4.12** show the relative technical resource potential for each local planning authority in the county, in terms of electricity and heat. The results indicate that with the exception of Northampton, onshore wind forms the greatest technical resource potential for all the local authorities in the county, although heat pumps, solar PV and solar thermal also have significant potential. The greatest wind energy potential is found within Daventry, East Northamptonshire, Kettering and South Northamptonshire. **Map 4.13** shows the technical wind energy resource opportunities within Northamptonshire.
- 4.32 Daventry, South Northamptonshire, Kettering and East Northamptonshire also have notable potential for the generation of energy from plant biomass in particular from energy crops and agricultural arisings. As an urban authority, Northampton has significant potential for the use of energy from waste (MSW and C & I), sewage gas and waste wood.
- 4.33 There are many sites which have the potential for small scale hydro power generation in the county, particularly in East Northamptonshire, although the combined potential is relatively small compared to other technologies. Opportunities to exploit this potential would be worth considering, particularly where major new developments are planned nearby.

LEICESTER, LEICESTERSHIRE AND RUTLAND

Table 4.6: Technical Renewable Energy Resource Potential for Leicester, Leicestershire and Rutland for 2020 and 2030 in MW and GWh

Technology	Blaby				Charnwood				Harborough			
	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	21.93	34.58	21.93	34.58	164.26	259.00	164.26	259.00	751.44	1,184.86	751.44	1,184.86
Medium Wind	1.44	2.27	1.44	2.27	2.78	4.38	2.78	4.38	21.89	34.52	21.89	34.52
Small Wind	49.61	78.23	49.61	78.23	168.57	265.81	168.57	265.81	484.71	764.29	484.71	764.29
Small Scale Wind <6kW	6.43	9.01	6.43	9.01	24.97	35.00	24.97	35.00	55.83	78.25	55.83	78.25
Managed Woodland (heat)	0.21	0.83	0.21	0.83	2.30	9.07	2.30	9.07	1.74	6.86	1.74	6.86
Managed Woodland (elec)	0.03	0.23	0.03	0.23	0.38	2.86	0.38	2.86	0.29	2.18	0.29	2.18
Energy Crops (heat) Medium	1.20	4.73	1.32	5.20	4.12	16.24	4.53	17.86	15.84	62.44	17.42	68.67
Energy Crops (elec) Medium	0.21	1.58	0.23	1.73	0.71	5.35	0.78	5.88	2.72	20.49	2.99	22.53
Agricultural Arisings	0.61	3.23	0.61	3.23	1.57	8.23	1.57	8.23	3.99	20.95	3.99	20.95
Waste Wood (heat)	0.60	3.18	0.67	3.51	0.76	4.02	0.84	4.44	0.43	2.28	0.48	2.52
Waste Wood (elec)	0.71	3.71	0.78	4.09	0.89	4.69	0.99	5.18	0.51	2.66	0.56	2.94
Poultry Litter	0.04	0.20	0.04	0.20	0.46	2.43	0.46	2.43	0.00	0.00	0.00	0.00
Wet Organic Waste	1.88	9.86	1.88	9.86	2.80	14.69	2.80	14.69	7.47	39.26	7.47	39.26
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	2.82	14.80	3.10	16.28	4.18	21.98	4.60	24.18	3.03	15.92	3.33	17.51
Commercial and Industrial	3.31	17.42	3.48	18.31	4.19	22.03	4.41	23.16	2.38	12.49	2.50	13.13
Landfill Gas	5.61	29.49	1.53	8.04	1.16	6.10	0.32	1.66	3.65	19.19	1.00	5.23
Sewage Gas	0.00	0.00	0.00	0.00	5.00	21.88	5.37	23.52	0.00	0.00	0.00	0.00
Hydro	0.07	0.36	0.07	0.36	0.29	1.50	0.29	1.50	0.00	0.00	0.00	0.00
Solar PV	27.01	21.29	31.24	24.63	43.93	34.63	45.92	36.20	23.96	18.89	25.54	20.14
Solar Thermal	24.01	10.52	28.25	12.37	37.78	16.55	39.77	17.42	19.92	8.72	21.50	9.42
Heat Pumps	175.55	399.83	186.13	423.93	279.47	636.52	284.44	647.84	158.57	361.16	162.53	370.18
Total (electricity)	121.71	226.26	122.40	211.06	426.13	710.56	428.45	713.67	1,361.86	2,213.97	1,361.53	2,205.80
Total (heat)	201.57	419.08	216.58	445.84	324.43	682.39	331.88	696.62	196.50	441.46	203.67	457.64

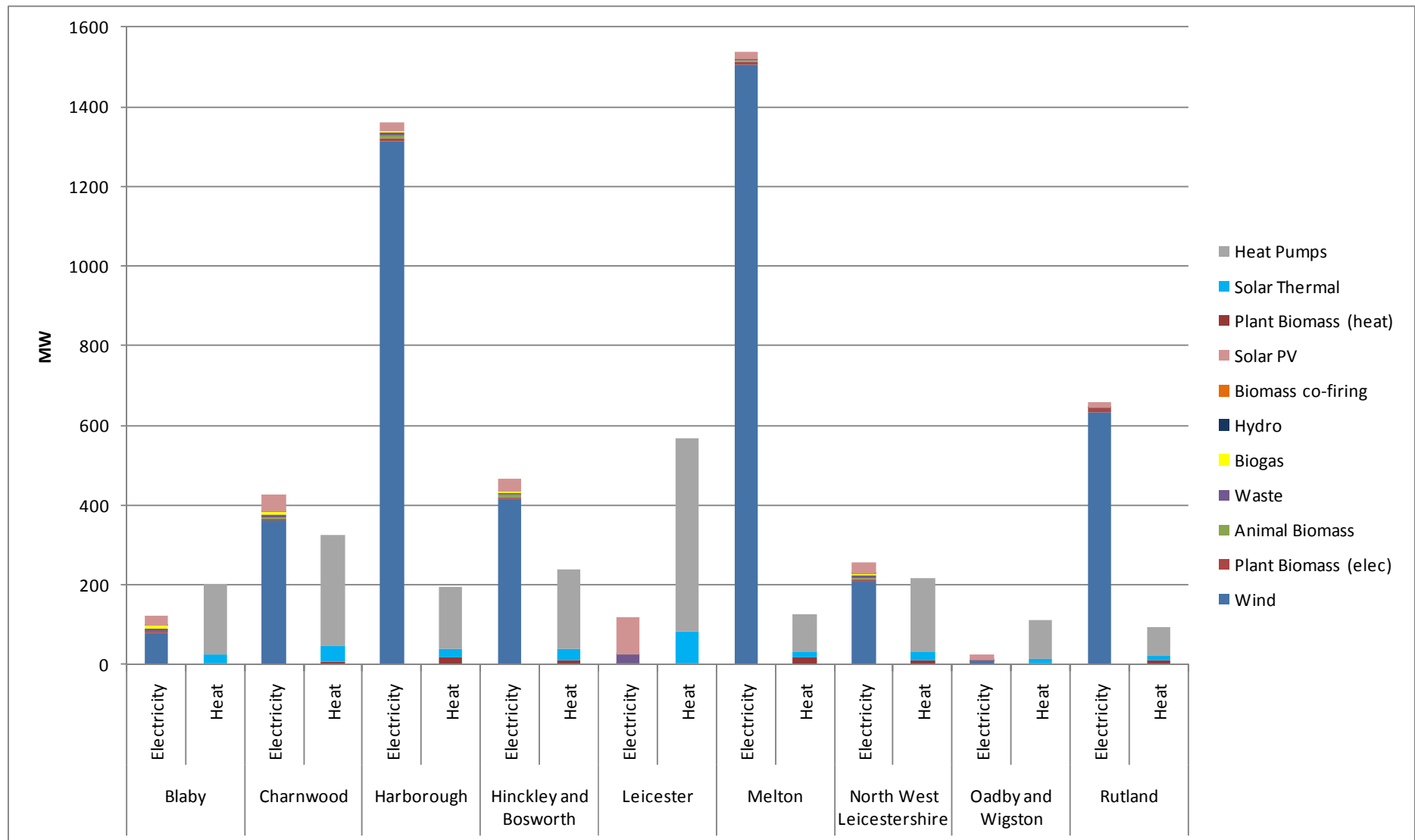
Table 4.6: Technical Renewable Energy Resource Potential for Leicester, Leicestershire and Rutland for 2020 and 2030 in MW and GWh

Technology	Hinckley and Bosworth				Leicester				Melton			
	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	178.97	282.21	178.97	282.21	0.00	0.00	0.00	0.00	977.39	1,541.16	977.39	1,541.16
Medium Wind	3.88	6.11	3.88	6.11	0.00	0.00	0.00	0.00	14.79	23.32	14.79	23.32
Small Wind	198.62	313.19	198.62	313.19	0.34	0.53	0.34	0.53	468.84	739.26	468.84	739.26
Small Scale Wind <6kW	34.65	48.57	34.65	48.57	0.00	0.00	0.00	0.00	42.58	59.68	42.58	59.68
Managed Woodland (heat)	1.41	5.56	1.41	5.56	0.04	0.16	0.04	0.16	2.03	8.00	2.03	8.00
Managed Woodland (elec)	0.23	1.73	0.23	1.73	0.01	0.08	0.01	0.08	0.33	2.49	0.33	2.49
Energy Crops (heat) Medium	7.25	28.58	7.98	31.46	0.45	1.77	0.49	1.93	15.90	62.68	17.49	68.95
Energy Crops (elec) Medium	1.25	9.42	1.37	10.32	0.08	0.60	0.08	0.60	2.73	20.57	3.01	22.68
Agricultural Arisings	1.86	9.75	1.86	9.75	0.05	0.25	0.05	0.25	3.90	20.52	3.90	20.52
Waste Wood (heat)	0.48	2.51	0.53	2.77	1.95	10.26	2.16	11.33	0.25	1.33	0.28	1.47
Waste Wood (elec)	0.56	2.93	0.61	3.23	2.28	11.97	2.52	13.22	0.30	1.55	0.33	1.72
Poultry Litter	0.08	0.40	0.08	0.40	0.00	0.00	0.00	0.00	0.34	1.79	0.34	1.79
Wet Organic Waste	4.62	24.29	4.62	24.29	0.27	1.44	0.27	1.44	5.91	31.07	5.91	31.07
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	3.27	17.20	3.60	18.92	9.76	51.31	10.74	56.44	1.70	8.94	1.87	9.84
Commercial and Industrial	2.62	13.75	2.75	14.45	12.42	65.29	13.06	68.63	1.39	7.31	1.46	7.68
Landfill Gas	1.94	10.18	0.53	2.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sewage Gas	0.29	1.25	0.31	1.34	0.00	0.00	0.00	0.00	0.77	3.35	0.82	3.60
Hydro	0.00	0.00	0.00	0.00	0.06	0.31	0.06	0.31	0.00	0.00	0.00	0.00
Solar PV	32.80	25.86	37.66	29.69	93.69	73.87	107.67	84.89	15.20	11.98	16.74	13.20
Solar Thermal	28.44	12.46	33.30	14.59	79.54	34.84	93.52	40.96	12.77	5.59	14.31	6.27
Heat Pumps	199.04	453.33	211.19	481.01	486.00	1,106.91	520.93	1,186.47	96.05	218.76	99.88	227.49
Total (electricity)	465.62	766.82	469.73	766.98	118.96	205.64	134.79	226.38	1,536.17	2,472.98	1,538.32	2,477.99
Total (heat)	236.62	502.43	254.41	535.38	567.98	1,153.94	617.14	1,240.85	127.00	296.37	133.99	312.17

Table 4.6: Technical Renewable Energy Resource Potential for Leicester, Leicestershire and Rutland for 2020 and 2030 in MW and GWh

Technology	North West Leicestershire				Oadby and Wigston				Rutland			
	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	64.27	101.35	64.27	101.35	4.12	6.49	4.12	6.49	412.04	649.70	412.04	649.70
Medium Wind	1.83	2.89	1.83	2.89	0.11	0.18	0.11	0.18	10.26	16.18	10.26	16.18
Small Wind	104.24	164.36	104.24	164.36	3.37	5.32	3.37	5.32	162.41	256.09	162.41	256.09
Small Scale Wind <6kW	39.86	55.87	39.86	55.87	0.00	0.00	0.00	0.00	49.15	68.89	49.15	68.89
Managed Woodland (heat)	2.48	9.78	2.48	9.78	0.02	0.08	0.02	0.08	2.17	8.55	2.17	8.55
Managed Woodland (elec)	0.41	3.09	0.41	3.09	0.00	0.00	0.00	0.00	0.36	2.71	0.36	2.71
Energy Crops (heat) Medium	7.35	28.97	8.09	31.89	1.20	4.73	1.32	5.20	8.57	33.78	9.43	37.17
Energy Crops (elec) Medium	1.26	9.49	1.39	10.47	0.21	1.58	0.23	1.73	1.47	11.07	1.62	12.20
Agricultural Arisings	1.41	7.43	1.41	7.43	0.03	0.13	0.03	0.13	6.00	31.54	5.05	26.52
Waste Wood (heat)	0.63	3.29	0.69	3.63	0.23	1.22	0.26	1.35	0.18	0.93	0.20	1.03
Waste Wood (elec)	0.73	3.84	0.81	4.24	0.27	1.42	0.30	1.57	0.21	1.09	0.23	1.20
Poultry Litter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.15	0.03	0.15
Wet Organic Waste	2.68	14.09	2.68	14.09	0.25	1.30	0.25	1.30	1.27	6.66	1.27	6.66
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	3.34	17.53	3.67	19.28	1.33	7.01	1.47	7.71	1.54	8.12	1.70	8.93
Commercial and Industrial	3.43	18.03	3.61	18.96	1.27	6.70	1.34	7.04	0.50	2.61	0.52	2.74
Landfill Gas	4.17	21.93	1.14	5.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sewage Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro	0.54	2.79	0.54	2.79	0.01	0.05	0.01	0.05	0.06	0.31	0.06	0.31
Solar PV	27.74	21.87	29.92	23.59	14.49	11.42	15.39	12.13	11.68	9.21	13.28	10.47
Solar Thermal	22.73	9.96	24.91	10.91	12.38	5.42	13.28	5.82	9.87	4.32	11.47	5.02
Heat Pumps	184.68	420.63	190.13	433.04	97.05	221.04	99.29	226.14	71.85	163.65	75.85	172.76
Total (electricity)	255.91	444.56	255.78	434.38	25.47	41.61	26.61	43.67	656.97	1,064.32	657.97	1,062.75
Total (heat)	217.87	472.62	226.30	489.25	110.88	232.49	114.17	238.59	92.64	211.24	99.12	224.54

Figure 4.5: Technical Renewable Energy Resource Potential for Leicester, Leicestershire and Rutland for 2020 in MW



DISCUSSION OF LEICESTER, LEICESTERSHIRE AND RUTLAND RESULTS

- 4.34 The results of the technical renewable energy potential for Leicester, Leicestershire and Rutland are set out **Table 4.6** and **Figure 4.5**. **Maps 4.14** and **4.15** show the relative technical resource potential for each local planning authority in the county, in terms of electricity and heat. The results indicate that with commercial scale wind forms the greatest technical resource potential for all the local authorities with the exception of Leicester and Oadby and Wigston. Heat pumps, solar PV and solar thermal also have significant potential, particularly in the more urban authorities such as Leicester.
- 4.35 The greatest wind energy potential is found within Harborough, Melton and Rutland. Rutland does however have significant constraints in relation to bird sensitivity issues – as defined by the Natural England/RSPB bird sensitivity study (see **Map 4.16** which shows the technical wind energy resource opportunities within Leicester, Leicestershire and Rutland). There is considerable potential for small scale wind linked to community, government and tourism related buildings, particularly within these rural authorities.
- 4.36 Harborough has notable potential for the generation of energy from energy crops although this potential is still relatively small when compared with onshore wind. As more urban authorities, Leicester and Charnwood have potential for the use of energy from waste (MSW and C & I), and waste wood. Charnwood also has the second highest potential for the generation of energy from sewage gas within the East Midlands. Blaby also has notable potential

for landfill gas although it is understood that much of this potential has already been realised.

- 4.37 Whilst there are a number of sites which have potential for hydropower within the county, the technical generation capacity of these schemes is limited.

Protected Landscapes - Peak District National Park and Lincolnshire Wolds AONB

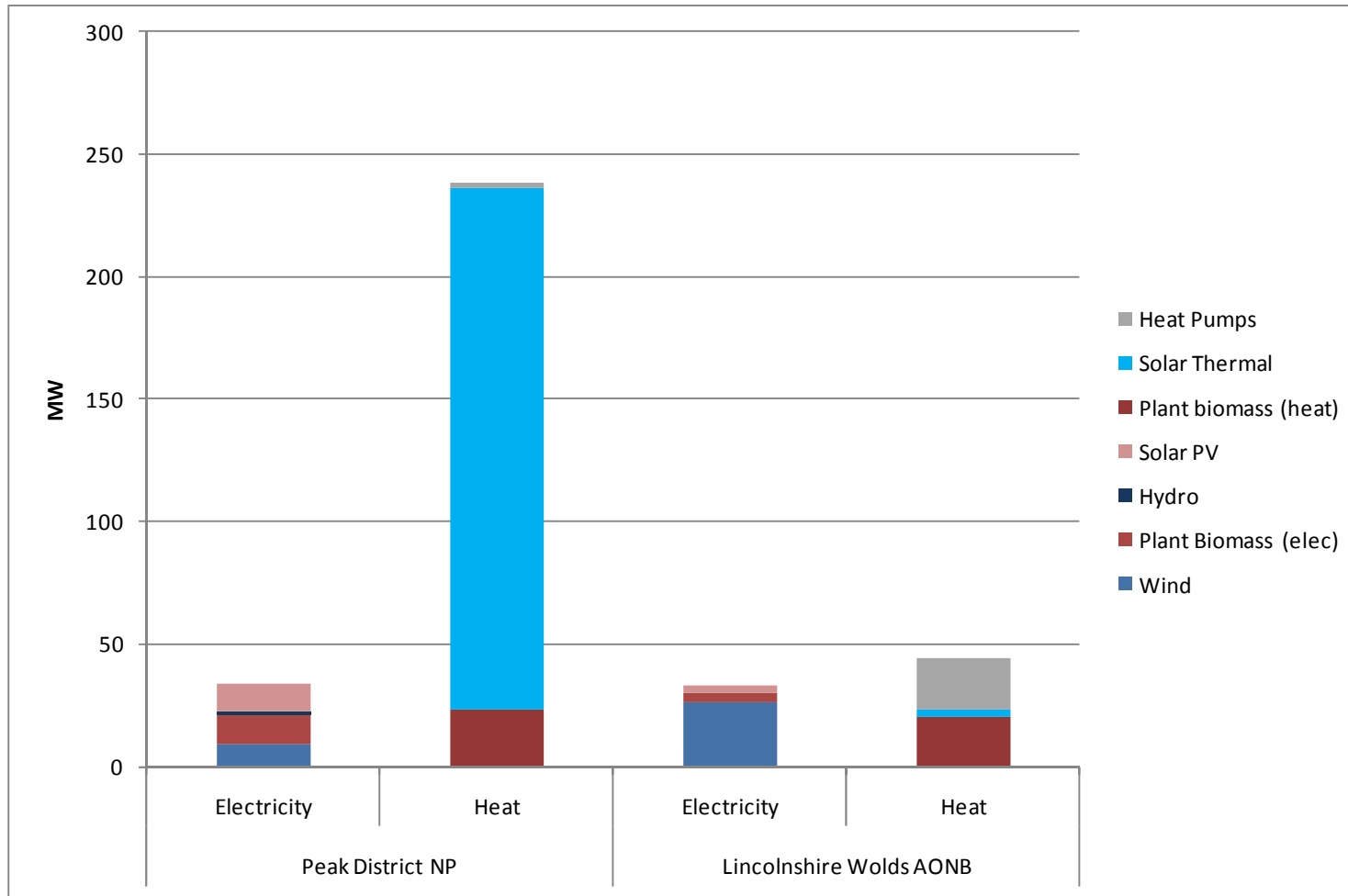
- 4.38 The following table summarises the potential for wind, managed woodland, energy crops, hydropower, solar and heat pumps within the Peak District National Park and Lincolnshire Wolds AONB.
- 4.39 Please note that the results for the Peak District National Park have been obtained from the Peak Sub-regional Study, whereas the results of the Lincolnshire Wolds AONB have been calculated using the assumptions set out in **Chapter 3**. It has not been possible to disaggregate the results for the protected landscapes for the remaining technologies as the data is only available on a district wide basis. The district wide results for these technologies are set out in **Tables 4.2 and 4.4** above. **Map 1.1** shows the location of the Peak District National Park and Lincolnshire Wolds AONB and their respective local authorities.
- 4.40 The results indicate that the Peak Sub-region Climate Change Study has identified significant technical potential for generating energy from managed woodland and microgeneration technologies such as solar thermal within the National Park. With due care and design, these technologies have the potential to be without compromising the special qualities of the protected landscape,
- 4.41 Significant potential has also been identified in the Lincolnshire Wolds for microgeneration technologies – in particular small scale wind linked to community uses and heat pumps.

Table 4.7: Renewable Energy Resource Potential for the Peak District National Park and Lincolnshire Wolds AONB 2020 and 2030 in MW and GWh

Technology	Peak District NP				Lincolnshire Wolds AONB			
	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Medium Wind	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Small Wind	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Small Scale Wind <6kW	9.05	12.68	9.05	12.68	26.25	36.79	26.25	36.79
Managed Woodland (heat)	23.57	92.90	23.57	92.90	3.79	14.94	3.79	14.94
Managed Woodland (elec)	12.33	92.90	12.33	92.90	0.62	4.67	0.62	4.67
Energy Crops (heat) Medium	0.00	0.00	0.00	0.00	16.74	65.99	18.42	72.61
Energy Crops (elec) Medium	0.00	0.00	0.00	0.00	2.88	21.70	3.17	23.88
Agricultural Arisings	*	*	*	*	*	*	*	*
Waste Wood (heat)	*	*	*	*	*	*	*	*
Waste Wood (elec)	*	*	*	*	*	*	*	*
Poultry Litter	*	*	*	*	*	*	*	*
Wet Organic Waste	*	*	*	*	*	*	*	*
Biomass Co-firing	*	*	*	*	*	*	*	*
Municipal Solid Waste (MSW)	*	*	*	*	*	*	*	*
Commercial and Industrial	*	*	*	*	*	*	*	*
Landfill Gas	*	*	*	*	*	*	*	*
Sewage Gas	*	*	*	*	*	*	*	*
Hydro	1.16	6.00	1.16	6.00	0.00	0.00	0.00	0.00
Solar PV	11.42	9.00	11.42	9.00	3.55	2.80	4.33	3.41
Solar Thermal	212.33	93.00	212.33	93.00	2.97	1.30	3.77	1.65
Heat Pumps	2.63	6.00	2.63	6.00	20.80	47.37	22.78	51.88
Total (electricity)	33.95	120.58	33.95	120.58	33.30	65.96	34.37	68.76
Total (heat)	238.53	191.90	238.53	191.90	44.30	129.60	48.76	141.09

* The data is only available on a whole district basis and is set out in Table 4.2 for the Lincolnshire Wolds local authorities (East and West Lindsey) and in Table 4.4 for the National Park local authorities (High Peak, Derbyshire Dales and NE Derbyshire).

Figure 4.6: Technical Renewable Energy Resource Potential for Peak District National Park and Lincolnshire Wolds AONB for 2020 in MW



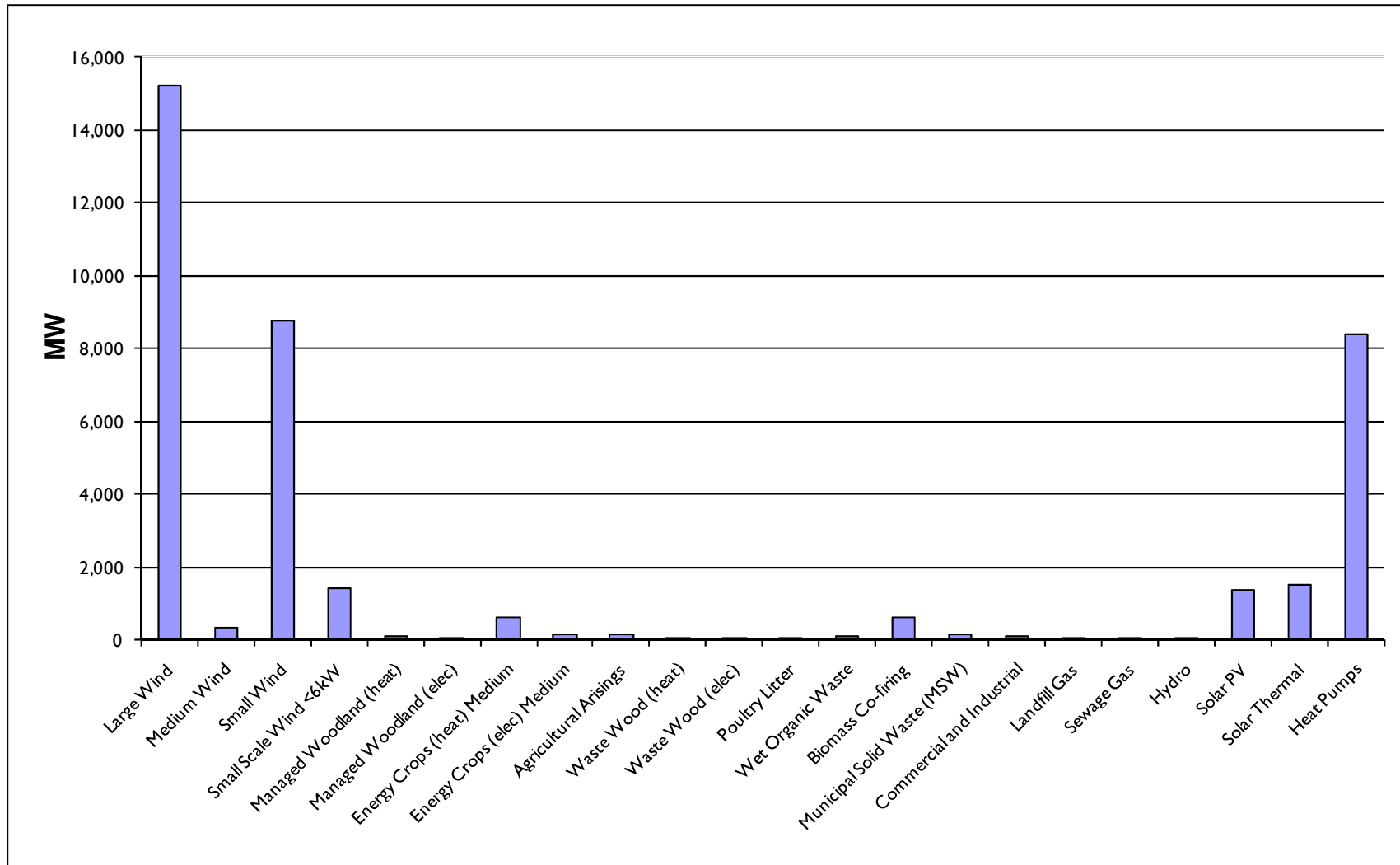
EAST MIDLANDS SUMMARY

- 4.42 **Table 4.8** and **Figure 4.7** set out the potential technical resource of each technology for the East Midlands in terms of installed capacity (MW) for 2020.
- 4.43 **Please note that the DECC methodology assumes that the biomass energy resource will be used alternatively for electricity or heat – not both. Care therefore needs to be taken in interpreting these results that the biomass resource estimates (for electricity and heat) are not double counted.**
- 4.44 The results of the resource assessment are also summarised for the East Midlands in the following maps:
- **Map 4.17:** Summary of technical potential for onshore commercial-scale and micro wind
 - **Map 4.18:** Summary of technical potential for plant biomass (electricity)
 - **Map 4.19:** Summary of potential for plant biomass (heat)
 - **Map 4.20:** Summary of potential for animal biomass and waste
 - **Map 4.21:** Summary of potential for biogas, biomass co-firing and hydropower
 - **Map 4.22:** Summary of potential for microgeneration
 - **Map 4.23 and 4.24:** Summary of potential in East Midlands (elec and heat)

Table 4.8: Renewable Energy Resource Potential for the East Midlands for 2020 in MW

Technology	TOTAL
Large Wind	15,221.45
Medium Wind	359.31
Small Wind	8,785.65
Small Scale Wind <6kW	1,430.00
Managed Woodland (heat)	108.34
Managed Woodland (elec)	28.90
Energy Crops (heat) Medium	607.87
Energy Crops (elec) Medium	170.03
Agricultural Arisings	165.94
Waste Wood (heat)	23.41
Waste Wood (elec)	27.32
Poultry Litter	20.24
Wet Organic Waste	118.97
Biomass Co-firing	609.40
Municipal Solid Waste (MSW)	147.62
Commercial and Industrial	127.33
Landfill Gas	50.85
Sewage Gas	18.29
Hydro	18.65
Solar PV	1,379.38
Solar Thermal	1,502.46
Heat Pumps	8,371.90
TOTAL (electricity)	28,679.34
Total (heat)	10,613.98

Figure 4.7: Technical Renewable Energy Resource Potential for East Midlands for 2020 in MW



Comparison of East Midland Results with Electricity Demand

4.45 Electricity demand for the East Midlands in 2009 (based on sales to domestic and commercial and industrial consumers) was 21,184.6GWh.¹² **Table 4.9** shows recent trends in consumption, a fall in demand between 2005 and 2009 of 11.5%. This equates to an average annual fall in demand of 2.3%.

Table 4.9: Electricity consumption in the East Midlands

Year	Consumption (GWh)
2005	23,938
2006	23,499
2007	22,637.2
2008	22,275.9
2009	21,184.6

4.46 The Department of Energy and Climate Change produces annual electricity demand projections for 2015, 2020, 2025 and 2030. However, opinion is varied on the data that should underpin such projections, particularly given the recent economic recession and its impact on electricity consumption. As such, there is uncertainty as to how the electricity demand in the East Midlands will change between now and 2020.

¹² DECC (2010) Sub-national authority electricity consumption statistics 2005, 2006, 2007, 2008, 2009

4.47 For the purpose of comparing electricity demand with renewable energy deployment, a conservative assumption has been made – that 2020 electricity demand will remain at 2009 levels i.e. 21,184.6GWh.

Renewable energy targets

4.48 The UK Renewable Energy Strategy¹³ sets out that in order to meet the target of producing 15% of our energy demand from renewables sources, 30% of our electricity demand needs to be generated by renewables.

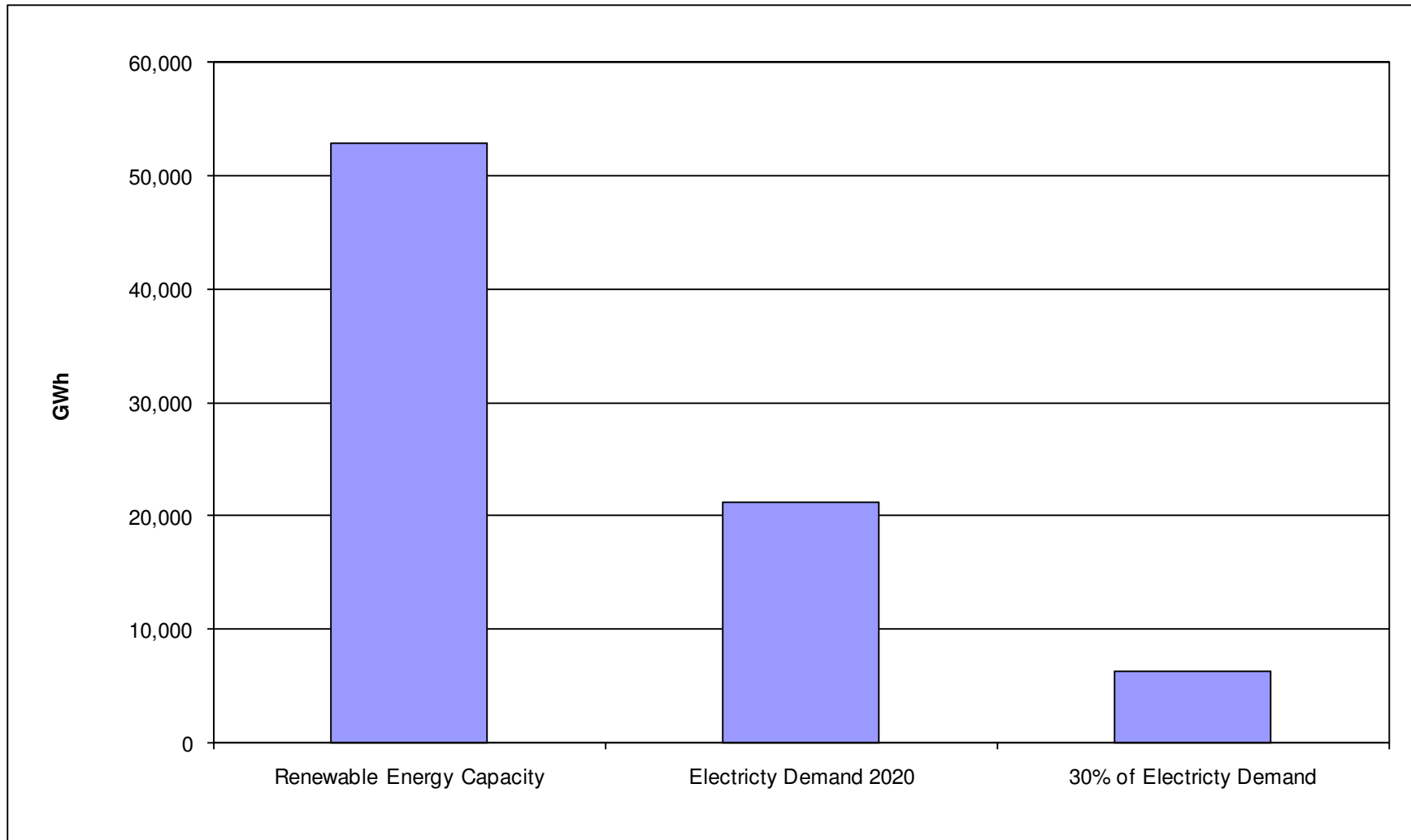
4.49 In the case of the East Midlands, 30% of the conservative estimate for demand in 2020 (21,184.6GWh) is 6,355.4GWh.

Technical Capacity

4.50 The total technical renewable energy capacity within the East Midlands for renewable energy (as calculated by this study) is 52,776.4GWh, more than twice the conservative estimate of total electricity demand for the East Midlands in 2020 and eight times that required to meet the region’s proportion of the UK’s target of 30% of electricity to be generated by renewables by 2020 (**Figure 1**).

¹³ HM Government (2009) The UK Renewable Energy Strategy

Figure 4.8: Comparison of Potential Electricity Demand within East Midlands in 2020 and the Government's Renewable Energy Target with the East Midlands Technical Renewable Energy Capacity



5 Heat Mapping

INTRODUCTION

- 5.1 District heating is the infrastructure for delivering heat and hot water to several buildings, using a central heat source and a network of pipes. This is a more efficient way of generating and delivering heat than the use of individual heating systems in every building. In 2010 there were relatively few district heating systems in use in the UK, although it is generally believed that nationally there is significant potential for district heating. Notably, in the East Midlands there are district heating systems in Nottingham and Mansfield.
- 5.2 A district heating system typically comprises an energy centre, a network of insulated pipes and a series of heat exchangers with heat meters in the individual buildings which are being supplied with heat. The energy centre may generate heat only, or it may be a combined heat and power (CHP) plant. Some district heating systems also include cooling.
- 5.3 District heating can range in scale from small systems such as a biomass boiler supplying a few homes to large scale schemes serving entire city centres. A wide variety of heat sources can be used, such as gas boilers, biomass boilers, CHP systems or waste heat from power stations. This flexibility helps to future-proof district heating systems.
- 5.4 One of the main constraints to district heating is the need to identify a sufficient heat demand density. This is a spatial

characteristic which indicates the degree to which heat demand from buildings is concentrated in a specific area. This characteristic can be used as a broad indication of areas with potential for district heating and can be mapped using GIS software. Both existing development and proposed future development can be included. Urban areas with high population densities offer the most potential. The civil works associated with laying heat mains and establishing connections to individual buildings is expensive. High heat densities mean shorter pipe runs and therefore lower costs. District heating schemes are also cheaper in new developments due to the lower cost of civil works on new sites.

- 5.5 A lack of overall size and diversity of heat loads can also act as constraints to district heating. The phasing of large developments can present challenges to district heating schemes, as the system needs to be able to adapt and accommodate future heat loads as they come on line, while being economically viable before these heat loads are connected. Existing buildings situated close to new developments for which district heating is being considered can offer significant benefits in that they can act as district heating 'anchor' points around which new systems could be established. As these heat loads already exist, incorporating them into the network would provide a stimulus for early implementation of the scheme. The inclusion of large public sector 'anchor load' sites such as social housing schemes, universities and local authority buildings can be particularly beneficial.

5.6 By definition heat distribution has to be organised spatially, and there are a number of spatial factors which influence strongly the viability of opportunities for (and benefits from) district heating systems:

- Existing heat demand density: the level of demand for heat in terms of kWh per area per year.
- Diversity of existing heat load: more diverse loads tend to have lower peak to base load ratios and hence the heating plant works at higher operating efficiencies for longer periods to make optimum use of the system.
- Location and nature of new development: the capital cost of installing district heating is much lower if it is integrated into the design at the masterplanning stage
- Redevelopment of existing buildings and infrastructure: the cost of connection to district heating can be lower if carried out at the same time as other works
- Public sector and Anchor heat loads: in order to establish district heating a sufficient customer base must be secured to justify the initial cost of the investment. Public sector and other large heat loads can form the basis of this.
- Existing heat sources: Use of waste/excess heat from existing sources can reduce the total up-front capital expenditure required to initiate a new community heating project.

5.7 Heat masterplanning is the process by which an area is searched for the most viable opportunities for initiating heat distribution projects. Access to accurate, high resolution geographic information on the factors listed above is a crucial element in locating and quantifying the potential for buildings and/ or extending heat distribution networks.

ADDRESS-LEVEL HEAT MAPPING METHODOLOGY

5.8 In order to produce the heat maps, a set of key indicators was used, comprising:

- Existing heat demand.** This was modelled using a methodology developed by the Centre for Sustainable Energy and Geofutures, which represents the most accurate method for geographically modelling heat demand available. This is described in more detail below.
- 'Anchor' heat loads.** These are large, relatively constant public and private sector loads and include a combination of modelled and actual heat consumption data.
- Future potential heat demand.** This was modelled based on data about future potential residential and commercial development
- Sources of waste heat.** This was gathered using local authorities' local knowledge and data on thermal power stations and Combined Heat and Power (CHP) installations published by DECC.

5.9 The following sections detail how these indicators were created.

Heat supply

5.10 Potential sources of waste heat were identified in two different ways:

- Local authorities were asked to provide data about current and potential future sources of waste heat in their localities;

- Data published by DECC was used to identify thermal power stations and CHP installations in the region. This included those operating and some which were under construction at the time the data was collected.

- 5.11 Most of this data gives capacity in terms of electrical capacity. For the purposes of mapping heat supply, this was converted into annual thermal output but assuming a given capacity factor and thermal efficiency for each technology type.
- 5.12 Both current and future waste heat sources were collected. If a district heating system can use heat which is generated as a by-product of another process, costs and carbon emissions can be reduced.
- 5.13 CHP was included within sources of waste heat; although the heat generated by CHP is not wasted, CHP installations can provide good starting points which can be extended to supply more than one building and so form the starting point of a district heating system.

Existing heat demand

Modelling demand

- 5.14 The Centre for Sustainable Energy and Geofutures have developed a methodology to produce address-level heat demand maps. Prior to the development of this methodology, heat demand maps have been based on arbitrary geographies such as grid squares or census areas of various sizes, with each model value aggregating hundreds of addresses using top-down approaches. An address-level map represents a significant improvement on these approaches because it is buildings, as opposed to grid squares or census output areas, which must be connected

to heat distribution systems. The most appropriate geographic resolution for a heat demand map is therefore at the level of individual addresses. Ideally such a map would be based on actual (metered) fuel used for space and water heating. However this requires full access to energy supplier meter databases, which unfortunately is not available at the time of preparing this report. Therefore the methodology uses publicly available datasets to estimate heat demand at the premise level.

- 5.15 The address-level heat demand modelling methodology starts with a dataset representing the addresses and locations of premises (and hence the buildings that contain them). It combines this dataset with information from numerous sources representing characteristics of these premises which can be used to estimate their heat demand. It then performs this estimate for every premise individually, running a set of benchmarks against these characteristics. Finally this premise-level dataset is aggregated to building level to preserve agreement with the real-world population of buildings. The result of the modelling process is a spatial relational database storing the address text, geographic coordinates, and estimated heat demand of all buildings in the study area as defined by the master address list used - in this case the National Land and Property Gazetteer (NLPG). This database is then used to generate maps for analytical and reporting purposes.

Integrating actual demand data

- 5.16 Actual demand data has been integrated into the East Midlands Heat Map where possible. Two sources of actual demand data were used. The first was the register of Display Energy Certificates which records actual energy consumption for all public sector buildings to which the

public have access and which have an area of more than 1,000 square metres. The second was data provided by local authorities in the region on the heat consumption in their buildings, which had been collected as part of their reporting to central government on National Indicator 185 (NI 185). Table 27 in **Appendix 5.1** shows where local authorities' NI185 data was included.

5.17 Not all local authorities were able to provide NI 185 data in the required format. In order to integrate it into the heat map, geographical information such as co-ordinates or accurate addresses are required. Where it was not possible to use actual metered data, the energy consumption shown for local authority-owned buildings in the heat map was modelled.

Identifying Anchor heat loads

5.18 The term “Anchor Loads” is used to describe a set of ideal early heat customers which can be used to initiate a district heating project. The types of customer considered in this way comprise a combination of (1) public sector heat users and (2) private sector heat users with ideal load profiles or very high loads. It is useful to identify the locations of potential Anchor Loads as part of the heat mapping process, as these can, by definition, lead to the identification of heat distribution project opportunities. They therefore represent a useful starting point for the investigation of a particular area – the process would involve identifying the specific Anchor Load buildings, and then searching the surrounding area for other high heat users. **Table 5.1** below shows how anchor loads were identified, while Tables 2 to 11 in **Appendix 5.1** list anchor loads in the identified priority areas.

Table 5.1: Anchor Load Types

Anchor load group	Address categories
Public sector buildings with metered data	Buildings included in Display Energy Certificate register Buildings included in NI185 data
Emergency Services	Fire Station Police Station Prison
Education	Primary Education Secondary Education University
Health	Hospital Primary Health
Other	Halls of residence Hotel Care Homes Swimming Pools

Projected future heat demand

Residential

5.19 Local authorities in the region were asked to provide data from their Strategic Housing Land Availability Assessment (SHLAA). This is an assessment of potential housing sites in their locality, along with an estimate of the number of dwellings that could be included in each site.

5.20 This data was used to estimate the heat demand that each SHLAA site would create if completed. Heat demand was estimated by assuming a specific mix of dwelling types for a specific density of housing. Three density bands were used, and the mix of dwelling types for each density is shown in **Table 5.2**:

Table 5.2: Site Density Assumptions for SHLAA Modelling

Density Category	Density Assumptions
Low density: Up to 30 dwellings per hectare	0% flats, 20% terraced houses, 35% semi detached houses, 45% detached houses
Medium density: 31 to 49 dwellings per hectare	25% flats, 25% terraced houses, 30% semi detached houses, 20% detached houses
High density: 50+ dwellings per hectare	30% flats, 40% terraced houses, 25% semi detached houses, 5% detached houses

5.21 When covering an entire region it is difficult to make assumptions about density that would suit every local authority area and so some compromises had to be made here. Suggested density assumptions were circulated to the project steering group, and **Table 5.2** above represents a middle way between the suggestions that were made by individual local authorities as to what would be suitable in their own localities.

5.22 A database model was used to calculate the mix of housing types that would be present within each site, based on the assumptions about density, and benchmarks were used to model the heat demand on each site based on energy demand under 2006 building regulations.

5.23 Regionally, the SHLAA data has some significant gaps. Different local authorities are at different stages with their SHLAA assessments and where versions had not been made publicly available local authorities were not able to supply data for use on this project. In some cases the data that could be supplied was not available in a GIS format, which meant that it was not possible to use in this project. In other cases the number of potential dwellings was not available, and so the heat demand for these sites could not be modelled. This means that the SHLAA data used in the heat mapping work does not cover all local authorities in the region. Table 27 in **Appendix 5.1** shows which local authorities' SHLAA data was included.

5.24 It should also be noted that the Strategic Housing Land Availability Assessments include all sites that *could* be used for housing and that by no means all of the sites within a SHLAA will eventually come forward. The incorporation of SHLAA sites within the heat mapping is a way of identifying potential sites, but it is not an acknowledgement that the SHLAA sites will definitely come forward.

Non-residential

5.25 Local authorities in the region were asked to provide data on planning permissions and allocations for non-residential sites, along with associated gain and loss of floorspace in different use classes.

5.26 This data was used in a database model to calculate the heat demand from new non-residential development. Energy consumption benchmarks were assigned to each use class, and in this way heat demand per site was calculated. For sites that were being redeveloped from one use class to another, this could mean that heat consumption could actually fall, if the new use class was of a type that tends to

consume less heat. In this case the change in heat consumption would be a negative number.

5.27 The non-residential data has some significant gaps. Some local authorities were unable to provide this data. Some local authorities were able to provide data on non-residential permissions and allocations but did not hold the data in GIS format or with co-ordinates, which meant that it could not be used for mapping. Finally, the data was requested in a specific format, in terms of the layout, but there was much variation in the formats of the data provided by different local authorities. It was necessary to standardise the data in order to combine data from all local authorities that had provided it, but where the format provided was very different from the format requested, this was not possible within the timescales of the project and it has therefore not been possible to include all of the non-residential permissions / allocations data that was provided. This means that future non-residential heat demand has not been mapped in all parts of the region. Table 27 in **Appendix 5.1** shows the local authorities for which non-residential data was included. Tables 28 to 38 in **Appendix 5.1** show the future sources of heat demand which are found in the identified priority areas.

ANALYSIS AND RESULTS

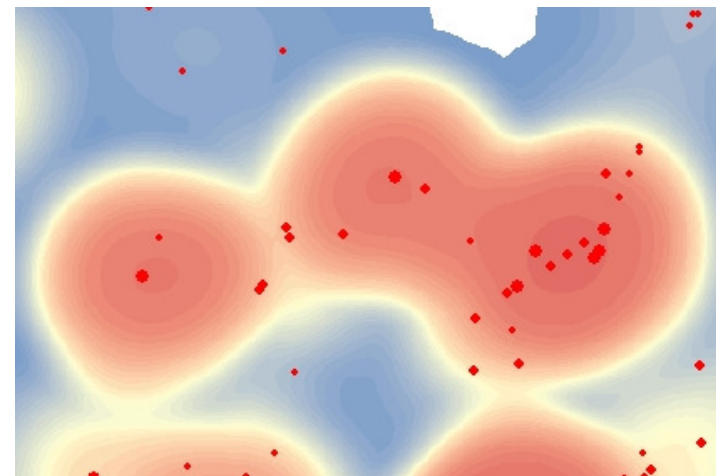
Spatial factors influencing the viability of district heating

5.28 The indicators described above are used to find areas of high heat demand which could accommodate viable opportunities for heat distribution projects. The above datasets are all point data; when shown on a map they

appear as points representing individual buildings, or in the case of new development, the centre of a development site.

5.29 It is useful to convert this point data into continuous surfaces using spatial interpolation methods. Essentially the interpolation divides the area (in this case the East Midlands region) into cells, and for each cell calculates an average heat demand per square metre by taking the heat demand from each building in the cell and the neighbouring cells and 'smoothing' it among the points. This is easier to understand when the points and surfaces are viewed together on a map; where there are points representing high heat demand from a building, the surface will show higher heat demand per metre squared closer to the building, and further away heat demand will be lower. **Figure 5.1** below shows a surface derived from points. The points are sized so that higher heat demand is shown as a larger symbol. The surface is created by smoothing out this heat demand to create a contour effect. This is a useful visual and analytical tool.

Figure 5.1: Example of points and surfaces



Region-wide identification of priority areas

- 5.30 To identify priority areas, an overlay analysis was performed. Surfaces were created for three of the key indicators; existing heat demand, anchor loads, and future heat demand. Each surface was made up of cells of 100m square. Thresholds were applied to each surface, and then the surfaces were overlaid on a map. Areas where the threshold was exceeded for each surface were considered to be more suitable for district heating.
- 5.31 A surface was not created for the waste heat sources because the points are very far apart; smoothing the points simply results in a surface which replicates the points. For this reason waste heat was not included in the overlay analysis; instead, locations of sources of waste heat were taken into account when the final priority areas were selected.
- 5.32 **Table 5.3** shows the thresholds which were chosen and the reasoning behind these.

Table 5.3: Threshold levels for priority area indicators

Indicator	Threshold	Reasoning
Existing heat demand	20 kWh per m ² per year	The threshold for heat demand for district heating is generally considered to be 3,000kW per km ² . This translates to 25kWh per m ² per year. However, using 25kWh in the weighted overlay analysis gave a high number of very fragmented areas, and so the threshold was lowered slightly to 20kWh to obtain fewer and larger priority areas.
Anchor load heat demand	2kWh per m ² per year	The purpose of this indicator was to check for the presence of anchor loads. If this indicator is above zero, anchor loads are present. As anchor loads were present in most areas, a low threshold of 2kWh was applied in order to identify the more concentrated areas of anchor load heat demand.
Future heat demand	0kWh per m ² per year	The purpose of this indicator was to check for the presence of potential future heat demand from new development. The threshold was set to zero, so that all potential new development with a positive heat demand would be included (some new development has a negative heat demand as it will replace a higher existing heat load).

- 5.33 The sequence of maps below illustrates overlaying of the surfaces with thresholds applied.
- 5.34 **Map 5.1** shows an area in Derby where existing heat demand is above 20kWh per m² per year. **Map 5.2** shows the same area, but now with areas where heat demand from anchor loads is above 2kWh per m² per year. On this map

points showing the location of the anchor load buildings are included.

5.35 **Map 5.3** shows potential future demand from new development in the same area, along with points representing the centre of the development areas.

5.36 **Map 5.4** shows the three surfaces overlaid. The black line shows the priority area identified. The outline of the priority area does not exactly match the overlap; this is because the overlay analysis is performed at regional level, dividing the region up into cells of 100m². The outline is based on cells of this size. When the maps are produced, more detailed surfaces are created for aesthetic purposes; the maps here show cell sizes of 5m².

5.37 This overlay analysis identified 203 areas where the thresholds were met for all three surfaces. In the first instance the priority areas were chosen from this group of 203. The size of each area and its total existing heat demand were used to prioritise the areas in the first instance.

5.38 Proximity to an existing or potential source of waste heat was investigated at this point, but it was found that in most cases the areas identified were not near enough to sources of waste heat to make it a viable reason to select the area as one of the main priority areas.

5.39 A 'top eleven' areas were chosen from the 203 areas where all three thresholds were met. These areas were chosen for their size, their high existing heat demand, and their potential future heat demand. One further area was identified where the threshold for existing heat demand was not met, but the potential future heat demand was considerably higher than most of the areas where the existing heat demand threshold was met.

5.40 Among these twelve areas, there are two pairs of areas (in Derby and Nottingham) that are so close to each other that each pair should really be considered to be one priority area, which reduces the twelve areas to ten.

5.41 Another consideration was to distribute priority areas relatively evenly across the region. The project steering group asked that there be at least one priority area in each county and unitary authority. After this selection of areas, two counties (Derbyshire and Leicestershire) and one unitary authority (Rutland) did not have priority areas. The list of 203 areas where all three thresholds were met was searched for the most promising areas within each county, adding two priority areas to the selection. However, there were no areas within Rutland where all of the thresholds were met; on investigation this was because relatively few anchor loads were identified in Rutland. This is likely to be a characteristic of the NLPG data rather than a property of Rutland itself. The most promising area where the other two thresholds were met was selected to be Rutland's priority area. Therefore although this area has been identified as a priority area, it is a priority relative to other areas in Rutland, but for the region as a whole there are other areas which would be more suitable for district heating.

5.42 Therefore a total of eleven priority areas were identified. These are described in the following maps.

5.43 The priority areas were chosen 'automatically' based on the criteria chosen and need more local knowledge to be refined. Local authorities will want to move the boundaries of the areas based on their local knowledge.

5.44 The analysis identifies the areas where the indicator surfaces overlap, but the surfaces are influenced by points which are

outside of the overlap. This means that when the priority areas (which have been identified 'automatically' using the overlay analysis described above) are looked at in more detail we find that the area considered as the priority area should be extended beyond the boundaries of the area where the surfaces overlap. In fact what is labelled 'priority area' should perhaps be called 'overlap area', with the priority area being any suitably sized area around this. The maps suggest where this could be extended by showing areas of especially high heat demand from the existing or future heat surfaces.

- 5.45 The eleven priority areas are the areas that the analysis has identified as those with the most potential (taking into account the need to distribute the priority areas among all counties and unitary authorities); however, it does not mean that these are the only areas with potential for district heating.

Priority area maps and discussion

- 5.46 **Map 5.5** shows the priority areas at a regional level.
- 5.47 The priority area maps show both surfaces and points. Anchor loads, potential future demand and waste heat sources are all shown as points on the maps. It should be noted that the size of the points represent the magnitude of demand / output, but the point sizes are not comparable for the different datasets. These scales are based on the range of demand for each dataset throughout the whole region.
- 5.48 Anchor load surfaces are shown in red and are always shown at the same threshold level which was used in the overlay analysis. It should be noted that the other surfaces (existing heat and future heat demand) are shown at

different threshold levels in different maps. This is to provide more information about the level of heat demand. The legend of each map should be consulted carefully.

- 5.49 The priority areas are presented in alphabetical order according to the local authority area where they are located. Each county and unitary has a priority area, but not every district has one.

Corby Priority Area

- 5.50 **Map 5.6** shows the Corby Priority Area. This area has existing heat demand under 20kWh per m², but was chosen because of its high potential future heat demand (note that the future heat demand surface only shows demand above 10kWh per m² per year). This is an interesting example of identification of priority areas because the area identified is the overlap of the anchor load and future heat surfaces, but both of these surfaces are influenced by points outside of the area identified as the priority area. The area should be extended to take in the second future demand point to the west of the elliptical area shown, and to include the anchor load points to the east of the ellipsis and the health centre and hospital to the north. This priority area is dependent on the new development coming forward, because without this district heating would not be viable. However, if the developments do come forward the nearby anchor loads could provide ideal starting points for the system. The new development sites shown on this map are both SHLAA sites with capacity for 500-600 dwellings each, and a potential heat demand of approximately 3.5 GWh per year.

Derby Priority Areas

- 5.51 **Map 5.7** shows two priority areas in Derby which could be merged together to create one priority area. They are

linked by an area of high existing heat demand (this map only shows existing heat demand above 100kWh per m² per year). Future heat demand is not shown on the map because there is low-level future heat demand (up to 3kWh per m²) throughout the area in view, but almost none higher than this. There are a considerable number of anchor loads in the priority areas shown; in addition there is a CHP plant in the centre of the upper priority area (labelled as a source of waste heat), from which a district heating system could be developed.

- 5.52 **Map 5.8** shows another area in Derby which has been identified as an area of priority. Again, there is low level future heat demand which is not shown on the map, and the main reason for identification as a priority area is the presence of several large anchor loads, combined with reasonably high existing heat demand.

Derbyshire Priority Area

- 5.53 **Map 5.9** shows the priority area identified for Derbyshire. Existing heat demand over 50kWh per m² per year is shown, along with future heat demand over 2kWh per m². Although there are several future heat demand points within the priority area, they do not between them create much heat demand, but there is an area immediately to the east of the identified area where the future heat demand points are more clustered and the priority area should be extended to take this in. It could also be extended to take in the grey area of high existing heat demand to the east. The area on the west side of the priority area where it extends into the park is a result of the need to use 100m square cell sizes to undertake a regional-level analysis, and further definition of the area would remove this part of the priority area.

Kettering Priority Area

- 5.54 **Map 5.10** shows the priority area identified for Kettering. Existing heat demand over 100kWh per m² and future heat demand over 5kWh per m² are shown to give further information about where the areas of highest heat demand are. Again, the boundaries of the priority area could be extended to the west to take in the area of high future heat demand. This priority area has a balance between all three indicators and a mixture of anchor loads.

Leicester Priority Area

- 5.55 **Map 5.11** shows the priority area identified for Leicester. This has an area of almost two square kilometres. The shape of the area was defined by the anchor loads, because existing heat demand and future heat demand both met the thresholds over a larger area than that shown on the map. For this reason future heat demand and existing heat demand are shown at higher threshold levels than those used for the overlay analysis (100kWh per m² and 10kWh per m² respectively). The area to the west of the priority area has high existing heat demand and high potential future heat demand. It was not selected as a priority area due to the relative lack of existing anchor loads, but if it is considered likely that most of the identified future development will go ahead, this area could also be identified as a priority area in the local plan and developers encouraged to incorporate readiness for DH into their designs.

Leicestershire Priority Area

- 5.56 **Map 5.12** shows Leicestershire's priority area, which is in Harborough district. It has an area of approximately 800 metres square, and is well supplied with anchor loads. The

map shows existing heat over 50kWh per m², which is in the southern central part of the priority area. The future heat point in the centre of the priority area is a SHLAA site with a capacity of around 40 dwellings and so is relatively small-scale. The future heat demand to the south west of the map is from one SHLAA site with a potential yield of over 600 dwellings, with the edge of the site being approximately 500m from the edge of the priority area, so if this development were to go ahead it could potentially join up to a district heating system within the priority area.

Lincoln Priority Area

- 5.57 **Map 5.13** shows Lincoln's priority area. To the east of the priority area is a CHP plant located in the hospital, which is labelled on the map as a source of waste heat. The priority area could be extended to include this as it is potentially a good point from which to start a district heating system. Only very high existing heat demand is shown on this map (above 100kWh per m²), and most of the priority area has existing heat demand at or above this level. Future heat demand over 5kWh per m² is shown on the map, and the southern part of the priority area has future heat demand above this level.

Mansfield Priority Area

- 5.58 **Map 5.14** shows Mansfield's priority area. Existing heat demand above 50kWh per m² and future heat demand above 2 kWh per m² are shown on the map. The area is well supplied with anchor loads. There already fifteen small-scale coal and gas-fired district heating systems situated in parts of Mansfield, Mansfield Woodhouse and Warsop. In total they serve over 2,000 council and private properties. They were installed at the time the council housing they

serve was built and so the oldest are approximately 35 years old. A small number of the properties served are located within the eastern edge of the identified priority area.

Nottingham Priority Area

- 5.59 **Maps 5.15 and 5.16** show Nottingham's priority area. This is illustrated with two maps because it is larger than the other priority areas. **Map 5.15** shows the existing heat, anchor load and future heat surfaces. Existing heat is shown above 100kWh per m² and future heat is shown above 5kWh per m² (if these surfaces were shown at their threshold levels of 20kWh per m² and 0.1kWh per m² respectively, they would cover almost the whole map of this area). **Map 5.16** shows point data and the extent of the existing district heating network. Most of the existing primary district heating network is within the southern priority area, as would be expected. The St Ann's estate district heating network supplies mainly domestic properties and is to the east of the southern priority area.

Rutland Priority Area

- 5.60 **Map 5.17** shows Rutland's priority area. As noted above, relatively few large anchor loads have been identified in Rutland, and there is nowhere in the local authority area where the threshold for anchor load heat demand is met. To identify a priority area in Rutland the best area was chosen where the other two thresholds were met. The map shows the threshold levels of existing heat demand and future heat demand. If the new developments identified in the centre of the priority area come forward, these could be joined to the central anchor loads to initiate a district heating network.

6 Policy Guidance

INTRODUCTION

6.1 This chapter provides guidance for local planning authorities on what further assumptions and scenario testing could be used to refine the results of the technical renewable energy potential to calculate the deployable potential – i.e. considering transmission, supply chain and planning constraints and opportunities. The Chapter also includes a review of how local planning authorities within the East Midlands can play a proactive role in facilitating renewable and low carbon energy development through the establishment of a positive planning policy framework and the types of policy approaches that could be incorporated within Development Plans. The chapter concludes with a review of how local authorities can seek to monitor the implementation of renewable energy schemes within their area.

ASSESSMENT OF DEPLOYABLE POTENTIAL

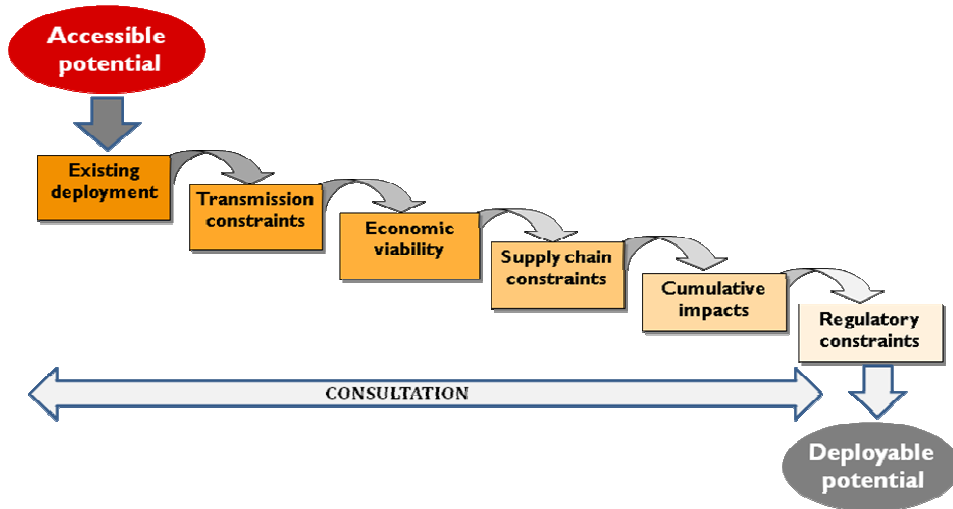
6.2 The resource assessment in **Chapter 4** identifies the theoretically accessible resource, not the deployable resource. For some technologies such as onshore wind, the theoretical potential represents a significant overestimate of what will be actually likely to be developed. To assist planners in the interpretation of the resource assessment set out in this report this section provides information on:

- The **key factors likely to influence the future uptake of renewables** within the East Midlands – i.e. the assessment of deployable potential.
- The value of using **scenarios** (possible mixes) of different renewable energy resources and technologies that could be used to achieve different levels of deployment.
- **Visualisation and conversion tables** - to aid in the process of comparing the relative size and output of different technologies and the number of developments that may be required to meet a certain target.

Key factors influencing deployable potential

6.3 There are a number of factors which need to be taken into account to refine the assessment of technical potential to a more realistic estimation of deployable potential. These are summarised in **Figure 6.1** below. Estimating the deployable potential is a difficult exercise which is exacerbated by significant changes that are taking place in government policy which will clearly have a significant impact on outcomes for 2020 and even more so for 2030.

Figure 6.1: Key renewable/low carbon energy deployment constraints



Existing deployment

To assess the level of deployable potential that could be delivered, it is necessary to consider the existing level of renewable energy deployment within an area and the key factors that have influenced the rate of deployment to date. This may include factors such as presence of existing schemes and cumulative impacts etc.

Transmission Constraints

The transmission system is important factor for commercial-scale (transmission connected) projects as the generated electricity needs is connected to the UK transmission system in order to supply national electricity demands. The major connection issues that affect the deployment of renewable energy projects are:

Economic viability

Access – the wait in the queue to access the network. Projects in some areas suffer significant delays from this.

Capacity of the link – output from projects maybe constrained below full output due to the capacity of the link

Costs associated with use of link – as transmission costs incorporate a price signal to encourage generation to locate close to the site of electricity demand (in order to reduce transmission losses) the charging regime is argued to be biased against many renewables as most renewable energy sources are far away from sources of demand (urban and suburban).

If a new project is to be built and operated, it must deliver a competitive return to the operator of the renewable facility. In the UK, this is largely influenced by support operators receive from financial mechanisms sanctioned by the government. The most important of these for commercial scale renewable energy projects is the Renewable Obligation for renewable electricity. However, other important financial schemes include the feed-in tariff for small-scale power generation and the renewable heat incentive. Typical industry practice means that projects are only commissioned if they pass some benchmarked rate of return. Typically the ‘hurdle’ rate of return varies by technology type.

Supply chain constraints	Supply constraints include bottlenecks related to availability of materials, equipment and services and the necessary labour to build, install, operate and maintain installed renewable capacity. The simultaneous increase in demand of renewable technologies and the competition for resources from other users across the globe as cause bottlenecks in supply, that have ultimately increased the cost of installation, lengthen the time of installation and lower amount of installation occurring.
Cumulative issues	The assessment of technical potential does not take into account cumulative impacts – ie the number of schemes that may be acceptable within a given area. For technologies such as wind energy, a landscape sensitivity analysis can be useful tool to evaluate cumulative impacts.
Environmental and regulatory Constraints	There are a number of environmental and regulatory related constraints which may have an influence on the uptake of renewable energy schemes – these include: Political and public acceptance of renewable energy projects and the likelihood of securing planning consent. Environmental regulations and the ability to secure necessary licences – e.g. water abstraction licenses for hydro schemes. Landscape or other international or national designations including National Parks and AONBs*

*It is important to note that the deployable potential for renewable technologies will be more constrained where National Park designation is a material planning consideration since there is a 'legal requirement under the 1949 Act (as amended)' to ensure that the special qualities of this designation and its setting are not compromised.

Please see Peak Sub-regional Climate Change Study National Park and the landscape sensitivity study maps in **Appendix 3.1**.

The Development of Scenarios

- 6.4 Developing target scenarios can be a powerful tool to assist translation of the 'technical resource' – i.e. what is theoretically available to what may actually be delivered on the ground. It can assist by:
- examining the implications of varying levels of constraint/ ambition;
 - helping to visualise outcomes and allowing target setting;
 - testing what is realistic from what might be deemed science fiction.
- 6.5 It can also help inform stakeholder discussions around possible targets and therefore secure buy-in to targets from key consultees.
- 6.6 Trying to predict the impact of the various assumptions relating to transmission, supply, financial viability etc is not a precise science, and will require a combination of expert knowledge of the technologies and the policy context they operate in, together with a detailed knowledge of local politics and infrastructure. Scenarios can therefore be used to test various options.
- 6.7 The precise nature of the variables that could be considered under each scenario is likely to be specific to each local authority area, and therefore the description of the

assumptions for each scenario should be tested with key stakeholders in each authority. It is suggested that that two or three scenarios for deployment should be considered typically representing low/ business as usual, medium and high deployment scenarios. For example:

- **Business as Usual** - could present extrapolations of the growth in the uptake of renewable energy over the past 10 years using the number of renewable energy schemes that have been commissioned in a local authority area to date.
- **Medium Growth Scenario** - could set out a future trajectory for renewables that may be achievable given the current economic circumstances, state of the industry and likely fiscal changes such as the introduction of the Renewable Heat Incentive.
- **High Growth Scenario** - could consider what needs to be done to achieve 15% of energy supply from renewables by 2020 and thereafter onward growth retaining this momentum.

6.8 The proposed scenarios should be tested with stakeholders, and a preferred scenario identified, which may well be a combination of, or modified version of the original scenarios. This approach enables stakeholders to discuss the scenarios and understand the key assumptions and parameters that will affect the level of deployment for each technology. This in turn should improve the robustness of assumptions, as well as help to achieve some buy-in, as

stakeholders will be engaged in the process of agreeing the targets.

Conversion tables

6.9 When consulting with stakeholders it may become apparent for various reasons that some technologies are considered to be more appropriate than others in certain areas due to perceived visual or other impacts, particularly in protected landscapes. To aid of the process of comparing the relative size and output of different technologies and the number of developments that may be required to meet a certain target, a 'conversion table' is set out in **Table 6.1** below. It is intended that these could be used by local authority planners and others to help them weigh up the relative number and balance of technologies that may be acceptable within their area. Electricity and heat equivalents are shown (noting that some technologies e.g. biomass and waste allow for 'combined heat and power').

Table 6.1: Renewable Energy technologies – output (generation capacity) per plant/ unit capacity

Technology	1. Capacity factor*	2. Typical individual plant installed capacity MW	3. Generation Output (MWh/yr) per typical plant capacity **	4. MWh output per MW of capacity
Electricity generators				
Large scale commercial wind turbine	0.18	2.5	3,942	1,577
Small wind turbine	0.16	0.006	8	1,402
Biomass CHP	0.56	5	24,528	4,906
Large biomass plant - electric-only	0.86	100	753,360	7,534
Medium sized biomass plant electric-only	0.86	50	376,680	7,534
Co-firing	0.9	5	39,420	7,884
Landfill gas	0.6	2	10,512	5,256
Bio/sewage gas	0.5	0.5	2,190	4,380
EfW	0.6	10	52,560	5,256
Hydro	0.59	0.2	1,034	5,168
Solar PV (domestic)	0.09	0.001	0.8	788
Heat generators				
Biomass CHP	0.56	14	68,678	4,906

Technology	1. Capacity factor*	2. Typical individual plant installed capacity MW	3. Generation Output (MWh/yr) per typical plant capacity **	4. MWh output per MW of capacity
Co-firing	0.9	5	39,420	7,884
Landfill gas	0.6	3	15,768	5,256
Bio/ sewage gas	0.5	0.1	438	4,380
EfW	0.6	11	57,816	5,256
Large biomass plant boilers	0.2	3	5,256	1,752
Small biomass plant boilers	0.2	0.2	350	1,752
Solar thermal (domestic)	0.05	0.0025	1.1	438

*Information on the sources of the capacity factors is contained in **Appendix 4.4**.

** The generation capacity is calculated using the following equation -

$$\text{MW/h} = \text{Installed capacity in MW (see column 2)} \times 365 \text{ (days in year)} \times 24 \text{ (hours in day)} \times \text{capacity factor (see column 1)*}$$

For example - one large 2.5MW (135m in height) wind turbine typically generates 3,942 MWh of electricity per year. This is equivalent to the typical annual generation capacity (see column 3 in **Table 6.1**) of:

- Approx 490 small 6kW wind turbines (15m in height)
- Four small scale hydro plants
- 4,900 domestic sized solar PV installations.

A visualisation of this is provided overleaf.

Comparison of renewable energy technologies



One commercial turbine
(2.5 megawatt)

=



490 small turbines
(6 kilowatt)



OR 4 hydropower plants
(200 kilowatt)



OR 4,900 domestic PV
(10 kilowatt)

PLANNING POLICY APPROACHES

6.10 The following section sets out guidance on the types of planning policy approaches that could be used by local authorities to facilitate renewable and low carbon energy development. There are essentially four broad categories of energy policy that can be included within a development plan¹⁴, as follows:

- **General policies** setting out the criteria for the assessment of renewable energy applications and the integration of renewable and low carbon energy targets.
- Policies identifying **suitable locations for standalone and low carbon energy developments**.
- Policies relating to the **integration of suitable energy within built developments**.
- Policies providing support for **community wide infrastructure**.

6.11 Further guidance on local policy approaches to renewable and low carbon energy is available from the 'Planning for Climate Change Guidance and Model Policies for Local Authorities' (TCPA for the Planning and Climate Change Coalition, November 2010).

¹⁴ or equivalent local plan documents that result from new planning legislation

General Policies

- 6.12 Criteria based policies seek to ensure that the environmental, social and economic impacts and benefits of renewable energy schemes are appropriately considered.
- 6.13 **Policy Context:** PPS 22 states that local planning policy should promote and encourage rather than restrict the development of the full range of renewable energy resources, subject to appropriate environmental safeguards. The criteria that will be applied in assessing applications for renewable energy projects should be set out and constraints on renewable energy development must not be included without reasoned justification. The wider environmental and economic benefits of renewable energy proposals, whatever their scale, are material considerations. Local planning authorities should not make assumptions about the technical and commercial feasibility of renewable energy projects as technological change may increase the range of locations where development is feasible. The potential cumulative contribution of small scale proposals to renewable energy targets should be recognised. Development proposals should demonstrate their environmental, economic and social benefits as well as how any environmental and social impacts have been mitigated through careful consideration of location, scale, design and other measures.
- 6.14 The Climate Change Supplement to PPS1 reiterates some of the messages of PPS22 and adds that local planning policies should not require applicants to demonstrate the overall need for renewable energy.

6.15 It should be noted that the planning policy framework for nationally designated areas comprising National Parks and Areas of Outstanding Natural Beauty (AONB) differs from other areas since policies must take into account statutory purposes. National, regional and local policies for low carbon development and the DECC methodology used in this study reflect this distinctive legislative approach. PPS7 sets out how these areas ‘ have been confirmed by the Government as having the highest status of protection in relation to landscape and scenic beauty’ (PPS7 para 21). The approach to development is further explained in the *English National Parks and the Broads UK Government Vision and Circular 2010*. Given that the policy focus for National Parks under the 1949 Act (as amended) is on landscape and natural beauty, National Park wide targets are not considered appropriate but, as with housing, it may be suitable to use estimates rather than targets.

6.16 **Potential Policy Approach:** Criteria based policies could be used to set out the key criteria that will be applied in assessing applications for renewable energy projects. General policies could also include renewable and low carbon energy deployment targets.

6.17 **Requirements:** Creating greater policy certainty for potential renewable energy developers is essential to realising the renewable and low carbon potential of the East Midlands. It is therefore essential that the development plan sets out clear guidance on the circumstances in which renewable energy proposals will be permitted. After expressing positive support in principle for renewable and low carbon energy development, development plan policy

could list the specific issues that will be taken into account in considering specific applications. It is important that policy does not purely repeat national policy but is relevant to the process of decision-making at the local level and focuses on locally distinctive criteria relating to environmental, social and economic impacts and benefits. This may relate to issues such as: impacts on landscape and townscape, visual intrusion, ecology, noise, odour, dust, traffic generation, historical, cultural features and areas, designated areas/ sites and cumulative impacts. Local planning authorities should not refuse planning permission for a renewable energy project because a local renewable energy target, if set by the local plan, has already been reached but where targets have not been reached, this should carry significant weight in favour of proposals.

6.18 It is important that the criteria:

- Reflect the characteristics of the different technologies that will be promoted or are likely to come forward for development within the local authority area.
- Reflect the social, economic and environmental issues that need to be considered at the local level. The impacts will differ with the technology, the scale of the proposal and the sensitivity of the local area.
- Are appropriate and will withstand the ‘tests of soundness’.
- Do provide appropriate safeguards but do not preclude the development of specific technologies
- Are relevant across the whole local authority area, or identify where variations are appropriate (e.g.

within designated areas or the specific requirements of urban vs. rural areas).

- Support opportunities for community-led renewable and low carbon developments.

6.19 It may be appropriate for more detailed issues to be left for Supplementary Planning Guidance (SPG).

6.20 Authority-wide renewable targets can also be included in local development plans and could be expressed as an overall total within a set time period, or in terms of the percentage of energy/heat demand met from these sources. Specific targets for each technology may be too prescriptive as the economic and commercial viability of different forms of renewable energy change over time. However, it is helpful to have the supporting evidence base which sets out the anticipated contribution of different technologies towards meeting the overall target, in order to identify which technologies are likely to make the most significant contributions within the context of local constraints and opportunities.

6.21 It is also important that any targets which are included are expressed as minimum targets so that once it has been reached, further renewable energy development is not precluded. Low and high scenarios may also be used to build flexibility into area wide targets. Monitoring of the targets will be essential in providing an important feedback loop on the effectiveness of the LDP and other mechanisms in facilitating the delivery of renewable and low carbon energy developments.

6.22 **Examples: Examples:** Waveney District Council Development Management Policy DM03 (Low Carbon and Renewable Energy) in Development Management Policies Proposed Submission (Final Draft) - this policy sets out targets for renewable energy production in Waveney District and lists criteria determining where renewable energy schemes will be permitted, e.g. where there are no significant adverse impacts on the amenities of nearby residents by way of noise, dust, odour or increases in traffic. It stipulates that small-scale developments will be permitted only where they are sympathetically designed and located, include any necessary mitigation measures and meet the other criteria set out. When the technology is no longer operational there is a requirement to decommission, remove the facility and complete a restoration of the site to its original condition.

6.23 Lincolnshire County Council have also recently approved a Wind Farm Policy which sets out the key criteria that should be considered by local planning authorities in considering applications for wind energy developments.

6.24 GLA Consolidated London Plan 2008 Policy 4A.3: Sustainable Design and Construction - this policy lists numerous measures that will be employed in order to ensure that developments meet high standards of sustainable design and construction, for example minimising energy use, reusing existing land and buildings and using renewable energy where feasible. All development applications must include a statement about the potential implications of the development on sustainable design and construction principles.

Location-specific Policies

- 6.25 There two main types of policy relating to stand-alone renewable and low carbon energy developments that may be appropriate for inclusion in an development plan
- Site allocations policies for stand-alone renewable and low carbon energy.
 - Broad locational policies for stand-alone renewable and low carbon energy.

Site Allocations Policy for Stand-alone Renewable and Low Carbon Energy

- 6.26 **Policy Context:** Locational considerations for renewable energy development are set out in PPS22 and comprise:
- Potential for an adverse effect on internationally designated sites.
 - Potential for an adverse effect on nationally designated sites.
 - Potential to constitute inappropriate development in the green belt due to impacts on its openness.
 - The need to avoid creating buffer zones around internationally or nationally designated sites whilst considering potential impact of development just outside designated site boundaries to the designations themselves.
 - The need to assess applications for development in local landscape or nature conservation areas against criteria based policies in the development plan (see above), which may include criteria specific to the type of area concerned.

- Other locational considerations such as recognition that renewable energy can only be developed where the resource exists and where economically feasible.

- 6.27 The Planning and Climate Change Supplement to PPSI states that in deciding which areas and sites are suitable for development in general, as well as the suitable type and intensity of any development, local authorities should take into account the extent to which existing or planned opportunities for decentralised and renewable or low carbon energy could contribute to the energy supply of the development.
- 6.28 **Potential Policy Approach:** Development Plans could allocate sites for the development of standalone renewable and low carbon energy schemes.
- 6.29 **Requirements:** In some local authority areas criteria-based policies may be sufficient for identifying suitable locations for standalone renewable and low carbon energy. However, where local authorities want to give more strategic direction to the siting of renewables or the results of a renewable energy assessment identify potential, allocating sites specifically for standalone renewables may be beneficial. Local authorities may wish to allocate sites which have the greatest potential for sustainable energy and carbon reduction or sites that could potentially be developed for other purposes (e.g. resulting in the sterilisation of good wind power sites). In addition, if sites exist that have potential for standalone renewable or low carbon energy use but are constrained in a way that would make them less attractive to commercial developers, then

allocating the site is a way of promoting that site for renewable/low carbon development to a wider audience such as land owners or co-operatives.

- 6.30 It is advisable that site allocation policies for standalone renewable and low carbon energy schemes refer to as broad a range of technologies as feasible to help ensure that local policy is applicable to the widest range of development proposals that may come forward. Identification of sites for specific uses should be founded on a robust and credible assessment of the suitability and availability of land for particular uses or a mix of uses and the probability that it will be developed.
- 6.31 **Example:** Policy EP19 of the City of Norwich's Replacement Local Plan provides an example of a Development Plan that has identified a site for energy development. It identifies the site of a former power station at Cremorne Lane as potentially suitable for a biomass power plant, utilising agricultural or forestry resources from the Yare valley and transporting them by water to the site.
- 6.32 The Policy notes that a planning application for a development of this type on the site will require an environmental impact assessment. This will consider the:
- Viability of transporting the raw materials to the plant by rail or river.
 - Visual effects of the proposed development on the Broads National Park and the Thorpe Ridge and Thorpe St. Andrew Conservation Areas.
 - Effects the development would have on air quality.

Broad Locational Policy for Stand-alone Renewable and Low Carbon Energy

- 6.33 **Policy Context:** The Planning and Climate Change Supplement to PPS1 states that alongside any criteria-based policy, local planning authorities should consider identifying suitable areas for renewable and low carbon sources, and supporting infrastructure, where this would help secure their development but should not reject proposals solely because they are outside such areas. See also policy context under 'Site Allocations Policy for Stand-alone Renewable and Low Carbon Energy'.
- 6.34 **Potential Policy Approach:** Development plan policy could identify broad locations/ areas where the development of particular types of renewable and low carbon energy may be considered more appropriate.
- 6.35 **Requirements:** The identification of broad locations for specific types of renewable energy can be a useful means of proactively guiding developments to the most appropriate locations and away from the most sensitive areas. It can also provide a greater degree of certainty in the planning process for developers by directing them to areas where there is greater likelihood of securing planning consent. In order to identify broad areas/ locations, it is essential that a robust evidence base is prepared, mapping out the potential opportunities and constraints associated with different forms of renewables within the area. It will not be necessary to identify broad locations for all types of renewable energy as many technologies such as solar, heat pumps, farm-scale AD, and small-scale biomass can be

located in nearly all areas and the appropriateness of these technologies can only be realistically assessed on a site by site basis.

- 6.36 It is important to frame locational policies such that they do not preclude projects in other (unconstrained but currently considered suboptimal) areas – for example if better wind-speed data becomes available or if the factors determining optimal sites for wind turbines change.
- 6.37 One tool which is being used by a number of local authorities in England to guide the location of large and medium-scale wind energy development is **landscape sensitivity assessment**. As landscape impacts are one of the key constraining factors for wind energy developments, a landscape sensitivity assessment can help to identify those areas where landscapes are more or less sensitive to wind energy development. It can also help to provide guidance on the design of wind farm developments within the different types of landscape. An example of the landscape sensitivity mapping undertaken as part of the Peak Sub-Regional Climate Change Study is provided in **Appendix 3.1**. It should not, however, be interpreted as a definitive statement on the suitability of a particular site for wind turbine development as that is a matter for the detailed planning application. Landscape sensitivity assessments can be adopted as Supplementary Planning Documents (SPDs).
- 6.38 **Example:** Huntingdonshire District Council adopted a Supplementary Planning Document (SPD) on Wind Power in 2006. The SPD assists with the interpretation and application of policies concerned with landscape character

and the location of renewable energy schemes. It is based on an assessment of the landscape sensitivity to wind turbines or biomass planting.

- 6.39 The following box provides a summary of existing landscape sensitivity/ character studies/ tools within the East Midlands.

Landscape Sensitivity/ Character Assessments within the East Midlands

In the East Midlands, a number of local authorities have undertaken landscape sensitivity assessments. The Peak Sub-Region Climate Change Study for example includes an assessment of the sensitivity of the landscape to wind and biomass crops (see **Appendix 3.1**).

County wide environmental sensitivity mapping studies, that have been carried out to a common methodology include:

- Derbyshire County Council's Areas of Multiple Environmental Sensitivity (AMES)
- Nottinghamshire County Council Areas of Multiple Environmental Sensitivity (AMES), out to consultation (2011)

Sources of information that should be considered to develop local level landscape capacity and sensitivity studies to inform the siting of renewable energy proposals include:

- Landscape character assessments and strategies carried out by county or district councils.

- Landscape characterisation studies and strategies for the Peak District and the Lincolnshire Wolds.
- The East Midlands Landscape Character Assessment. The aim of the East Midlands Landscape Character Assessment (EMLCA) is to increase understanding of the area's varied landscape, including its seascapes, by identifying distinctive, rare or special characteristics. EMLCA presents objective, non-technical descriptions of each of the 31 East Midlands landscape character types. At a strategic level it describes the major forces for change that the East Midlands landscapes are experiencing and where these are being experienced. It may be particularly useful for cross-border issues between counties, or where finer-grained character assessment has not been carried out or been carried out less recently. Associated with this, Woodland Opportunity Mapping was also carried out, and can be used to identify Regional Landscape Character Types (RLCTs) where woodland creation and biomass planting would be in keeping with landscape character.. These reports and maps can be found at: http://www.naturalengland.org.uk/regions/east_midlands/ourwork/characterassessment.aspx
- National Character Area profiles These identify at a broader scale to the regional work, distinctive or special characteristics of landscapes across England, and may be particularly useful for dealing with cross

regional geographical areas e.g. when considering the larger landscape scale. The profiles are in the process of being reviewed and updated to include Statements of Environmental Opportunity for each NCA. The work is expected to be completed across England during 2011.

- 6.40 The following box provides guidance on the consideration of the historic environment in relation to location-specific policies.

Location-specific policies and the Historic Environment

Policy HE1 of PPS 5 Planning for the Historic Environment, 2010, sets out the broad principles to be considered with regard to measures to mitigate or adapt to the effects of climate change, which would include renewable energy schemes. Historic environment considerations should be addressed in criteria-based policies; however, in cases where local authorities decide to opt for location-specific policies, whether specific site allocations or broad locations, in order to try and assess the deployable potential for standalone renewable and low carbon schemes, as opposed to the technical potential outlined in Chapter 4, the following matters should be considered as part of the evidence base in order to make an assessment of the sensitivity of the heritage assets in the area to change:

- an understanding of the number and significance of the heritage assets in the area, whether designated or not, and how they might be affected by development at a specific site or wider area, either directly or indirectly;
- consideration of setting issues, in accordance with PPS 5 policies HE 9 and HE 10, including proximity, the effect of topography, noise, movement and light, the identification of important views to and from key designated heritage assets, particularly registered parks and gardens, country houses and churches, and intervisibility between heritage assets, e.g. prehistoric archaeological sites;
- the historic character of the landscape using Historic Landscape Characterisations, and the identification of particular historic landscape survivals, such as ridge and furrow;
- potential cumulative impacts with respect to any existing or consented renewable energy sites and in relation to impacts on the landscape, biodiversity and the historic environment;
- potential construction constraints such as routes through villages with HGV bans.

The level of detail of the assessment will depend on whether specific locations are being considered or broad locations. In the case of the latter, it should be made clear that individual proposals will need to be assessed on a case-by-case basis.

English Heritage has produced a range of guidance on renewable energy and is preparing guidance on 'setting' and will also be updating its guidance on Wind Energy and the

Historic Environment

<http://www.helm.org.uk/server/show/nav.19691>. There is also guidance in the PPS 5 Practice Guide.

Policies on Integration within Built Development

6.41 There are two main types of policy options relating to development/ building integrated renewable and low carbon energy developments that may be appropriate for inclusion with a development plan:

- Setting of sustainable building standards (that exceed the national requirement) or minimum carbon reduction targets for strategic new development sites.
- Setting of area-wide sustainable building standards (that exceed the national requirement) or minimum carbon reduction targets for new development.

Setting of sustainable building standards (that exceed the national requirement) or carbon reduction targets for strategic new development sites

6.42 **Policy Context:** The previous Government stated an intention that all new homes would be zero carbon by 2016 and all non-domestic buildings by 2019, and the new Government has confirmed that national regulatory requirements (Building Regulations) will be progressively tightened to meet these requirements. The Act is complemented by the policies contained in PPSs and provides a legal basis for the implementation of

development plan policies against the national framework. The Climate Change Supplement to PPS1 states that local planning authorities should encourage the delivery of sustainable buildings and help to achieve the national timetable for reducing carbon emissions from buildings. It goes on to add that it could be appropriate for local authorities to accelerate the national timetable where they can demonstrate clearly the local circumstances that warrant and allow this. Local requirements should focus on development area or site-specific opportunities and specify the requirement in terms of nationally described sustainable buildings standards (CSH or BREEAM).

- 6.43 It also states that based on local evidence of feasibility and potential, local planning authorities should set a target percentage of the energy used by new development to come from decentralised and renewable or low carbon sources, where viable. The target should avoid prescription on technologies and be flexible in how carbon savings from local energy supplies are to be secured.
- 6.44 The Planning & Energy Act 2008 enables local planning authorities to set reasonable requirements in the development plan for the generation of energy from local renewable sources and low carbon energy and for energy efficiency. This can be translated into carbon reduction targets.
- 6.45 **Potential Policy Approach:** Development plan policy could (where appropriate) identify strategic sites which will be required to meet a Code for Sustainable Homes or BREEAM rating that goes beyond that expected by national

policy. Alternatively, development plan policy could set carbon reduction targets (in excess of the current Sustainable Building Standards) for strategic development sites.

- 6.46 **Requirements:** In preparing their development plans, local planning authorities do not need to duplicate policy contained in PPS but as set out in national policy may identify sites where there is the potential to deliver sustainable buildings that exceed the national requirement. Certain sites by virtue of their scale, mix of development or proximity to renewable resources, will be in a better position to maximise the use of renewables and low carbon energy than others. Identifying specific sites may therefore be more effective in delivering renewable and low carbon energy proposals than more generic area wide targets.
- 6.47 It will be important that specific site allocations policies can be justified on the basis of sound evidence and compliance with national policy. Additional costs are associated with delivering developments with higher carbon reductions. The evidence base will therefore need to show that there is sufficient demand for development within the area and that the low carbon policies do not render development unviable. If development pressure is low, this may result in undue burdens on developers with development proposals not taking place or moving to surrounding areas with less stringent policies. Policy should also not act as a barrier to the delivery of affordable housing.
- 6.48 **Examples:** The London Borough of Barnet's Area Action Plan (AAP) for Mill Hill East is an example of where a

specific site has been identified as suitable for higher design standards for non-domestic buildings, specifying BREEAM 'Excellent' for all commercial and community buildings. When using CSH or BREEAM to achieve energy objectives, it is important to stipulate specific scores in the energy domains of these accreditation systems – e.g. “BREEAM Excellent overall, including Excellent on energy.”

Setting of area-wide sustainable building standards (that exceed the national requirement) or specific carbon reduction targets for new development.

- 6.49 **Policy Context:** See policy context for the 'setting of strategic site targets for development/building integrated renewable and low carbon energy'.
- 6.50 **Potential Policy Approach:** Development plan policy could (where appropriate) require certain types of development within the local authority area as a whole, or broad areas within it, to achieve sustainable building standards at a higher level than required by national policy or set area-wide carbon reduction targets.
- 6.51 **Requirements:** As well as assessing strategic sites for the potential for higher sustainable building standards, it is also possible for LPAs to identify broad areas to achieve sustainable building standards or carbon reduction targets at a higher level than that required by national policy if the appropriate evidence base justifying the policy approach is provided. Broad areas may be highlighted because of their proximity to a renewable resource or to influence development in a regeneration or 'flagship' area. Alternatively, development plan policy could require certain

types of development e.g. above a certain size threshold across the whole local authority area to adopt carbon reduction targets in excess of Building Regulations. This policy has similar advantages/disadvantages and requirements to those set out in the section above on strategic sites. It has the advantage, however, that it could influence a greater number of developments, although the requirements may need to be weaker as they will need to be feasible and clearly justified for all potential developments within the area.

- 6.52 In due course, with the changes to Building regulations and the move to zero-carbon buildings, area-wide targets of this nature may become redundant. However local authorities may want to set site or development specific targets where justified by local circumstances.
- 6.53 **Example:** The London Energy Partnership has been tasked with setting up and delivering the Mayor's 'Energy Action Areas' to act as an exemplar of low carbon developments in London. Four pilot areas have been selected in Merton, Barking, New Wembley and Southwark. Within these areas, it is proposed that higher energy standards will be required for new build and retrofit and they will showcase best practice for integrating sustainable energy.
- 6.54 A number of local authorities in England including Milton Keynes and Ashford Borough Council require a 'carbon neutral' standard to be met across all new development above a certain size in their area. For example in the Milton Keynes Adopted Replacement Local Plan, planning policy (D4) requires all new developments exceeding five domestic

dwellings or those that incorporate over 1,000 square metres of floor space to be carbon neutral. The zero carbon standard should be met on-site where possible. However, where this is not feasible developers are required to pay contributions in to a local carbon offset fund.

Policies on Community Wide Infrastructure

6.55 The information from heat mapping can support both the formal planning process for new developments and the process of planning for decentralised energy systems themselves, through:

- the development of appropriate and consistently evidenced policy to encourage district heating in local policies and targets;
- improving the quality of decision making on district heating in the development control process through provision of consistent and locally-specific information to development control officers, building developers, and the decentralised energy industry;
- the provision of information for the identification of heat distribution opportunities outside of the planning system, for example through local energy masterplanning;
- supporting the commercial analysis of opportunities for creating/expanding heat distribution systems

6.56 **Policy Context:** The PPSI Supplement on Climate Change states that local authorities should “where there are particular and demonstrable opportunities for greater use of decentralised and renewable or low carbon energy than the

target percentage, bring forward development area or site-specific targets to secure this potential” (P.26 para iii). This can include specifying priority areas for district heating.

6.57 **Potential Policy Approach:** The provision of community-wide infrastructure for heat distribution needs to be considered as early as possible in the strategic planning process as it will underpin a range of related sustainable energy policies on district-wide and site-specific targets. Any such strategic planning will need to be supported by a robust set of spatial heat demand data, such as heat maps, which will provide valuable spatial intelligence in support of policy objectives.

6.58 Policy development on promoting energy infrastructure can then draw on this strategic view of opportunities to inform local policy objectives and targets, while encouraging developers to maximise opportunities for low carbon developments.

6.59 A gradual approach to the development of district heating systems so that they become extensive over time can be beneficial. Policies can be district-wide or site-specific and, where appropriate, could require developments to:

- contribute in some way towards the delivery of a district heating network
- incorporate infrastructure for district heating
- connect to existing district heating networks where available
- design onsite heating systems to be able to connect to future district heating networks

- 6.60 Policies could consider an order of preference for heating systems in new larger scale developments, particularly in relation to strategic sites, which embodies the principles of maximising the opportunities for efficient community-scale heat distribution and minimising site emissions from heat consumption. The current London Plan adopts a hierarchy of this type – see the ‘Examples’ section below.
- 6.61 **Requirements:** The strategic long term view needed for energy infrastructure policy development is beneficial not just for policy makers, but also for other stakeholders – particularly developers. For example, the zero carbon requirement for residential development through Building Regulations from 2016 is highly likely, through necessity, to draw on community scale energy infrastructure solutions such as biomass CHP with district heating once the cost-effectiveness of options are considered. This has implications for the phasing of development areas in that it may not currently be known which elements will come under the 2016 zero carbon remit and so may be obliged to adopt community-scale solutions regardless of any local targets. In other words, even if the initial phases of the development fall under earlier, less demanding targets, the later phases from 2016 are highly likely to require community-scale solutions and it is therefore prudent to plan for this at the earliest opportunity.
- 6.62 Phasing can also cause complications for community-scale solutions. For example, where a development is built out in phases, the design of a CHP district heating system is likely to require a certain amount of modularity to sequentially accommodate each phase. Projects may start off as heat-only systems until the network covers an area which provides a large enough load to accommodate CHP. CHP plant sized for the whole development would also need to account for fewer heat sales during the initial phases, when only a proportion of end-users would be active.
- 6.63 Local authorities will need to effectively communicate policy requirements and the tools for assessment (such as heat maps) to other parties, such as development control officers. This will inform their negotiations with developers – so that they know when and where to insist on connection to or provision of district heating infrastructure, and when to focus on other carbon reduction opportunities.
- 6.64 Effective policies on large scale heat distribution have a key role to play in reducing emissions not only from new development, but also from existing buildings that wouldn’t otherwise benefit. Such policies applied to new development can facilitate both the creation and extension of heat distribution networks – either through the installation of a new site-wide heat network supplied from on-site heating plant, or by connecting as extensions to existing networks, thereby improving their economics and spatial coverage. Opportunities can therefore arise to supply existing development as part of refurbishment schemes.
- 6.65 Heat distribution networks resulting from such policies are also ‘future proofed’ to the extent that they have much longer lifetimes than the boiler plants that supply them – hence, over time a heat distribution network could facilitate

a move from gas heating plant, to combined heat and power with biomass or fuel cells, etc.

6.66 **Examples:** The Consultation Draft Replacement London Plan (Chapter 5) includes Policy 5.6, which concerns decentralised energy in development proposals. Part of this states that major development proposals should select energy systems in accordance with the following hierarchy:

1. Connection to existing heating or cooling networks
2. Site wide CHP network
3. Communal heating and cooling

In the same document, Policy 5.5 addresses decentralised energy networks by setting an overall target for the use of localised decentralised energy systems and requiring boroughs to identify opportunities for expanding existing networks and establishing new networks with the help of the London Heat Map Tool.

6.67 Plymouth City Council has also adopted a community-scale approach on energy infrastructure for its City Centre. Policy CC05 of the City Centre and University Area Action Plan concerns the delivery of an integrated Combined Heat and Power and District Heating and Cooling network. Where a network is not yet established, proposals for larger scale developments will be encouraged to:

- contribute towards the establishment of a network
- include heating and cooling systems that allow future connection to a network

6.68 Where a network is established, proposals for larger scale developments will be encouraged to:

- connect to the network
- make an offsite contribution towards local completion of the network.

6.69 Bristol Development Framework Core Strategy with Potential Minor and Significant Changes (Dec 2010) takes a similar approach with Policy BCS14, which proposes the use of an energy hierarchy and the use of Heat Priority Areas to encourage district heating networks.

MONITORING

6.70 Local planning authorities should monitor the success of their development plans and other mechanisms/ initiatives in delivering renewable energy developments within their local authority area. Such monitoring could include tracking the number of renewable and low carbon energy proposals which have been approved/ refused planning permission. The Department of Energy and Climate Change's RESTATS and Renewable Energy Planning Database (REPD) databases provide useful sources of information on renewable energy applications. Further information on these databases is set out in **Box 6.1**.

BOX 6.1: DECC Renewable Energy Planning Monitoring and Review Programme

Data on national energy use and supply, including renewable and low carbon energy, is gathered by the **Renewable Energy Statistics Database (RESTATS)** monitoring programme [www.restats.org.uk]. The data is gathered from four principal sources:

- 1) a review of existing databases
- 2) an annual survey of renewable energy developers
- 3) estimates of the uptake of small-scale renewable energy technologies
- 4) gap analysis technology surveys – to verify the accuracy of the data.

The results of the database are published annually in the Digest of UK Energy Statistics (DUKES) [<http://www.decc.gov.uk/en/content/cms/statistics/publications/dukes/dukes.aspx>].

Renewable Energy Planning Database (REPD)

In conjunction with the RESTATS database, DECC also monitors the progress of renewable energy projects through the planning system through the **Renewable Energy Planning Database Project**. This monitoring programme is run by AEA Technology on behalf of DECC and collects information from local planning authorities and renewable energy developers in the UK on the status of all renewable energy projects at each stage of the planning process - from intended applications through to construction and commissioning. Details on key planning and environmental issues are also recorded.

The data is made publicly available in the form of excel spreadsheets via the RESTATS web site and are updated on a monthly basis. [www.restats.decc.gov.uk/cms/planning-database]. The data can be easily disaggregated to a local level.

The key findings are also summarised in four quarterly reports covering England, Scotland, Wales and Northern Ireland. These reports provide details on the progress of renewable energy projects according to funding source, technology type and location.

7 Next Steps

- 7.1 This report sets out the current position of renewables and low carbon energy within the East Midlands, presenting a comprehensive review of the ‘technical potential’ up until 2020 and 2030. Understanding the potential supply of renewables in a local area is an important starting point in considering the opportunities to move to low carbon communities. Identifying and mapping the resource available in an area enables local planning authorities to plan strategically for the development of renewables.
- 7.2 The detailed heat mapping work also provides an essential evidence base on local heat demand and supply – enabling the identification of strategic opportunities for matching up heat suppliers and consumers. This can enable planners and developers to identify future opportunities for district heating and/or the use of waste heat.
- 7.3 The original intention by DECC was that the work would input to a complete review of potential across all of the English regions and assist in the development of renewable energy targets for regional spatial strategies. Despite the expected abolition of Regional Strategies, there remains an important imperative for effective strategic planning with local authorities having a critical role to play in encouraging the uptake of renewables.
- 7.4 To take forward the findings of this study it is suggested that East Midlands Councils and the members of the Steering

Group should disseminate the findings of the study and evidence base to all local authorities in the region to assist with their strategic planning of renewables and low carbon energy developments.

Renewable energy assessment – Next Steps

- 7.5 In relation to the renewable energy assessment, Local authorities should then consider undertaking the following key tasks:
- 1) **Review the data sources and assumptions** contained in this report to ascertain if any amendments/refinements need to be made to better reflect local circumstances or to incorporate local data sources.
 - 2) **Refine the assessment of technical renewable energy potential** to calculate the level of deployable potential within their local authority, or update existing studies where appropriate in light of the findings in this report.
 - 3) **Develop and test any scenarios with stakeholders** to enable a preferred scenario to be identified. This may well be a combination of, or modified version of the original scenarios. This approach will enable stakeholders to discuss the scenarios and understand the key assumptions and parameters that will affect the level of deployment for each technology. This in turn should improve the robustness of assumptions.

- 4) **Refine and select preferred scenario** setting a clear target/ ambition for the delivery of renewables within the local authority area.
- 5) **Ensure proposed ambition is reflected in supportive planning policy and is incorporated within the Development Plan or equivalent.** The policy should then be tested with wider stakeholders as part of the standard development plan consultation and approval process.

Heat Mapping – Next Steps

- 7.6 The heat mapping process has identified priority areas at a regional level. Local authorities that contain one of the main priority areas should look carefully at the opportunities identified within these areas, but all local authorities in the region may find smaller-scale opportunities by examining the heat maps for their localities. Those local authorities who were not able to provide data on potential future housing and commercial property development should overlay the information they have about future development onto the heat maps as it becomes available, as this may identify additional opportunities.
- 7.7 All of the major priority areas contain high existing heat demand, anchor loads, and potential future demand for heat from new development; these can all be important factors in creating opportunities for district heating. The factor that is most influential varies between the areas.

- 7.8 The role for a local authority varies depending on the nature of the opportunity for district heating, although there is always a role for the authority to facilitate consultation with the local community on district heating proposals. Where the opportunity is based around new development which of itself may have a sufficient potential heat demand to make district heating feasible, the local authority's role is around setting policies which encourage developers to set up district heating networks. Depending on the phasing of development, these could start off being small-scale networks, with the potential to be joined up at a later date to form one larger network. For larger development areas with masterplans, more detailed feasibility work for district heating could be incorporated at the masterplanning stage. See **Chapter 6** for example area-specific district heating policies.
- 7.9 Where the opportunity is based around a public sector anchor load (a publically-owned building with a high, relatively steady heat demand), the local authority can take the role of project developer, with support from engineering consultants or an energy service company. It could alternatively take the role of customer and contract an energy services company to drive the development of the project. The stages of district heating project development are described in *Community Energy: Planning, Development and Delivery*, a guide produced by a range of organisations

including the Combined Heat and Power Association¹⁵. This is summarised below.

- 7.10 The first step is to **gather data**. Some of this data is provided by the heat map, but more detail will also be needed. The heat map is based around modelled heat demand data, with some actual demand data (from energy bills) integrated for some public sector buildings. The heat map can help to identify the buildings which are the most likely candidates to first be connected to a district heating system, but further actual demand data will need to be gathered from the buildings to double-check this, and also to provide information about the load profiles of the candidate buildings. The load and its profile must be known for the system to be sized correctly, and for the system to run efficiently- a steady demand load is preferable. It helps to include a variety of building types with different load profiles, to even out the overall load profile.
- 7.11 The next stage is **project definition**. The scale and extent of the project must be defined, and the partners who need to be involved must be identified and brought on board. Following this an **options appraisal** should be carried out to identify the most suitable technology. Next, a **detailed feasibility study** must be undertaken to consider issues such as the layout of the network, heat loss from the

network, the local topography, and the location of the plant room. **Financial and business modelling** are the final stages. Financial modelling is required to test whether the project as defined by the technical feasibility study will also be financially feasible. Business modelling involves defining the legal structure of the project; this would normally be some kind of Energy Services Company (ESCo). An ESCo can be defined as 'a business providing a broad range of energy and carbon-management solutions, including the design and implementation of energy-saving projects, energy conservation, power generation and energy supply.'¹⁶

- 7.12 *Community Energy: Planning, Development and Delivery* details the strengths and weaknesses of different ESCo arrangements and the following is summarised from this document. **Private ESCos** are profit-driven and tend to run larger projects. On the positive side, in this approach the private company brings the investment capital and expertise and takes on the risk of the project failing. However, a private company requires higher rates of return and therefore will need to charge more per unit of energy; customers are also tied to a monopoly supplier.

¹⁵ *Community Energy: Planning, Development and Delivery*, Michael King and Rob Shaw, 2010. Available from www.chpa.co.uk/media/28c4e605/Comm_Energy_PlanDevDel.pdf

¹⁶ *Community Energy: Planning, Development and Delivery* [referenced above], p. 28

- 7.13 Local authorities can set up their own trading companies to form **public ESCos**. The strengths of this approach are that by retaining control the local authority can keep the activities of the ESCo aligned with its original environmental and social objectives, and the ESCo can borrow at lower cost because it belongs to the local authority. However, the local authority bears the financial risk of the project failing.
- 7.14 **Public / private hybrid ESCos** are also a possibility. These are joint ventures where ownership is shared between the local authority and a private company. This allows the local authority to maintain influence over the social and environmental aims of the project, with the project risk being shared between the public and private sector.
- 7.15 In developing a plan or ambition for the development of renewable and/ or low carbon energy within an area, it is critical that careful consideration is also given to how it is going to be realised. Setting out a clear action plan and/or strategy for the delivery of renewable and low carbon energy, in conjunction with other key partners is therefore essential to ensure that targets and ambitions are delivered on the ground.