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Hinckley and Bosworth Renewable Energy Capacity Study

Re-issued Final Report
Prepared by LUC in association with CSE
December 2014

Project Title: Hinckley and Bosworth Renewable Energy Capacity Study

Client: Hinckley and Bosworth Borough Council

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Abbreviations

AD – Anaerobic Digestion
ASHP – Air Source Heat Pump
BREEAM – Building Research Establishment Environmental Assessment Method
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
EA – Environment Agency
EMC – East Midlands Councils
EU – European Union
FIT – Feed In Tariff
GSHP – Ground Source Heat Pump
GW/h – Gigawatt-hours
IPC – Infrastructure Planning Commission
kW – kilowatt
LPA – Local Planning Authority
LUC – Land Use Consultants
MoD – Ministry of Defence
MW - Megawatt
MSW – Municipal and Solid Waste
NE – Natural England
NNR – National Nature Reserve
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
SHW – Solar Hot Water
SPA – Special Protection Area
SSSI – Site of Special Scientific Interest

A note on units of energy

This report expresses the results of the assessment both in terms of megawatts (MW) and gigawatt-hours (GWh). The key difference here is that the former refers to the generation capacity of the technology i.e. its maximum instantaneous output or 'nameplate' rating, whilst the latter refers to the generation yield of the technology i.e. the amount of energy it is likely to produce over a specified time period – normally a year. A domestic solar photovoltaic system, for example, might be rated at two kilowatts (its maximum output when light conditions are optimum), and over the course of a year it might typically generate 1,800 kilowatt-hours.

Depending on the scale of the energy plant, generation capacity is normally expressed in either watts (W), kilowatts (kW), megawatts (MW) or gigawatts (GW). A wind turbine capacity of two megawatts, for example, can also be expressed as 2,000 kilowatts (or 0.002 gigawatts). Similarly, generation yield is normally stated in watt-hours (Wh), kilowatt-hours (kWh), megawatt-hours (MWh) or gigawatt-hours (GWh).

To convert from generation capacity to generation yield, an assumption needs to be made on the levels of generation at which the technology will actually operate throughout the year, as it will not operate at its maximum generation capacity all the time. Industry-standard figures called 'capacity factors' are therefore used. This takes into account the characteristics of specific technologies and can be defined as: the actual energy yield produced over a period of time expressed as a proportion of the energy yield that would have been produced if the energy plant had operated at its full generation capacity continuously over the same period. Capacity factors vary considerably between technologies; for example, solar photovoltaics may typically have a capacity factor of 0.09 whereas a large scale wind turbine may have one of 0.25. The conversion from megawatts to gigawatt-hours in the tables below uses the following formula:

Gigawatt-hours = megawatts x Capacity Factor x no. hours in a year x 0.001

This effectively means that, in terms of energy yield, a one megawatt wind turbine is not directly comparable with a one megawatt solar photovoltaic farm i.e. the solar farm will typically produce less energy over the course of a year as it can be windy during day and night (but the sun only shines during the day). This is important to note when setting targets as the use of generation yields will provide a much better measure of renewable energy deployed than simply using generation capacities. Additionally, carbon emissions are calculated directly from generation yields rather than generation capacities.

EXECUTIVE SUMMARY

Background

1 LUC and the Centre for Sustainable Energy (CSE) were commissioned in October 2012 to prepare a Renewable Energy Capacity Study for Hinckley and Bosworth Borough Council. The study assesses the technical and deployable potential for renewable energy and low carbon energy (including CHP and District Heating) within the Borough up until 2020 and 2026[1].

2 The key study objectives were to:

1. Update the analysis of technical potential and assess the deployable potential for renewable and low carbon energy within the Borough.
2. Identify and map the key opportunity areas for renewable and low carbon developments including detailed heat mapping and anchor points.
3. Develop a Borough specific renewable energy generation target.
4. Provide guidance on the incorporation of findings into Site Allocations and Development Management Policies document and Earl Shilton and Barwell AAP.
5. Provide guidance on a framework to monitor the uptake of large and small scale renewable and low carbon developments within the Borough.

3 The need for this study arose from four key drivers, to:

- **contribute towards the Government targets to reduce carbon emissions and increase renewable energy generation.** The Government's target is to reduce the UK's carbon emissions by 80% (below 1990 levels) by 2050 and to ensure that 15% of our total energy consumption (including electricity, heat and transport) comes from renewable energy sources by 2020.
- **align the Borough's key policy documents and strategies with the requirements of the National Planning Policy Framework (NPPF)** which states that LPAs should have a positive strategy to promote energy from renewable and low carbon sources and should consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure the development of such.
- **enable the Borough to play a proactive role in the delivery of county wide strategies** such as the Carbon Reduction Strategy for Leicestershire; Leicestershire's Sustainable Community Strategy; and Leicestershire Together Climate Ready Plan.
- **ensure the Council has a sound evidence base to inform the preparation of their Development Management Plan Policies**.

4 The study focuses on renewable electricity and heat technologies, including both commercial scale renewables and microgeneration (on-site and building-integrated renewables) and district heating. The study does not cover energy efficiency issues or renewable transport fuels.

Existing Energy Profile

5 During 2010, 1,509 GWh of energy were consumed across the domestic, industrial/commercial, and the land use, land use change and forestry sectors in the Borough of Hinckley and Bosworth. Gas consumption in the domestic sector is likely to decrease slightly over the next decade due to

[1] The 2020 timescale is linked to the Government's target to deliver 15% of the UK's energy consumption from renewables by 2020, in line with the EU Directive. The 2026 timescale is related to timeframe of Hinckley and Bosworth's Local Plan (2006-2016).

energy efficiency initiatives (for example the Green Deal). Electricity consumption is however likely to increase and may reduce or reverse the effect of reductions in gas consumption on overall carbon emissions.

6 Existing renewable energy generation within the Borough is very low with a current installed capacity of just over 5.26MW. The main source of existing renewable energy generation in the Borough is the Bradgate Landfill Gas scheme which has an installed capacity of 2.64MW. Since the introduction of the Feed-In Tariff (FiT) in April 2010, there has been a significant increase in the number of domestic solar photovoltaic (PV) installations within the Borough. Up until February 2013, 644 solar PV installations have been commissioned. This equates to a total installed capacity of 2.6MW. There have also been three domestic wind energy turbines installed under the FIT with a total capacity of 24kW (0.024MW).

7 Existing renewable energy generation within the Borough equates to only 1% of existing energy consumption within the Borough and 2.8% of the existing installed renewable energy capacity in Leicestershire (excluding Leicester City) and Rutland.

8 In relation to known future developments, pre-planning consultations are underway in relation to a 1.5 MW biomass boiler proposed at John Cleveland College in Hinckley.

Assessment of Technical Potential for Renewables

9 An assessment was undertaken of the technical potential for renewables within Hinckley and Bosworth. The 'technical potential' is an estimate of the total amount of renewable energy that could be delivered in the area based on a number of assumptions regarding the amount of resource and space. The assessment of technical potential was informed by the East Midlands *Low Carbon Energy Opportunities and Heat Mapping Study* which LUC, SQW and CSE completed on behalf of the East Midlands Councils in 2011.

10 The East Midlands Study involved an assessment of technical potential for renewable energy within the region based on the use of a number of clearly defined data sources and parameters/ assumptions for each technology. These data sources and assumptions were reviewed and refined as part of this study to ensure that the assessment reflected the local characteristics of Hinckley and Bosworth. A summary of the detailed assumptions used to inform the assessment is provided the Chapter 3 of the main report and the accompanying appendices.

11 The assessment results found that the technical potential for renewable and low carbon energy within the Borough is substantial. **Figure 1** and **Figure 2** summarise the results of the analysis for electricity and heat generation. The technologies with the greatest technical resource for electricity generation are wind, solar PV (particularly solar arrays) and heat pumps. For heat, solar thermal, energy crops and waste present the greatest opportunities within the Borough.

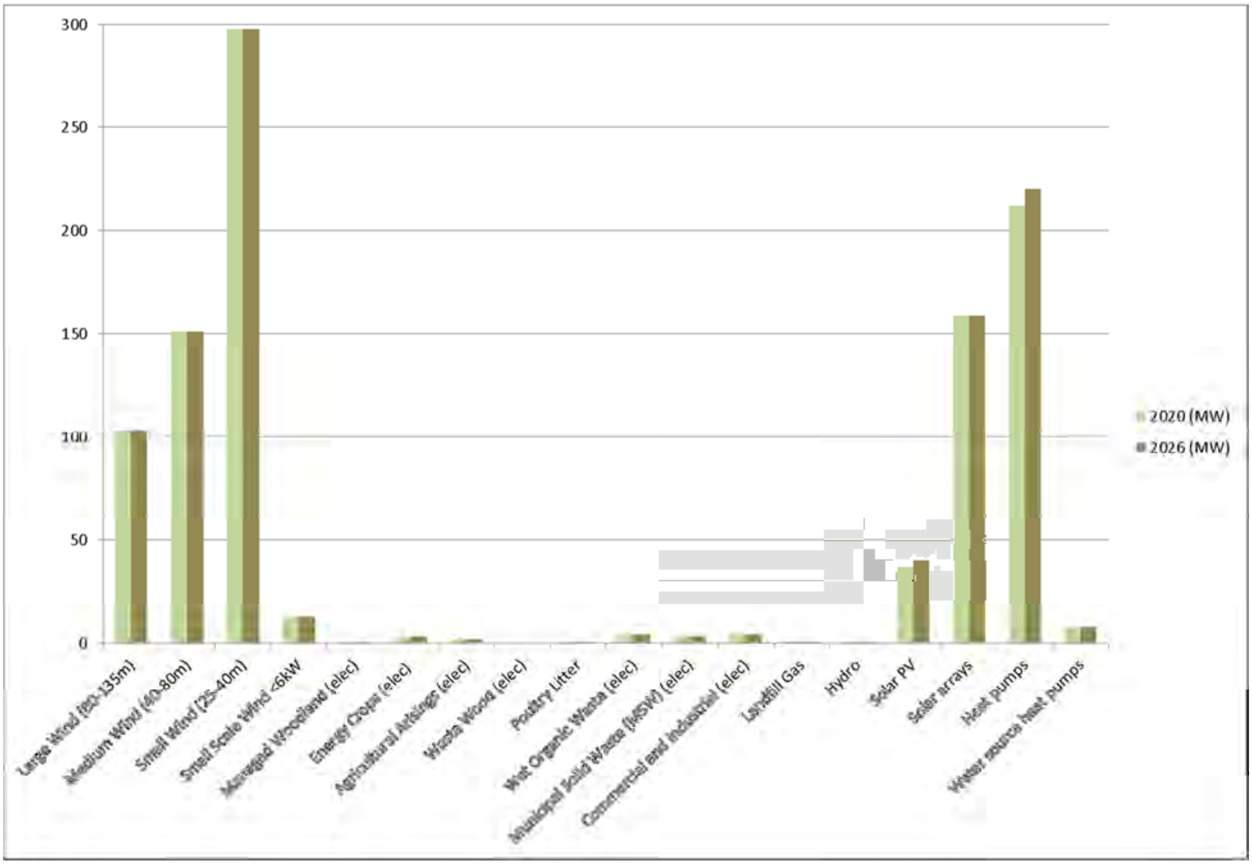


Figure 1: Technical Renewable Energy Resource Potential within Hinckley and Bosworth (electricity)

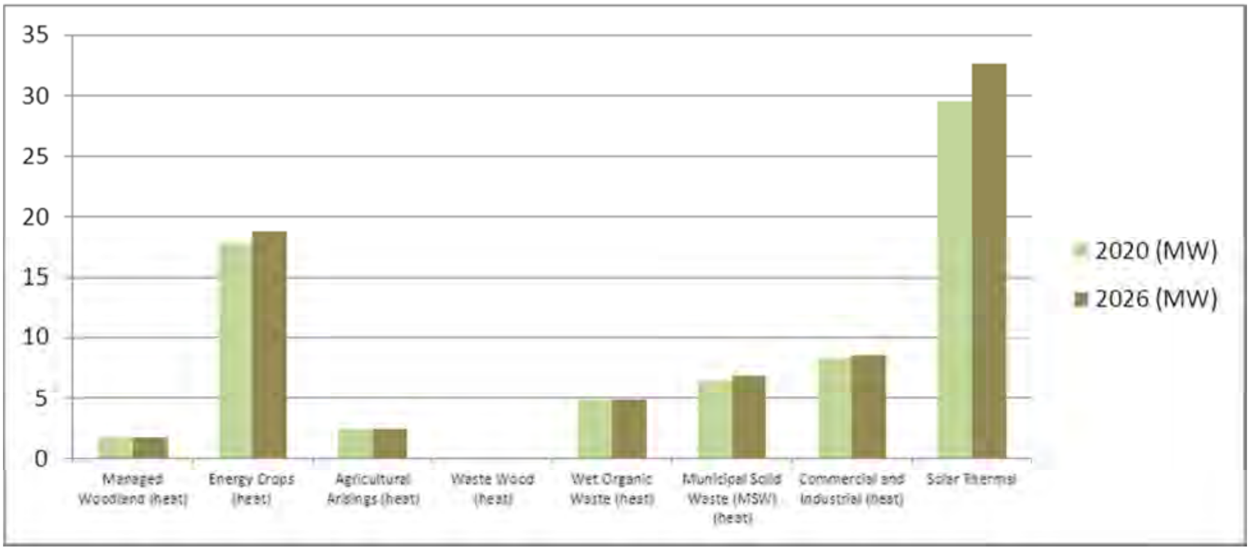


Figure 2: Technical Renewable Energy Resource Potential within Hinckley and Bosworth (heat)

Assessment of Technical Potential for District Heating

12 An assessment was undertaken of the technical potential for district heating within Hinckley and Bosworth. District heating, sometimes referred to as decentralised heat networks, supply heat from a localised central source directly to homes and businesses through a network of pipes carrying hot water. This means that individual homes and business do not need to generate their own heat on site.

13 The key conclusions were as follows. The total modelled heat demand in the Borough is 914,389 MWh per year, 35% of which is from non-domestic sources, with 65% coming from residential sources. Approximately 44% of the borough's heat demand comes from the Hinckley / Burbage area to the south, and 15% comes from the Earl Shilton / Barwell area.

14 Overlaying areas of high heat demand, locations of anchor loads and large domestic loads can identify areas with higher potential for district heating. It was found however that all three rarely coincide within the Borough. Areas where at least two of these criteria coincide were therefore identified at nine locations and these were subsequently reduced to three following further analysis: Hinckley, and Barwell & Earl Shilton.

15 Further analysis of the Hinckley area identified an average heat density of 0.04 MWh per square metre, which is normally too low for a district heating system, but there are zones within the area which have higher heat demand. The areas around the council offices grouping (particularly with the future relocation of the leisure centre) and the Magistrates Court are the most promising in Hinckley and may be worth further study. Similarly, the most promising areas for further study within Barwell & Earl Shilton include the area around Barwell C of E Junior School and William Bradford Community College. Both of these areas by themselves are only likely to be marginal in terms of suitability for district heating as most systems are found in more densely populated urban areas. More promising opportunities may be offered however if they could be linked to a larger system in the development of the Sustainable Urban Extensions to the west of Barwell and the south of Earl Shilton.

Wind Energy Landscape Sensitivity Assessment

16 In order to inform the assessment of deployable potential for wind energy within the Borough, an assessment was undertaken of the sensitivity of Hinckley and Bosworth's landscape to large, medium and small scale wind energy turbines. The assessment of technical potential found that wind turbines have the technical potential to deliver a significant amount of electricity within the Borough. However, one of the key factors determining the acceptability or otherwise of wind turbines is their potential impacts on the local landscape – this is due to their height and the movement they introduce into the landscape (i.e. rotating blades).

17 The assessment considered the relative sensitivity of Hinckley and Bosworth's ten landscape character areas[2] to three scales of wind turbine: small scale turbines (typically 15m - 40m to blade tip); medium scale turbines (typically 40m - 80m to blade tip); and large scale turbines (typically 80m - 135m to blade tip).

18 The assessment found that the landscapes in Hinckley and Bosworth have a moderate/ moderate-high sensitivity to large scale turbines (up to 135m to tip). A low/moderate/ moderate sensitivity to medium scale turbines (40-80m to tip) and a low/ low-moderate sensitivity to small turbines (i.e. those up to 40m to tip). It was also noted that the 'large' size category includes turbines between 80m and 135m and that as this is a large size range, the landscape will be more sensitive to turbines at the upper end of this range. Some of the larger scale landscapes may therefore be more able to accommodate turbines at the lower end of the 'large' size group e.g. Character Area B: Forest Hills, Character Area F: Hinckley, Barwell and Burbage Fringe, Character Area G: Fen Lanes and Character Area H: Upper Mease.

19 While the landscape sensitivity assessment provides an initial indication of the relative landscape sensitivity of different areas to wind turbine development, it is important it is not interpreted as a

[2] Hinckley and Bosworth Borough Council (2006) Landscape Character Assessment: Hinckley and Bosworth.

definitive statement on the suitability of a particular landscape for a particular development. It is not a replacement for detailed studies for specific siting and design and all developments will need to be assessed on their individual merits.

Assessment of Deployable Potential

20 The assessment of deployable potential sought to identify what renewable energy developments could realistically be achieved and delivered within the Borough. The process of researching and setting out the deployable potential is however not straightforward; there are no standard methodologies for doing this and the extent to which targets are achievable within a certain timeframe will largely depend on future national policy incentives, site specific factors and the will of local organisations and their effectiveness in facilitating the local actions required.

21 For the purpose of defining the deployable potential, two levels of implementation were considered as follows:

- '**Business as Usual'**: this projects forward to 2020 and 2026 by assuming a low level of renewables is implemented with little increase on the present level of deployment within the Borough, which as a baseline is already notably low.
- **'15% renewables':** this level of implementation explores the options for the Borough to source 15% of its total heat and electricity consumption from renewables by 2020. This aligns with the national commitment of delivering 15% of energy demand from renewable sources by 2020, but unlike the national target does not include energy used for transport, as this falls beyond the scope of the study. The study considered two potential options for achieving the 15% target Option A, which draws significantly on the wind power resource and Option B which focuses solely on non-wind technologies.

22 These options were then used to define the '**Recommended Target Potential'** that Hinckley and Bosworth Council could consider for setting a target for renewable energy deployment within the Borough. A summary of the Recommended Target Potential is set out in **Figure 3.**

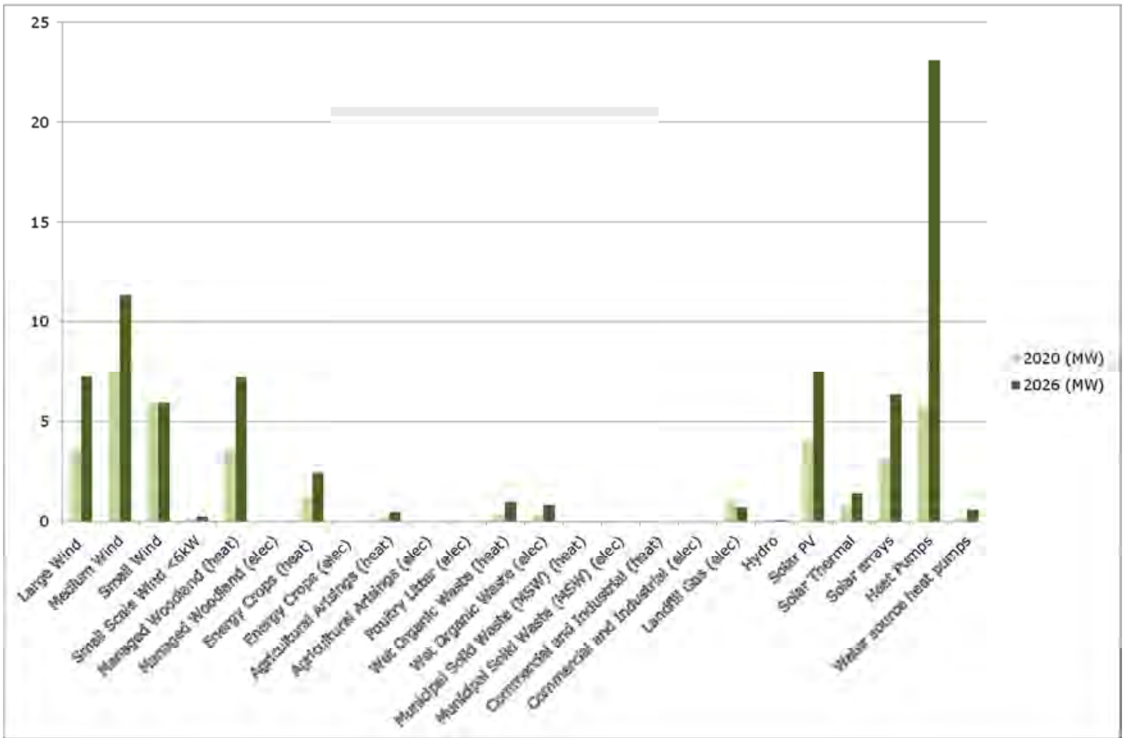


Figure 3: Recommended Target Potential for Hinckley and Bosworth (electricity and heat)

23 The Business as Usual approach suggests that Hinckley and Bosworth would achieve a very low level of renewables deployment up to 2026 by providing only 2.3% of the Borough's non-

transport annual energy demand by 2020 and 3.2% by 2026. This compares with a Recommended Target Potential of 7.1% by 2020 and 14% by 2026.

24 Wind power clearly has the potential to be a key technology in achieving a renewables target which significantly improves on the Business as Usual approach. The 15% by 2020 'Option B' (non-wind deployment) technology mix illustrates the heavy reliance that would be placed on technologies such as solar, heat pumps and biomass heating if wind is not deployed, and indicates the challenges that would be encountered at this level of deployment. This particular mix, for example, would require 16MW of large scale solar arrays and an additional amount of building-integrated PV equivalent to 7,360 domestic sized systems. The study therefore recommends that wind at all scales should contribute to deployment targets for the Borough, but with a focus on small/medium scale turbines and including the smaller end of the 'large scale' size range considered. This is in view of the findings of the landscape sensitivity analysis which indicate that the landscape within Hinckley and Bosworth has moderate-high sensitivity to large scale wind turbines.

25 The proposed targets are suggested as being achievable but will rely on Hinckley and Bosworth Council adopting suitably conducive policies to facilitate their achievement and a positive and proactive approach from developers, other public sector organisations and local communities. Success in meeting these targets will therefore depend on an effective consultation with these groups to set the proposals in the context of other Local Plan (2006 – 2026) policies and national targets, to raise awareness of the technology options available and to hear the community's concerns and preferences.

Recommendations

26 The final chapter of the report sets out a series of policy options for the Council to consider in the preparation of the Site Allocations and Development Management Policies Document and the Barwell and Earl Shilton Area Action Plan. This include:

- Setting a renewable energy vision and target.
- Establishing criteria for assessing renewable energy applications.
- Encouraging community renewables.
- Delivering the energy opportunities map.
- Allocating sites for standalone renewable and low carbon energy schemes.
- Setting targets for strategic sites.
- Identifying priority areas for delivery of district heating.
- Defining a policy for 'Allowable Solutions'.

27 The study concludes with guidance on the future monitoring of renewable energy developments within the Borough. It is essential that the Council effectively monitors the success of their development plans and other mechanisms/ initiatives in delivering renewable energy developments within the local authority area. As a minimum this should include tracking the number and generating capacity of renewable and low carbon energy proposals which have been approved/ refused planning permission and been commissioned within the area.

1 Introduction

Project Aim and Objectives

1.1 LUC and the Centre for Sustainable Energy (CSE) were commissioned in October 2012 to prepare a Renewable Energy Capacity Study for Hinckley and Bosworth Borough Council. The study seeks to provide a robust evidence base on the technical and deployable potential for renewable energy and low carbon energy (including CHP and District Heating) within the Borough. This will be used to inform the development of renewable and low carbon policies in the Council's Site Allocations and Development Management Policies Document, the Barwell and Earl Shilton Area Action Plan (AAP) and future climate change strategies and decision-making.

1.2 This study builds upon the findings of the regional study, also prepared by LUC and CSE, on Low Carbon Energy Opportunities and Heat Mapping for Local Planning Areas across the East Midlands (March 2011). The regional study identified the **technical** potential for renewable and low carbon energy within the East Midlands. This study revisits and refines this technical assessment, taking account of the local context in Hinckley and Bosworth. Critically, the study then explores the **deployable** potential for renewables within the Borough, i.e. what could realistically be delivered on the ground. This includes the identification of key opportunity areas and a target for the delivery of renewables and low carbon energy within the Borough. The study concludes with a series of recommendations on how to interpret and use the study findings and how to monitor the future delivery of renewables within the Borough.

In summary, the **key study objectives** were to:

1 Update the analysis of technical potential and assess the deployable potential for renewable and low carbon energy within the Borough.

2 Identify and map the key opportunity areas for renewable and low carbon developments including detailed heat mapping and anchor points.

3 Develop a Borough specific renewable energy generation target.

4 Provide guidance on the incorporation of findings into Site Allocations and Development Management Policies document and Earl Shilton and Barwell AAP.

5 Provide guidance on a framework to monitor the uptake of large and small scale renewable and low carbon developments within the Borough.

Need for the Study

1.3 The need for this study arose from four key drivers:

The need to contribute towards the Government targets to reduce carbon emissions and increase renewable energy generation

1.4 There are very strong and challenging policy drivers for reducing CO_2 emissions and delivering renewable and low carbon energy. The Government's target is to reduce the UK's carbon emissions by 80% (below 1990 levels) by 2050 and ensure that 15% of our total energy consumption (including electricity, heat and transport) comes from renewable energy sources by 2020. These are the policy requirements that underpin this Renewable Energy Capacity Study.

The need to align the Borough's key policy documents and strategies with the requirements of the National Planning Policy Framework (NPPF)

1.5 One of the core planning principles of the NPPF (2012) is *"to support the transition to a low carbon future.... and encourage the use of renewable resources"* . The NPPF goes on to state that LPAs should have a positive strategy to promote energy from renewable and low carbon sources and should consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure the development of such. It also states that local authorities should identify opportunities where development can draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

1.6 This study seeks to provide the evidence base for the Council to identify the opportunities for renewable and low carbon energy and assist in the formulation of policies to support these NPPF objectives.

The desire for the Borough to play a proactive role in the delivery of county wide strategies

1.7 The Council has also been involved in a number of county wide strategies, plans, and commitments to reduce carbon emissions, encourage renewable energy and low carbon developments and adapt to climate change. These strategies and plans (some of which are still in the process of being prepared) include:

- A Carbon Reduction Strategy for Leicestershire;
- Leicestershire's Sustainable Community Strategy;
- Leicestershire Together Climate Ready Plan.

1.8 The Council is keen to ensure that it is playing its part in the delivery of these strategies through the development of its own renewable and low carbon policies and strategies.

The need for the Council to have a sound evidence base to inform the preparation of their Development Management Plan Policies

1.9 Spatial Objective 12 of the adopted Hinckley and Bosworth Core Strategy (December 2009) relates to Climate Change and Resource Efficiency. This objective seeks to minimise the impacts of climate change, invest in green infrastructure, minimise the use of resources and energy, increase the use of renewable energy technologies, and minimise greenhouse gas emissions.

1.10 Policy 24: Sustainable Design and Technology of the Core Strategy builds upon Spatial Objective 12 by assigning minimum sustainable building standards for new developments. In addition, Policy 21: National Forest seeks to support proposals that contribute to the National Forest Strategy which looks to increase wood fuel energy use. Core Strategy policies 21 and 24 go some way to meeting Spatial Objective 12. However, the Core Strategy does not provide criteria based policies for the assessment of applications for small or large scale renewable developments, and does not examine areas where these developments may be suitable or unsuitable.

1.11 The Site Allocations and Development Management Policies document was being prepared in March 2013, with pre-submission consultation scheduled for August/September 2013. This document provides the opportunity to include robust development management policies which will seek to meet Spatial Objective 12 and increase the suitable deployment of renewable and low carbon energy technologies and minimise greenhouse gas emissions. The identification of key opportunity areas will also seek to ensure that renewable energy developments are guided to the most appropriate areas within the Borough.

Project Scope

Technologies

1.12 The study focuses on 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 1.1.**

Table 1.1: Technologies covered in study

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

1.13 The study <u>does not</u> cover energy efficiency issues, or renewable transport fuels[3]. It is fully recognised that there are close links between the technologies covered by this study and energy efficiency and transport fuels. For example, in the way that energy demand and carbon reduction targets are met, and in terms of the industrial and supply chain opportunities.

1.14 Building related CO_2 emissions currently account for approximately 25% of all CO_2 emissions, so improving their energy efficiency should therefore be a priority. The Government has implemented various mechanisms and standards to deliver energy efficiency improvements in old and new buildings in the UK, namely the Green Deal, Part L of the Building Regulations and from 2016-2019 'Allowable Solutions' for 'Zero Carbon' standards. A brief summary of these key initiatives is provided in **Box 1.**

[3] Renewable transport fuels include biodiesel, bioethanol and biomethane. The Government is increasing production and supply in the UK through the Renewable Transport Fuel Obligation (RTFO) which requires biofuel and fossil fuel suppliers selling over 450,000 litres a year to road transport to ensure that a proportion comes from renewable sources and are sustainable. Suppliers that fail to supply an appropriate proportion of renewable fuel must pay a fine.

Box 1: Summary of Key Energy Efficiency Measures

Green Deal (2013) for existing buildings

In January 2013, the UK government introduced the *Green Deal* to improve the energy efficiency of the UK's existing building stock. The *Deal* encourages business and home owners to invest in green technologies to improve their property's energy efficiency, saving carbon and money. Property owners pay nothing upfront but instead pay back the costs gradually through energy bills. The *Deal* has a 'golden rule' which guarantees that the financial savings generated by installed green technologies must be equal to or greater than the repayments attached to the property's energy bill. Further information is available from https://www.gov.uk/green-deal-energy-saving-measures/how-the-green-deal-works

Building Regulations, Zero Carbon and Allowable Solutions

Building Regulations set the standards for the design and construction of most new buildings and many building alterations in England and Wales. Part L (2010) deals with the conservation of fuel and power and sets mandatory standards for building materials, energy use and generation in new buildings. Forthcoming revisions to Part L include increasingly stringent limits on the CO_2 emissions. By autumn of 2013, buildings will be required to be 25% more energy efficient. By 2016, new homes will need to be 'Zero Carbon', followed by non-domestic buildings in 2019. 'Zero Carbon' is a concept which is still in the process of being defined by Central Government. Buildings must achieve both carbon compliance, reducing CO_2 emissions on-site down to a fixed target level through energy efficient design (Fabric Energy Efficiency Standards and low and zero carbon technologies), and 'Allowable Solutions' which involve mitigating the remaining carbon emissions through the securing of carbon reductions off-site. Allowable Solutions off-site are likely to include investments in community energy efficiency and renewable energy projects.

As national carbon compliance become tougher to achieve local planning authorities are less likely to go beyond the Building Regulations in their local development management policies. However, LPAs can still require sites to go beyond Building Regulations where viable although all requirements should be compatible with the Building Regulations. Many favour (as set out in the Hinckley and Bosworth Core Strategy) the incorporation of sustainability standards, such as BREEAM and the Code for Sustainable (CfSH) Homes, in to planning requirements. Whilst the Building Regulation provide mandatory minimum requirements for carbon emissions, sustainability standards address sustainability in broader terms promoting high standards relating to on-site energy generation, water and waste efficiency and biodiversity benefits. The Government has however announced in October 2012 that they are undertaking 'a radical and fundamental review of the entire framework of Building Regulations and voluntary housing standards such as CfSH and BREEAM.

1.15 As outlined above, whilst energy efficiency and renewable transport fuels form critical components of the Government's energy strategy, they fall outside the scope of this study.

Timescale

1.16 The assessments of renewable energy potential and the proposed targets have been considered with reference to two timeframes, 2020 and 2026. The 2020 timescale is linked to the Government's target to deliver 15% of the UK's energy consumption from renewables by 2020, in line with the EU Directive. The 2026 timescale is related to timeframe of Hinckley and Bosworth's Local Plan (2006-2016).

Study Approach

1.17 The study involved ten key tasks as set out in **Table 1.2** below:

Table 1.2: Summary of Key Study Tasks

Key Tasks	Description
1: **Policy review**	Review of the policy context for renewable energy at the national, regional and local level. (see Chapter 2)
2. Review of **existing renewable energy developments** within the Borough	Identification of the existing number and mix of renewable energy schemes within the Borough. This included both large and small scale schemes including those that received funding under the Renewables Obligation and the Feed in Tariff. (see Chapter 2)
3. Assessment of **technical potential**	Assessment of the technical potential (i.e. the total theoretical potential) for renewable and low carbon energy within the Borough. This included revisiting and revising the assumptions used in the East Midlands Councils study – Low Carbon Opportunities and Heat Mapping for Local Planning Authority Areas Across the East Midlands: Final Report (2011). (see Chapters 3 and 4)
4. Assessment of **landscape sensitivity** to wind energy	Analysis of the sensitivity of Hinckley and Bosworth's landscape to large, medium and small scale wind energy development. (see Chapter 5)
5. Assessment of **deployable potential**	Assessment of the deployable potential for renewable and low carbon energy within the Borough (See Chapter 6)
6. Setting a **target**	Identification of a target for renewable and low carbon energy generation for Hinckley and Bosworth and comparison with Business as Usual and achievement of the 15% target. (See Chapter 6)
7. Identification of key **opportunity areas**	Identification of key areas of opportunity for renewable and low carbon energy generation within the Borough. (See Chapter 7)
8. Development of a **monitoring framework**	Development of a monitoring framework for keeping check on the number of renewable and low carbon energy schemes being delivered in the Borough. (see Chapter 7)
9. **Reporting**	Preparation of draft and final report.
10. **Consultation**	Consultation with key experts in the preparation of the report and with the Council's internal Renewable Energy Task and Finish Group.

Report Structure

1.18 The remainder of this report is structured as follows:

Chapter 2: provides a brief overview of the existing energy profile (in terms of energy consumption and existing renewable energy generation) and the key policy drivers for the study.

Chapter 3: presents the findings of the technical resource assessment for renewable energy.

Chapter 4: presents the findings of the technical assessment for district heating.

Chapter 5: sets out the findings of the landscape sensitivity study for wind energy developments.

Chapter 6: presents the findings of the assessment of deployable renewable energy potential.

Chapter 7: provides recommendations on how the information set out this report could be used by the Council to formulate robust planning policies for renewable and low carbon energy. Recommendations are also provided on establishing a robust framework for monitoring renewable and low carbon projects within the Borough.

2 Existing Energy Profile and Policy Drivers

Introduction

2.1 This chapter describes the current energy consumption within the Borough and the generation capacity of existing renewable energy schemes. The chapter also provides an overview of the national and local policy context for generating renewable and low carbon forms of energy.

Existing Energy Profile

Existing Consumption

2.2 According to statistics held by the Department for Energy and Climate Change (DECC), 1,509 GWh energy were consumed across the domestic, industrial/commercial, and the land use, land use change and forestry (LULUCF) sectors in the Borough of Hinckley and Bosworth during 2010. This level of consumption equates to a total of approximately 492 ktCO_2 emitted over the course of the year. Energy consumption arising from the use of transport (both road and rail) within the Borough has been excluded from the above calculations as it is considered to be outside of the scope of this study.

2.3 **Figure 2.1** shows how this total figure for non-transport related carbon emissions is split across sector types. The chart shows that the industrial sector accounts for a slightly higher proportion of total emissions than the domestic sector in this case. Emissions arising from LULUCF activities have not been included on the chart as they were found to have a negligible impact. In fact, a closer look at the data suggests that activities in this sector have actually led to a marginal reduction in emissions of approximately 0.10 tonnes CO_2 per year, with the Borough becoming a sink rather than a source for this emission type. This may be partly due to the growth of the National Forest with more carbon being sequestered through the planting of trees than is released through farming and other activities on balance within this sector.

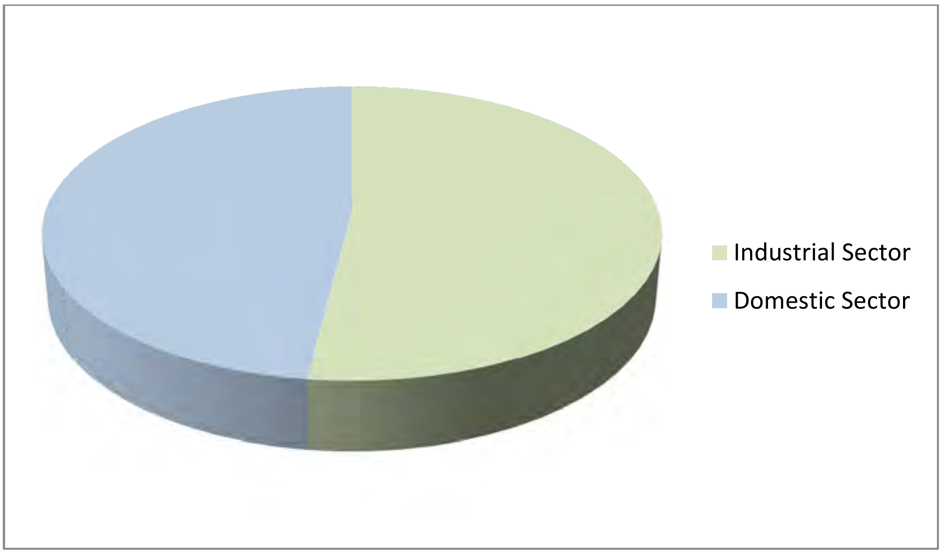


Figure 2.1: Local CO_2 emission estimates for Hinckley and Boswell (2010 figures).

2.4 These figures provide a baseline against which future emissions can be benchmarked and progress towards any relevant targets can be monitored.

2.5 **Table 2.1** presents a sub-set of this data for 2010 in the form of building-related energy consumption within the Borough, mostly based on metered data, as split between domestic and industrial/commercial users.

Table 2.1: Hinckley and Bosworth energy consumption statistics (non-transport)

Sector	Electricity (MWh/yr)	Gas (MWh/yr)	Other (MWh/yr)	Total (MWh/yr)	CO_2 emissions (tonnes/yr)
Domestic					
Domestic heat	113,840	653,723	2,604	770,167	176,247
Domestic power	80,115	-	-	80,115	38,856
Total domestic	***193,955***	***653,723***	***2,604***	***850,282***	***215,103***
Industrial/ commercial					
Industrial/commercial heat	-	235,889	178,704	414,593	122,182
Industrial/commercial power	244,553	-	-	244,553	118,608
Total Industrial/commercial	***244,553***	***235,889***	***178,704***	***659,146***	***240,790***
Total	**438,508**	**889,612**	**181,308**	**1,509,428**	**455,893**

Note: These figures are for 2010 and exclude some large industrial energy users for reasons of commercial confidentiality.

2.6 The figure for gas consumption in the domestic sector is likely to decrease slightly over the next decade due to energy efficiency initiatives (for example the Green Deal), although other changes in factors such as comfort levels and electricity consumption may reduce or reverse the effect on overall carbon emissions.

Existing Energy generation

2.7 Information on the type, capacity and planning/ operational status of existing renewable energy schemes within the Borough was obtained from the following sources:

- Renewable Energy Planning Database (REPD)(A national database ran by AEA Technology on behalf of DECC);
- OFGEM Feed in Tariff Register; which provides information on all accredited microgeneration installations;
- Information on planning applications provided directly by Hinckley and Bosworth Borough Council Planning Register;
- CHAPSTATS, the Ofgem CHP register.

2.8 Hinckley and Bosworth starts from a low base of renewable energy generation. To date the Borough's main source of renewable energy generation is the Bradgate Landfill Gas scheme which has an installed capacity of 2.64MW. In recent years there has been a significant increase in the number of domestic solar PV installations within the Borough.

2.9 Since the introduction of the Feed In Tariff[4] in April 2010, up until February 2013, there were 621 installations of solar PV on domestic properties, 20 on commercial properties, two on industrial

[4] Feed-In Tariffs were introduced on 1 April 2010 and **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

premises and one community development. This equates to a total installed capacity of 2.6MW. There have also been three domestic wind energy turbines installed under the FIT with a total capacity of 24kW (0.024MW). Prior to the introduction of the FIT, it is known that the Council received six applications for micro wind energy turbines and two solar PV installations. It is known that two medium scale turbines have been installed but the installed capacity of these is not known. It is also not known whether the other schemes have been installed or not, so these potential developments have not been included in the summary table set out below.

2.10 In relation to known future proposals, Pre-planning consultations are underway in relation to a 1.5 MW biomass boiler proposed at John Cleveland College in Hinckley. An application for this scheme has not however been submitted to date (March 2013).

Table 2.2: Summary of Existing Renewable Energy Developments within Hinckley and Bosworth

Technology	No of Developments	Installed Capacity (MW)
Large, medium or small scale Wind	0	0
Micro Scale Wind*	3	0.024
Biomass	0	0
MSW	0	0
Landfill	1	2.64
Solar PV	644	2.6
Solar PV Array	0	0
Solar thermal	unknown	unknown
Hydro	0	0
Micro CHP	**0**	**0**
TOTAL	**625**	**5.264**

2.11 The total installed generating capacity of renewable energy projects in Hinckley and Bosworth is 5.264 MW or 15,190 MWh/yr. This compares with existing energy use within the Borough of 1,509,428 MWh/yr. Current renewable energy generation therefore accounts for 1% of existing consumption.

Comparison with Leicestershire

2.12 In 2009, Leicestershire's domestic and commercial/industrial users (excluding Leicester City) used a total of 9,093 GWh for both electricity and gas, a reduction of 1,789 GWh since 2005.

2.13 A summary of the existing renewable energy developments within Leicestershire (excluding Leicester City) are summarised in **Table 2.3** below. Please note that this includes schemes which are operational or are currently under construction. This information has been obtained from the DECC REPD and the Ofgem FIT Register and is therefore only as accurate as the information contained with these databases.

national grid. Most domestic technologies qualify for the scheme, including: solar electricity (PV) (roof mounted or standalone), wind turbines (building mounted or free standing), hydroelectricity, anaerobic digesters, micro combined heat and power (CHP).

Table 2.3: Summary of Existing Renewable Energy Developments within Leicestershire (excluding Leicester City and including Rutland)

Technology	Blaby		Charnwood		Harborough		Melton		NW Leicestershire		Oadby & Wigston		Rutland	
	No of Developments	Installed Capacity (MW)	No of Developments	Installed Capacity (MW)	No of Developments	Installed Capacity (MW)	No of Developments	Installed Capacity (MW)	No of Developments	Installed Capacity (MW)	No of Developments	Installed Capacity (MW)	No of Developments	Installed Capacity (MW)
Commercial Wind	0	0	4	14.05	4	44.3	3	28.4	2	1.28	0	0	0	0
Micro Scale Wind	1	0.006	3	0.22	11	0.129	1	0.05	2	0.033	0	0	3	0.013
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MSW	0	0	1	21	0	0	0	0	0	0	0	0	0	0
Landfill	3	9.44	3	6.58	1	2.3	0	0	2	3.07	0	0	0	0
Solar PV	475	1.674	899	3.501	624	2.532	462	1.882	530	1.989	311	1.073	356	1.470
Solar PV Array	0	0	1	32	0	0	1	4.8	0	0	0	0	0	0
Hydro	0	0	0	0	0	0	0	0	1	0.3	0	0	0	0
Micro CHP	0	0	0	0	0	0	0	0	1	0.02	0	0	0	0
TOTAL	**479**	**11.12**	**911**	**77.351**	**640**	**49.261**	**467**	**35.132**	**538**	**6.692**	**311**	**1.073**	**359**	**1.483**

2.14 Comparing **Table 2.2** and **Table 2.3**, only 2.8% of the existing installed renewable energy capacity in Leicestershire (excluding Leicester City) and Rutland is located within Hinckley and Bosworth. However, the Borough accounts for approximately 12% of the land area and 10.3% of the population within Leicestershire and Rutland.

Policy Drivers

2.15 The following section summarises the key policy and strategy drivers for renewable and low carbon energy at an international, national, county and local level.

International and European Policy

2.16 At the Kyoto conference of the United Nations Framework Convention on Climate Change in December 1997, most industrialised countries agreed to reduce emissions of the six principal man-made greenhouse gases to 5.2% below 1990 levels over the period 2008-2012. The UK agreed to a reduction target of 12.5%. The Kyoto Protocol became a legally binding treaty on 16th February 2005. The Doha Climate Change Conference in Dec 2012 led to the adoption of an amendment to the Kyoto Protocol establishing a second round of binding greenhouse gas emission targets for Europe, Australia and a handful of other developed countries. Further detailed climate change negotiations are planned for 2015.

2.17 In April 2009, the European Union adopted the **Directive on Renewable Energy** (2009/28/EC), which set targets for all Member States such that the EU will reach a 20% share of energy from renewable sources by 2020. The UK's binding target is to meet 15% of its energy consumption from renewable sources by 2020. Article 22 of Directive requires Member States to submit a report to the European Commission (EC) on progress in the promotion and use of energy from renewable sources. The UK's first progress report on the Promotion and Use of Energy from Renewable Sources for the UK (DECC, 2011) was delivered in December 2011 and showed that renewable energy accounted for 54TWh (3.3%) of the UK's total energy consumption in 2010 - an increase of 27% over a two year period.

National Policy

National Planning Policy Framework

2.18 The Government adopted the **National Planning Policy Framework (NPPF)** in March 2012, which sets out the environmental, social and economic planning policies for England. The NPPF has replaced the national Planning Policy Statements and Planning Policy Guidance notes (PPSs and PPGs) and some circulars with a single, streamlined document. Central to the NPPF policies is a presumption in favour of sustainable development, that development should be planned for positively and individual proposals should be approved wherever possible. One of the core planning principles of the NPPF is "to support the transition to a low carbon future in a changing climate…… and encourage the reuse of existing resources, including conversion of existing buildings, and encourage the use of renewable resources (for example, by the development of renewable energy)."

2.19 The NPPF states that "To help increase the use and supply of renewable and low carbon energy, local planning authorities should recognise the responsibility on all communities to contribute to energy generation from renewable or low carbon sources. They should:

- have a positive strategy to promote energy from renewable and low carbon sources;
- design their policies to maximise renewable and low carbon energy development while ensuring that adverse impacts are addressed satisfactorily, including cumulative landscape and visual impacts;
- consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure the development of such sources;
- support community-led initiatives for renewable and low carbon energy, including developments outside such areas being taken forward through neighbourhood planning; and

- identify opportunities where development can draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers." [para 97].

2.20 Further, when determining planning applications, local planning authorities should view sustainable developments favourably. This includes not requiring applicants for energy development to demonstrate the need for renewable and low carbon energy, and approving applications if their impacts are, or can be made, acceptable [para 98].

Other National Policy and Guidance

2.21 On 18th July 2011 the House of Commons debated and approved six **National Policy Statements** (NPSs) for Energy. The energy NPSs are designed to ensure that planning decisions are transparent and are taken against a clear policy framework, by setting out national policy against which proposals for major energy projects will be determined by the National Infrastructure Directorate (NID) (formerly the Infrastructure Planning Commission or IPC). Although the NPSs primary focus is for nationally significant projects they are also applicable to energy development that fall below 50MW. The Overarching National Policy Statement for Energy (EN-1) sets out national policy for energy infrastructure and describes the need for new national significant energy infrastructure projects. EN-3 (NPS for Renewable Energy Infrastructure) then provides the primary basis for decisions by the NID on applications it receives for nationally significant renewable energy infrastructure, providing guidance on various technologies and their potential for significant effects.

2.22 The **Planning and Energy Act** (2008) enables local planning authorities to set requirements for energy use and energy efficiency in local plans, including:

- a proportion of energy used in development in their area to be energy from renewable sources in the locality of the development;
- a proportion of energy used in development in their area to be low carbon energy from sources in the locality of the development; and
- development in their area to comply with energy efficiency standards that exceeds the energy requirements of building regulations.

2.23 The **UK Climate Change Programme 2006** updated the 2000 Climate Change Programme, building on existing commitments to achieve national targets for the reduction of carbon dioxide emissions. The Programme includes a range of measures to be implemented at both the international and national levels, including continuing to support electricity from renewables under the Renewables Obligation (the main financial mechanism by which the Government incentivises the deployment of large-scale renewable electricity generation). The Programme also introduced a requirement for annual reports to be presented to Parliament on emissions, our future plans and progress on domestic climate change.

2.24 The **UK Energy White Paper** (HM Government, 2007) sets out UK energy policy, recognising that in order to deliver energy security and accelerate the transition to a low carbon economy, the UK must save energy, develop cleaner energy supplies and secure reliable energy supplies at prices set in competitive markets. One of the key elements of the strategy is providing more support for low carbon technologies, including by encouraging public and private sector collaboration and increased international collaboration. Amongst other measures, the White Paper confirmed the Government's intention to strengthen the Renewables Obligation.

2.25 At the end of 2008, the **Climate Change Act** was passed, restating the UK Government's commitment to wind and other renewables in the move towards a low carbon economy. The Act looks ahead to reductions in UK carbon dioxide emissions of 80% by 2050 and makes these legally binding on the Government. As part of the Act, the Committee on Climate Change is required to report annually to Parliament on the progress made in reducing carbon emissions. The fourth annual progress report on meeting carbon budgets (Committee on Climate Change, 2012) showed that overall progress has been good. Economy-wide emissions fell by 7% in 2011, something that is attributed to a range of factors including the mild winter weather in 2011 (relative to very cold winter weather in 2010), rising fuel prices, falling incomes and transitory factors in power generation. However, the report recognises that, in order to remain on track for future carbon budgets, there is now an urgent need to move from policy planning to delivery, and to accelerate the pace at which measures are implemented.

2.26 The **UK Renewable Energy Strategy** (HM Government, 2009) set out how the UK will achieve its legally-binding target of obtaining 15% of all energy from renewable sources by 2020 to ensure a secure supply of energy and to tackle climate change. Whereas the Government had been working towards a UK 2020 target of 20% of electricity coming from renewable sources, the lead scenario in the Renewable Energy Strategy is that this figure has to be raised dramatically, in light of the less mature markets in renewable heat and transport fuel. The strategy suggests that the UK may need more than 30% of electricity and 12% of heat to be generated by renewable sources in order to meet the overall energy target.

2.27 In July 2010, the Coalition Government submitted the **UK Renewable Energy Action Plan** to the European Commission. This outlined the technologies that are expected to deliver 15% renewable energy in the UK by the year 2020 along with an indicative interim trajectory for the shares of energy from renewable resources in electricity, heating and cooling and transport.

2.28 In July 2011, the Government published a White Paper entitled **Planning our Electric Future: A White Paper for Secure, Affordable and Low-Carbon Electricity** (HM Government, 2011) setting out its commitment to transform the electricity market to achieve secure, affordable and low-carbon electricity. A key part of this strategy involves encouraging and facilitating the production of cleaner low-carbon energy sources, including wind energy, in order that national renewables targets can be met.

2.29 Also in July 2011, DECC produced the **UK Renewable Energy Roadmap** (DECC, 2011). This is an action plan for the deployment of renewable energy throughout the UK, and focuses on the eight technologies that are considered to have the greatest potential, one of which is onshore wind energy. The key actions in this area that are set out in the Roadmap include increasing overall capacity and upgrading transmission capacity, and co-funding the development of technical solutions to issues that can affect the viability of onshore wind farms, such as interference with aviation radar.

Financial Incentives

3.8 There are three main financial incentive schemes that the Government has introduced for generating renewable electricity;

- Renewable Energy Obligation (RO) (larger scale electricity generation).
- Feed-in Tariff (FiTs) (microgeneration - electricity).
- Renewable Heat Incentive (RHI) (heat).

2.30 The **Renewable Energy Obligation** is the main support mechanism for renewable electricity projects in the UK. The RO came into effect in 2002 in England and Wales and in Scotland and in 2005 in Northern Ireland. It places an obligation on UK electricity suppliers to source an increasing proportion of electricity they supply to customers from renewable sources. Renewables Obligation Certificates (ROCs) are green certificates issued by the Authority to operators of accredited renewable generating stations for the eligible renewable electricity they generate. Operators can then trade the ROCs with other parties, with the ROCs ultimately being used by suppliers to demonstrate that they have met their obligation.

2.31 In April 2010 the **Feed in Tariffs** (FITs) were introduced to replace the support provided by the Low Carbon Buildings Programme and stimulate the take up of installation of small to medium scale renewable electricity generation. The scheme includes:

- Fixed payment from the electricity supplier for every kWh generated (the "generation tariff").
- A guaranteed minimum payment additional to the generation tariff for every kWh exported to the wider electricity market (the "export tariff").
- Generators receiving FITs will also benefit from on-site use: where they use the electricity they generate on-site, they will be able to offset this against electricity they would otherwise have had to buy.
- Technologies included: wind, solar PV, hydro, anaerobic digestion and non-renewable micro CHP.

- Tariffs are tax free and will be paid for 25 years for new projects.

2.32 The tariff levels proposed have been calculated to ensure that the total benefits an investor can be expected to achieve (from the generation tariff, the export tariff and/or the offsetting benefit) should compensate the investor for the costs of the installation as well as provide financial return. The proposed tariff levels for new projects will decrease by predetermined rates each year. In March 2011, the coalition government cut the incentive for larger scale solar installations (greater than 50kW) by more than 50%.

2.33 The **Renewable Heat Incentive** (RHI) is a UK Government scheme set up to encourage uptake of renewable heat technologies among householders, communities and businesses through the provision of financial incentives. There are two phases to the introduction of the RHI:

- Phase 1: the introduction of the RHI for non-domestic installations in the industrial, business and public sectors.
- Phase 2: the domestic element of the RHI, is expected to be introduced in the summer of 2013 following the UK Government consultation published in September 2012.

2.34 There is no upper limit to the size of heat equipment eligible under the Renewable Heat Incentive and anyone who installs a renewable energy system producing heat after July 15th 2009 is eligible. The following technologies are included in the scheme; solid and gaseous biomass, solar thermal, ground and water source heat-pumps, on-site biogas, deep geothermal, energy from waste and injection of biomethane into the grid. Unlike FITs, tariffs will be paid not on the basis of a metered number of kWh generated, but instead on a "deemed" number of kWh, namely the reasonable heat requirement (or heat load) that the installation is intended to serve.

Regional and Local Policy and Guidance

Regional Spatial Strategy

2.35 The Government announced in the Coalition Agreement its intention to "rapidly abolish regional spatial strategies and return decision-making powers on housing and planning to local councils". The objective was to make local plans, and where desired neighbourhood plans, the basis for local planning decisions.

2.36 The Localism Act 2011 repealed Part 5 of the Local Democracy, Economic Development and Construction Act 2009, thereby removing the legal framework for the review of regional strategies or the adoption of new or revised regional strategies, and gave the Secretary of State powers to revoke in full or in part the existing strategies by order. The final revocation of the regional spatial strategies is now in progress. The former East Midlands Regional Spatial Strategy has therefore not been considered further in this study.

Climate Change Impacts in Leicestershire

2.37 The **Climate Change Strategy for Leicestershire** (March, 2005) presents a climate change mitigation and adaptation strategy for Leicestershire County Council. The strategy recognises that the development of generation capacity from renewable sources has significant potential to offset the emissions of carbon dioxide from fossil fuel use and to provide business growth and job opportunities. The document sets out a number of different strategies that can be implemented, including:

- The capture and use of methane from old coal mines.
- The development of bio mass fuel sources such as oil seed crops and woodland.
- The generation of electricity using waste gas from landfill sites and wastewater treatment works.
- The development of local solar, wind and, where feasible, hydro energy.

2.38 The **Draft Leicestershire Together Climate Ready Plan** is concerned with how climate change may impact on the achievement of the Leicestershire Together Partnership's priorities and outcomes. The Plan sets out the results of a risk assessment, to understand how climate change might impact upon the partnership's ability to achieve these priorities and outcomes. It identifies actions for the Partnership, where additional action is needed to reduce the risks from climate change, or to take advantage of opportunities. One of the identified actions is to adopt and support implementation of the Carbon Reduction Strategy. At the time of writing (March 2013), this document was due to be adopted shortly.

2.39 **The Draft Carbon Reduction Strategy for Leicestershire** is currently being prepared. The Strategy, when adopted, will seek to assess and understand the sources of current carbon emissions. The Strategy will develop scenarios that indicate the changes required in order to deliver a contribution to carbon emission reduction and establish targets. It will identify a strategy for delivery of carbon emission reduction and provide a framework within which partnerships and organisations can develop delivery plans and action in support of the overall targets. It will also seeks to act as a mechanism to review progress and take steps to address any failure to deliver the target or conversely consider reducing resource commitments to carbon emission reduction if targets are forecast to be exceeded. At the time of writing (March 2013), this document was due to be adopted shortly.

2.40 **Leicestershire Sustainable Community Strategy** (2008) recognises that efficient energy use and renewable energy generation have major roles to play in reducing the potential impact of climate change. Increased renewable energy generation and use of alternative fuel sources is identified as a 'sub outcome' under the priority outcome of reducing contribution to climate change.

The Development Plan

2.41 The **Hinckley and Bosworth Core Strategy** was adopted in December 2009. The Core Strategy provides the over-arching strategy and long term vision for Hinckley & Bosworth. To help ensure the vision for the Borough is achieved, it sets out 13 Spatial Objectives. Objective 12 Climate Change and Resource Efficiency, seeks to minimise the impacts of climate change by promoting the prudent use of resources through sustainable patterns of development, investment in green infrastructure, minimising the use of resources and energy, increasing reuse and recycling of natural resources, increasing the use of renewable energy technologies and minimising pollution, including greenhouse gas emissions.

2.42 The Core Strategy policies of relevance to the Renewable Energy study include:

- **Policy 24**: Sustainable Design and Technology sets a requirement that all development in Hinckley, Burbage, Barwell and Earl Shilton, unless it makes the development unviable, meet:
  - Minimum of Code for Sustainable Homes Level 3 to 2013;
  - Minimum of Code Level 4 from 2013-2016:
  - Code level 6 from 2016 onwards.

2.43 Residential developments in Key Rural Centres and Rural Villages will also be expected to meet the sustainability targets set out in Building a Greener Future. Schools, hospitals and office developments are required to meet BREEAM (or equivalent) assessment rating of 'very good.' From 2016 they will be required to meet, at a minimum, BREEAM (or equivalent) assessment rating of 'excellent.'

- **Policy 21**: National Forest supports, amongst other things, proposals that contribute to developing a new woodland economy for timber products and wood fuel energy.

2.44 The Council is in the process of preparing its Site Allocations and Development Management Policies document with pre-submission consultation scheduled for August –September 2013. This study seeks to provide a robust evidence base for the inclusion of policies to meet Spatial Objective 12 and increase the suitable deployment of renewable and low carbon energy technologies and minimise greenhouse gas emissions. This is in line with paragraph 97 of the NPPF as set out in paragraph 2.18 of this report.

2.45 **The identification of key opportunity areas will also seek to ensure that renewable energy developments are guided to the most appropriate areas within the Borough.**

Key Conclusions

2.46 This chapter has considered the existing energy profile of the Borough and key policy context. The key findings include:

- 1,509 GWh of energy were consumed across the domestic, industrial/commercial, and the land use, land use change and forestry sectors in the Borough of Hinckley and Bosworth during 2010.
- Gas consumption in the domestic sector is likely to decrease slightly over the next decade due to energy efficiency initiatives (for example the Green Deal), although electricity consumption is likely to increase and may reduce or reverse the effect on overall carbon emissions.
- Existing renewable energy generation within the Borough is low with a current installed capacity of just over 5.26MW. This equates to only 2.8% of the existing installed renewable energy capacity in Leicestershire and Rutland and 1% of existing energy consumption within the Borough.
- There are very strong and challenging policy drivers for both the reduction of CO_2 emissions and the inclusion of renewable and low carbon technologies from a European and national level;
- The national policy context through the NPPF provides a clear policy requirement for local planning authorities to plan positively for renewable and low carbon energy development.

3 Technical Resource Potential for Renewable Energy

Introduction

3.1 This chapter sets out the results of the assessment of the technical potential for renewables within Hinckley and Bosworth. The 'technical potential' is an estimate of the total amount of renewable energy that could be delivered in the area based on a number of assumptions regarding the amount of resource and space. The assessment of 'deployable potential' (i.e. what could realistically be achieved and delivered within the area) is provided in **Chapter 6.** The technical potential results in this chapter represent a considerable overestimate of what could be practically delivered in the Borough.

Background

3.2 The assessment of technical potential has been informed by the East Midlands *Low Carbon Energy Opportunities and Heat Mapping Study* which LUC, SQW and CSE completed on behalf of the East Midlands Councils in 2011. The East Midlands study was in turn based on a refinement of the DECC Methodology – *Renewable and Low Carbon Energy Capacity Methodology for the English Regions* (2010)[5].

3.3 The East Midlands Study involved an assessment of technical potential for renewable energy within the region based on the use of a number of clearly defined data sources and parameters/ assumptions for each technology. These data sources and assumptions were reviewed and refined as part of this study to ensure that the assessment reflects the local characteristics of Hinckley and Bosworth. A summary of the detailed assumptions used to inform the assessment is provided in **Appendix 3.1.** This appendix also provides information of where there have been any changes to the assumptions and data sources used in the East Midlands Study.

3.4 Consultations were undertaken with a range of consultees to inform the assumptions used in this assessment including: Natural England, renewable energy developers , wind turbine manufacturers, local community energy associations, LUC's agricultural expert, Leicestershire County Council waste and minerals officers, the Bradgate Landfill Gas Manager, the Environment Agency, Local Authority Officers and heat pump manufacturers and installers.

3.5 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. The conversion factors which have been used to calculate generation capacities are provided in **Appendix 3.2.**

3.6 As outlined in **Chapter 1**, the assessment of potential was undertaken using two timeframes 2020 (linked to the Government's 15% renewable target) and 2026 (relating to the timeframe for the Hinckley and Bosworth Local Plan 2006 - 2026). For some technologies in the assessment of **technical** potential, the total potential is not linked to a specific timeframe (e.g. 2020 or 2026) 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 2026 (e.g. for resources such as managed woodland, poultry litter and agricultural arisings etc.). For

[5] In March 2010, DECC published a methodology for quantifying the opportunities and constraints for deploying renewables and low carbon energy in the English Regions. The purpose of this methodology was to ensure that a consistent approach was used for the assessment of resource potential across the English regions. The methodology sets out a series of assumptions for calculating the technical potential for renewable energy within a region. It did not provide assumptions for assessing the 'deployable potential'.

this reason, for some technologies the results do not indicate any difference in potential between 2020 and 2026.

3.7 Where possible spatial data has been used to identify the locations/ areas with most potential for specific technologies. However it is not possible to identify locations for all types of renewable energy as many technologies such as building integrated solar, heat pumps, farm-scale Anaerobic Digestion (AD) and small-scale biomass can be located in nearly all areas.

Results of Technical Potential Assessment

3.8 The following section provides a summary of the technical potential for each technology type, in the following format:

- Brief description of the technology;
- Main assumptions used to calculate the technical potential (a detailed list of assumptions is provided in **Appendix 3.1**);
- Results and commentary.

Wind Energy

Description of technology

3.9 On-shore wind power is an established and proven technology with thousands of installations currently deployed across many countries. The UK has the largest wind energy resource in Europe. The UK Renewable Energy Strategy (2009) sets out a lead scenario in which wind generation, both onshore and offshore, will provide over two thirds of our renewable electricity supply by 2020.

3.10 Wind power uses energy from the wind to turn a rotor connected to an electrical generator. Although there are no rigid categories relating to the scale of wind turbines, for the purpose of this study, four size bands have been considered as follows:

Table 3.1: Typical scales of wind turbines

Scale	Typical Turbine Installed Capacity	Typical Turbine Height (to blade tip)
Micro	6kW	15m
Small	500kW	15-40m
Medium	900kW	40-80m
Large	2.5MW	80-135m

3.11 Most large and medium developments are connected to the national grid. Medium and small scale turbines may provide electricity for a single premises (e.g. a farm) or be connected to the grid directly for export. The number of turbines used per site ranges from the deployment of single turbines up to large groups of turbines (known as wind farms) capable of generating tens of megawatts. The amount of energy that turbines generate will depend primarily on wind speed but will be limited by the maximum output (kW/ MW) of the individual turbine.

Assumptions used

3.12 The assessment of technical potential for large, medium and small turbines was undertaken using GIS (Geographical information Systems) involving spatial mapping of the key constraints and opportunities. The assessment identified the areas with potential viable wind speeds and the number of turbines that could be theoretically deployed within these areas. A series of constraints relating to physical features and environmental protection were then removed.

3.13 The following key constraints and opportunities were considered. (Please note: The assumptions used for micro wind are set out in the micro generation section later in this chapter):

- **Wind speed –** e.g. assumed that a viable wind speed is 5 m/s at 45m above ground level.
- **Wind turbine size** – see Table 3.1 above for size of turbines considered and their output.
- **Wind turbine density** – i.e. assumed that it was possible to locate 4 large turbines, 10 medium and 50 small turbines per km^2.
- **Non accessible areas** – the following areas were excluded:
  - Roads
  - Railways
  - Inland waters
  - Built up areas
  - Airports (but none found in Borough)
  - Public rights of way
  - Overhead transmission lines etc.
- **Exclusion areas** – the following areas were excluded:
  - Ancient woodland
  - Sites of historic interest
  - Conservation areas
  - National and international nature conservation areas
  - Topple distance buffer around rail and roads (tip height plus 10%)
  - Topple distance buffer around public rights of way buffer (tip height +10%)
  - Buffers relating to proximity to residential and commercial properties - to take account of noise issues. (For domestic buildings the following buffers were applied: large turbines – 600m, medium - 500m, Small – 400m, Commercial properties – uniform 200m buffer)
  - Local Wildlife Sites
  - Slope (maximum 15 degrees)
- **MOD constraints** – safeguarding areas and MOD danger areas.

3.14 See **Appendix 3.1** for a detailed list and explanation of the parameters/ assumptions used.

3.15 The potential impact of wind turbines on the landscape is a key issue which can significantly affect where turbines are located. This has not been considered as part of the technical assessment as theoretically wind turbines can be sited within sensitive landscapes. A detailed consideration of the sensitivity of the landscape within Hinckley and Bosworth to wind turbines is provided in **Chapter 4.** The results of this sensitivity assessment are then incorporated into the assessment of deployable potential for wind in **Chapter 6.**

Results

3.16 **Table 3.2** below provides a summary of the technical potential for wind energy within the Borough. The analysis examined the potential for large, medium and small turbines and where potential existed for more than one size of turbines, it was assumed that the larger turbines would take precedence – i.e. to calculate the maximum technical potential.

Table 3.2: Summary of Technical Potential for Wind Energy

Resource	2020 (MW)	2020 (GWh)	2026 (MW)	2026 (GWh)
Large Wind (80-135m)	103.47	234.76	103.47	234.76
Medium Wind (40-80m)	151.23	343.12	151.23	343.12
Small Wind (15-40m)	297.67	675.37	297.67	675.37
Total - electricity	**552.37**	**1253.25**	**552.37**	**1253.25**

3.17 **Figure 3.4** shows the areas which have technical potential for wind energy. Please note that this assessment does not provide a sufficient evidence base for the actual siting and delivery of wind turbines but gives a high level assessment of potential areas that could be analysed in more detail.

3.18 In order to calculate the technical potential a series of opportunity and constraints maps were produced. **Figure 3.1** shows the wind speed within the Borough at 45m above ground level (agl). All areas within the Borough have wind speeds in excess of the minimum cut off of 5m/s with the highest wind speeds in the north east of the Borough and the lowest wind speeds around Atherstone. Wind speeds of 5m/s or above at hub height are needed to operate wind turbines efficiently, although many developers would not look to develop sites at the present time at sites with wind speeds lower than 6m/s.

3.19 It is important to acknowledge that macro scale wind data (such as NOABL[6]) which was used for this assessment can be inaccurate at the site specific level and therefore can only give a high level assessment of potential within the area. Developers looking at specific sites (particularly for large scale turbines) will normally require wind speeds to be accurately monitored using anemometers for an extended period of time, typically at least one year.

3.20 The results show that there is a total technical potential to deliver around 552MW of electricity from wind power in the Borough with the greatest potential for small and medium wind turbines as there are less constraints to these size of turbines in relation to proximity to dwellings. In reality, as will be discussed in **Chapter 4**, the deployable potential for wind is significantly lower.

3.21 The technical wind opportunity map for Hinckley and Bosworth (see **Figure 3.4**) indicates that there are pockets of land throughout the Borough that have potential for large, medium and small scale wind turbines. The maps shows negligible land availability in the more urban and suburban areas of the Borough including Hinckley, Barwell and Earl Shilton and where there are nature conservation and heritage designations such as the Bosworth Battlefield and pockets of ancient woodland local nature reserves[7] and SSSIs to the north west in the Charnwood Fringe area (see **Figures 3.2**). There is greatest potential for large and medium scale turbines in the more rural areas to the west of the Borough, where there are fewer property and infrastructure constraints (see **Figures 3.3, 3.5 and 3.6**). Access to the grid is however more problematic in these areas. There are significant areas of rural farmland throughout the Borough which are technically suitable for medium and small scale wind (see **Figures 3.6 and 3.7**), although again access to the grid is more problematic in the western part of the Borough where there are no 33kV substations.

3.22 The assessment of technical potential has not considered aviation constraints as no response was received from the MOD or NATS/NERL and detailed consultation is needed on a site by site basis to ascertain if it is likely to be significant concern or not. **Figure 3.8** illustrates the key aviation safeguarding considerations within the Borough. The maps show that radar interference could be a key constraint for large turbines and that mitigation may be required in relation to regular MOD low fly zones which cover most of the Borough. A clearer understanding these issues is required at the site specific level to determine their applicability and as such aviation constraints have not been used to rule out areas of potential as part of this technical assessment.

Biomass

Description of technology

3.23 Biomass can be generally defined as material of recent biological origin, derived from plant or animal matter. Modern biomass heating technology is well developed and can be used to provide heat to buildings of all sizes, either through individual boilers or via district heating networks. Biomass is also increasingly being used to fuel electricity plants or combined heat and power

[6] NOABL (National Oceanic and Atmospheric Administration (NOAA) Boundary Layer) wind speed database developed by ETSU for the DTI (Department of Trade and Industry) in 1997. This provides an estimated wind speed for a 1 km square at 10 m, 25 m and 45 m above ground level. The wind speed data in the ETSU NOABL database is the result of an air flow model that estimates the effect of topography on wind speed. There is no allowance for the effect of local thermally driven winds such as sea breezes or mountain/valley breezes or local roughness such as buildings and trees which can have a considerable effect on wind speeds.

[7] Local Nature Reserves were excluded at the request of Natural England.

(CHP) plants due to the low carbon emissions associated with its use. There are five main main types of biomass resource:

3.24 The principal sources of biomass fuel are as follows:

1. **Woodfuel** – products from management of existing woodlands (small diameter roundwood from coppicing or branches, lop and top as forest residues). Alternately biomass may be derived from new woodlands specifically planted for the purpose (e.g. short rotation forestry (SRF). The potential for SRF has not been assessed in this study.
2. **Energy crops** – these are multi-annual short rotation coppice willow and poplar (SRC) which are coppiced every 2-4 years and miscanthus and other energy grasses (e.g. reed grass and switchgrass) which are cut annually.
3. **Agricultural by-products** e.g. straw.
4. **Poultry Litter** e.g. the use of poultry bedding and manure.
5. **Waste wood** – i.e. primary processing co-products (sawdust, slabwood, points etc.) and clean wood waste from industry (e.g. pallets, furniture manufacture). General wood waste can also be used as a renewable fuel but contains contaminants which severely constrain the type and size of plant in which it can be used.
6. **Wet organic waste** e.g. animal manure and slurry and commercial/ MSW, food waste, grass and silage. This is usually used to generate energy via anaerobic digestion (AD) - the process of breaking down plant or animal matter by microbial action in the absence of air, to produce a gas with high methane content.

3.25 Arboricultural arisings from the pruning of trees are a potential sixth source of plant biomass which are not covered by the study.

3.26 Biomass plants can use the resources listed in 1-5 above to generate electricity, thermal energy or a combination of the two:

- **Plants designed primarily for the production of electricity.** These are generally the largest schemes, in the range 10–40 MW. Excess heat from the process is not typically utilised. These plants are major multi-million pound developments and due to their large size and requirement for significant quantities of biomass, they are unlikely to come forward for development within the Borough.
- **Combined Heat and Power (CHP) plants** where the primary purpose is the generation of electricity but the excess heat is utilised, for instance as industrial process heat or in a district heating scheme. The typical size range for CHP is 5-30 MW thermal energy output but smaller 'packaged' schemes of a few hundred kilowatts have been built in the UK. Most UK CHP systems are sized to have a thermal output of 1.5-2.5 times the electrical output.
- **Plants designed for the production of heat.** These cover a wide range of applications from domestic wood burning stoves and biomass boilers to boilers of a scale suitable for district heating, commercial and community buildings and industrial process heat. Their size can range from a few kilowatts to above 5MW thermal (heat) energy.

3.27 As outlined above, wet organic waste is used to generate energy via anaerobic digestion.

3.28 This assessment considers the energy output from biomass in the form of electricity and heat. Both options are therefore included in the assessments as appropriate.

3.29 Please note that the assessment of technical potential does not take into account imported sources of biomass (i.e. from outside the Borough) which in reality could make up a significant proposition of the biomass resource used within Hinckley and Bosworth in the future. This is considered in the assessment of deployable potential.

Assumptions used

1. Woodfuel

3.30 The assessment to estimate the technical potential of managed woodland within the Borough was based on the GIS assessment undertaken for the Borough as part of the East Midlands Study. This involved the identification of woodland within the Borough followed by the application of various assumptions about current management arrangements and constraints in terms of competition from alternative markets etc. The key assumptions used included:

- **Woodland estimate** - using National Forest Inventory data.
- **Yield classes** per woodland type (e.g. broadleaved, coniferous, mixed etc.).
- **Woodland management** – i.e. unmanaged, managed private, Forestry Commission managed.
- **Fuel requirement and conversion efficiencies** (for electivity and heat).
- **Available feedstock and competing uses** – i.e. amount uneconomic to harvest or woodfuel that could go to alternative markets.

2. Energy crops

3.31 The potential for energy crops could not be assessed using GIS as spatial data was not available. The key factors used to assess the technical potential from **energy crops** included:

- **Availability of land** - assumed energy crops planted on all bare and fallow land and an additional 10% of land in food production.
- **Type of Energy crop**: assumed 75% of land would be planted with miscanthus and 25% Short Rotation coppice (SRC).
- **Yield**: assumptions regarding yield i.e. oven dried tonnes per ha – assumed a 10% increase in yield in a 10 year period.
- **Fuel requirement, plant efficiencies and conversion factors**.
- **Exclusion areas –**applied various assumptions regarding % of land that would be inappropriate for conversion to energy crops e.g. common land, nature conservation designations, historic sites, BAP habitats, permanent grassland, grade 4 and 5 land only .

3. Agricultural Arisings (Straw)

3.32 The assessment methodology for agricultural arisings involved identifying the amount of wheat, spring barley & oilseed rape straw available in the region. A reduction in the quantity of feedstock available was then applied to take account of the demand for straw for animal bedding and feed (e.g. spring barley). The key assumptions included:

- **Existing feedstock** e.g. assumed 3 tonnes per ha of wheat and winter barley, 2 tonnes per ha of spring barley, 1.2 tonnes per ha of oil seed rape.
- **Fuel requirement, plant efficiencies and conversion factors**.
- **Competing demands** – assumed 50% of total straw will be used for cattle bedding and 100% of spring barley is used for animal feed.
- **Farmed area** - assumed area farmed for straw will remain constant until 2026.

4. Poultry Litter

3.33 The assessment methodology for poultry litter was undertaken by estimating the amount of poultry litter available from broiler birds. It was assumed that all of this resource could potentially be made available for energy generation. The key assumptions included:

- **Existing and potential feedstock –** i.e. number of birds as obtained from Census of Agriculture and Horticulture (2007 and 2010[8]) and assumed litter generation – i.e. per 1000 birds, assumed 16.5 tonnes of litter is produced per annum.
- **Feedstock requirements** – i.e. 11,000 tonnes of poultry litter required to generate 1MW per annum.

5. Waste Wood

3.34 It has not been possible to estimate the proportion of energy that could be generated from waste wood in the Borough as there is no publicly accessible information on waste wood arisings.

3.35 As part of the East Midlands Low Carbon Energy Opportunities and Heat Mapping Study (2011), an estimate of waste wood was generated based on the commercial and industrial waste wood arising within the East Midlands as set out in a WRAP waste wood market report (WRAP Wood Waste in the UK, 2009). The arisings for Hinckley and Bosworth were then calculated by prorating the arisings according to the number of employees within the Borough. This led to an estimate that there were around 6000 tonnes of waste wood arisings within the Borough. Further assumptions were then applied to take account of competing uses – such as for the manufacturing of wood panels using co-products.

3.36 As part of the research of this study, Environment Agency information (as mapped in WRAP, The Business Case for Waste Wood Hubs, 2012) identified that waste wood arising within the Borough is less than 1000 tonnes (6 times less than the estimate used for the East Midlands Study). The exact amount of arisings is not known but is considered to be minimal. Based on the very limited amount of waste wood resource available within the Borough, this study concludes that there is *negligible potential* for the generation of energy from waste wood within the Borough. This resource is therefore not considered further in this report.

6. Wet organic waste

3.37 The assessment methodology for wet organic waste was undertaken by estimating the amount of cattle and pig manure and commercial/ MSW food waste and grass and silage available. Reductions were then applied regarding the limits to extraction based on adhering to health and safety requirements and competing demand for use of the waste.

- **Existing feedstock** – i.e. used data on livestock numbers multiplied by manure factor and data for food and drink waste. Included grass and silage as potential feedstock.
- **Fuel requirements** - Assumed 37,000 tonnes of wet organic waste is required for 1MW capacity per annum.
- **Available feedstock and competing uses** – assumed collectable portion of cattle and pig manure is reduced as they are not housed all year round. Assumed not all food and drink waste is available for energy.

3.38 See **Appendix 3.1** for a detailed list and explanation of the parameters/ assumptions used.

Results

3.39 **Table 3.3** below provides a summary of the technical potential for heat or electricity generation from the various biomass resources within the Borough.

[8] Detailed Borough level information was not available for 2010 for all of the figures required some interpolation between the 2007 and 2010 surveys was undertaken.

Table 3.3: Summary of Technical Potential from Biomass

Technology	2020 (MW)	2020 (GWh)	2026 (MW)	2026 (GWh)
Woodfuel (heat)	1.80	7.10	1.80	7.10
Woodfuel (elec)	0.30	2.26	0.30	2.26
Energy Crops (heat)	17.71	69.81	18.77	73.99
Energy Crops (elec)	3.04	22.90	3.23	24.33
Agricultural Arisings (heat)	2.36	9.30	2.36	9.30
Agricultural Arisings (elec)	1.91	10.04	1.91	10.04
Waste Wood (heat)	Negligible			
Waste Wood (elec)				
Poultry Litter	0.07	0.37	0.07	0.37
Wet Organic Waste (heat)	4.82	19.72	4.82	19.72
Wet Organic Waste (elec)	4.02	21.13	4.02	21.13
TOTAL - heat	**26.69**	**105.93**	**27.75**	**110.11**
TOTAL - electricity	**9.34**	**56.7**	**9.53**	**57.13**

3.40 The results indicate that the Borough has limited biomass resources in relation to managed woodland, agricultural arising, waste wood and wet organic waste. However, this assessment only considers the local resource and not the potential to import biomass from neighbouring authorities. The importing of biomass is considered in more detailed as part of the assessment of deployable potential in **Chapter 6.**

Woodfuel

3.41 The assessment estimates that there is a technical potential to deliver 1.8 MW of heat or 0.3MW of electricity from the managed woodland within the Borough.

3.42 **Figure 3.9** shows the locations of these woodlands which spread throughout the Borough with some concentrations around the National Forest area to the north east and in the central corridor between the A444 and A447. The remainder of the National Forest outside the Borough does represent a significant wood fuel resource that could be used within biomass schemes in the north of Hinckley and Bosworth. The National Forest estimate that over the next 20 years up to 7,000 tonnes per year of woodfuel could be provided from the Forest.

3.43 Approximately half of the woodfuel resource identified within the Borough is currently in unmanaged woodlands. Whilst this potential resource can be utilised, it can be more challenging as there are no existing woodland management strategies and there may be a large number of landowners involved. **Figure 3.10** shows the current management arrangements of the woodland.

Energy Crops

3.44 The assessment estimates that there is the technical potential to deliver 17.71 MW of heat or 3.04MW of electricity from energy crops grown within the Borough. This assumes that energy crops are planted on all bare and fallow land in addition to 10% of land in food production. To date no energy crops have been planted in Hinckley and Bosworth.

3.45 In 2009 The Department for the Environment, Fisheries and Rural Affairs (DEFRA) published a series of regional maps indicating the local suitability of land for energy crops. The short rotation coppice map shows that the majority of Hinckley and Bosworth has a suitability of medium to high i.e. is expected to produce yields of over 8 oven dry tonnes (odt) per hectare per year. However, a variety of factors will influence the willingness of farmers to convert land to biomass production.

Agricultural Arisings

3.46 The assessment estimates that there is the technical potential to deliver 2.36MW of heat or 1.91MW of electricity from straw grown within the Borough. Approximately 78% of Hinckley and Bosworth is made up of agricultural land, including significant proportion for arable crops. Straw is however a market commodity which is required for a variety of uses including animal bedding, soil conditioner and animal feed etc. In reality only a small proportion of the viable resource will be available for energy production. The physical and chemical properties of straw also make it less suitable for heating applications but more suitable for large scale power production. These issues are considered further in the assessment of deployable potential.

Waste Wood

3.47 As outlined above, it has not been possible to estimate the proportion of energy that could be generated from waste wood in the Borough as there is no publicly available information on waste wood arisings. It is however known that the level of arisings are low (i.e. less than 1000 tonnes according to a recent WRAP report which cites EA figures) so the total technical potential is likely to be negligible. The use of waste wood does however have clear advantages as it can divert the disposal of wood to landfill, thereby also saving on disposal costs.

Poultry Litter

3.48 The assessment estimates that there is the technical potential to deliver 0.07MW of electricity from poultry litter within the Borough. The exact number of broiler hens within the Borough is not known but is estimated to be under 50,000. This is a minimal potential resource which is more likely to be more applicable for use as part of the feedstock for anaerobic digestion plants, along with cattle manure and pig slurry etc.

Wet Organic Waste

3.49 The assessment estimates that there is a technical potential to deliver 4.82MW of heat or 4.02 MW of electricity from wet organic wastes within the Borough. As previously outlined, there are a variety of waste streams that can be used for anaerobic digestion energy generation including animal manure and slurry and commercial/ MSW food waste, grass and silage. The assessment indicates that there are approximately 21,000 head of cattle and nearly 8,000 pigs generating around 127,600 tonnes of waste a year that could be used for AD. This is in addition to 6000 tonnes of food waste (from C&I waste) and 3,350 tonnes of silage and maize. As outlined above straw and energy crops can also be used in AD and form additional potential resource streams.

3.50 The assessment of technical potential is however subject to a number of caveats as the availability of animal manure depends whether the animals are kept indoors or outside and this is not known. There was also no C& I data available at the Borough level and therefore some interpolation had to be undertaken from the County and regional data.

3.51 In 2007, Leicestershire County Council published a feasibility study on Anaerobic Digestion. The study 'Biogas in Leicestershire, A Technical Feasibility Study for Leicestershire Anaerobic Digestion – A Renewable Energy Resource'. The study concluded that Leicestershire encompasses a considerable resource of animal manure, as well as considerable food waste resources which could be used for anaerobic digestion. The most significant issue however is the fact that a significant proportion of the available feedstock tends to be produced by a large number of smaller dispersed farms which makes it more difficult to establish plants. Further information on this is provided in **Chapter 6** in the assessment of deployable potential.

Waste

Description of technology

3.52 There are three main forms of waste that can be used to generate energy. (these are in addition to wood waste outlined in the previous section on biomass):

- **Municipal solid waste (MSW)** is collected by local authorities. It is mainly composed of household waste but also includes street sweepings, waste from reuse and recycling centres as well as local authority collected commercial and industrial waste. It does not include domestic sewage and waste water. The biodegradable fraction of municipal solid waste is considered to be a source of biomass. It can be combusted directly in an incinerator or by using advanced thermal treatments such as gasification or pyrolysis. These latter two processes tend to be used for electricity generation plant or combined heat and power (CHP) units as they involve chemically transforming the feedstock into a different form such as gas or oil, which is more suitable for electricity generation plant. Alternatively, it can also be anaerobically digested to generate 'biogas'.

- **Commercial and industrial (C&I) waste -** *Commercial waste* is waste from premises used wholly or mainly for the purposes of a trade or business or for the purpose of sport, recreation, education or entertainment but not including household, agricultural or industrial waste. *Industrial waste* is waste arising from the provision of public services and industrial activities, but excluding construction and demolition material. Some components are very similar in nature to municipal solid waste (particularly wastes from offices, e.g. paper, card, food wastes). The biodegradable fraction of commercial and industrial waste is therefore also a source of biomass, which can be combusted directly in an incinerator along with biodegradable MSW, or by using advanced thermal treatments such as gasification or pyrolysis to be used for electricity generation plant or combined heat and power (CHP) units. Alternatively, it can also be anaerobically digested to generate 'biogas'.
- **Landfill gas -** Landfill sites generate methane-rich gas which has been commercially exploited in the UK since the early 1990s. These almost all use electricity-only gas turbines or internal combustion engines. The gas originates from the putrescible or organic content of the municipal waste that has been disposed of in the landfill. Estimates suggest that biogas production builds up to peak around 10 years after sites are closed to new waste, and may continue at a falling rate for as long as 50 years afterwards.

Assumptions used

Municipal Solid Waste (MSW)

3.53 The assessment was undertaken using local authority municipal and household waste statistics from the waste management authority – i.e. Leicestershire County Council. Various assumptions were applied relating to future predicted waste levels and feedstock requirements. The key assumptions included:

- **Existing and potential feedstock** – used Hinckley & Bosworth waste statistics for 2011/12. Assumed increase in waste due to changes in household numbers based on CLG data. Assumed biodegradable fraction is 68% of total MSW.
- **Feedstock requirement** – Applied a benchmark of 10 kilo tonnes of MSW required for 1MW capacity per annum.

Commercial and Industrial Waste (C & I)

3.54 C & I data is not available at the local authority level. The assessment of the potential for generating energy from commercial and industrial waste was undertaken using estimates of the DEFRA waste arisings data for the East Midlands and the C&I waste arisings for Leics/LCC/Rutland from the Annual Monitoring Report. The key assumptions included:

- **Existing and potential feedstock** – included animal and vegetable waste and non-metallic waste from DEFRA survey – excluded sectors covered elsewhere and food and drink etc. Future C & I waste was based on future employee number projections.
- **Feedstock requirement** - Applied a benchmark of 10 kilo tonnes of C & I required for 1MW capacity per annum.

Landfill

3.55 The Office of Gas and Electricity Markets (OFGEM) Renewables Obligation register was used to identify the capacity of the existing Bradgate Landfill site within Hinckley and Bosworth. There are no operational landfill sites within the Borough. Data specific to Bradgate supplied by Inifnis was used to calculate the on-going energy generation capacity of the site until 2020 and 2026.

Results

3.56 **Table 3.4** below provides a summary of the technical potential for electricity generation from the various waste sources within the Borough.

Table 3.4: Summary of Technical Potential from Waste

Technology	2020 (MW)	2020 (GWh)	2026 (MW)	2026 (GWh)
Municipal Solid Waste (MSW) (heat)	6.44	33.85	6.82	35.85
Municipal Solid Waste (MSW) (elec)	3.22	16.92	3.41	17.92
Commercial and Industrial (heat)	8.32	43.73	8.56	44.99
Commercial and Industrial (elec)	4.16	21.86	4.28	22.50
Landfill Gas	1.05	5.20	0.71	3.50
TOTAL - heat	**14.76**	**77.58**	**15.38**	**80.84**
TOTAL - electricity	**8.43**	**43.98**	**8.4**	**43.92**

3.57 The assessment estimates that there is a technical potential to deliver a total of around 8.4MW of electricity and 14.76 MW of heat from waste sources by 2020 rising very slightly in 2026. The largest potential resource is from Commercial and Industrial Waste with an estimated 41,000 tonnes of biodegradable waste available per annum by 2020. This compares with 32,000 tonnes of waste available from MSW. The assessment of potential from landfill gas is based on the MWh output figures and projections from the Bradgate Landfill Gas Officer. The technical potential for landfill is therefore an accurate estimate of the deployable potential for this technology as there are no other existing or planned landfill gas sites in the Borough.

Small Scale Hydro

Description of Technology and Assumptions

3.58 The assessment of potential for small scale hydro power was based on the Environment Agency (EA) hydropower study '*Mapping Hydropower Opportunities in England and Wales'* (2009). The study used flow estimation techniques in addition to height data to calculate the potential 'barriers' for hydropower. The term 'barriers' was used to describe sites with sufficient drop to provide a hydropower opportunity. They are mostly weirs, but could also be other anthropogenic structures or natural features, such as waterfalls. Other environmental data was also classified to give a sensitivity categorisation to each of the potential barriers. The sensitivity of the barrier was based on presence of certain fish species and whether a location was located within a Special Area of Conservation (SAC).

3.59 Whilst the study identified all potential locations or 'barriers', a subset of these barriers were classified as 'win-wins'. Win-wins are defined in the EA study as being locations or barriers that have a potential greater than 10kW and where a hydropower scheme with a fish pass could deliver an improvement in the local environment (i.e. they are typically located within a heavily modified water body). The study did not identify any win-win locations within Hinckley and Bosworth. In the East Midlands Study – only win-win sites were identified in the technical potential, hence the study did not identify any potential for hydropower within Hinckley and Bosworth. For this study however, all potential barriers identified in the EA study (i.e. not just win-win opportunities) have been included in the assessment of technical potential.

Results

3.60 **Table 3.5** below provides a summary of the technical potential for electricity generation from small scale hydropower within the Borough.

Table 3.5: Summary of Technical Potential for Small Scale Hydro

Technology	2020 (MW)	2020 (GWh)	2026 (MW)	2026 (GWh)
Hydro - electricity	0.12	0.62	0.12	0.62

3.61 **Figure 3.11** shows the location of the hydropower sites identified in the Environment Agency study. A total of 58 sites were identified, all of which are under 10kW. The main rivers and brooks that have potential include the River Sence, Shenton Brook and Slate Brook.

3.62 As outlined above, the Environment Agency study also considers the environmental sensitivity of each site. 34 of the sites are considered to be of medium sensitivity, one of low sensitivity and 23 of unknown sensitivity. The low potential power output of the sites, in combination with the lack of sites with low sensitivity means that hydropower is not a significant renewable resource for Hinckley and Bosworth. There may however be opportunities linked to the restoration of historic mills and weirs, although these are likely to be very small scale schemes.

Large Scale Solar Arrays

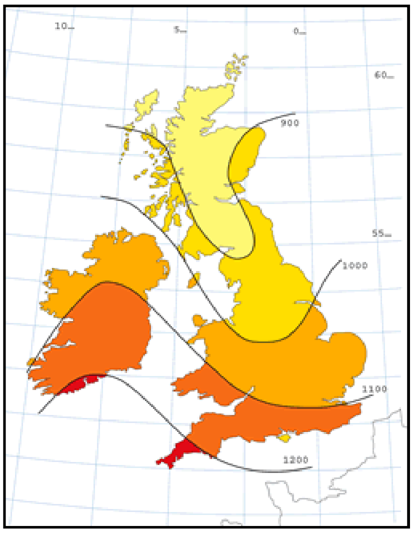
Description of Technology

3.63 In addition to PV modules associated with built development, there are an increasing number of solar PV arrays or solar farms being built in the UK. A solar PV array would typically involve the erection of several rows of PV units on fixed mounted racks or modules set up to track the sun. The size of solar array installations currently being considered by developers in England is around 1-3MW. A 1MW development would typically require a site of approximately 2-3 hectares but sites of up to 5 hectares are being considered on the South West peninsula. The output of a typical panel used would be approximately 200 watts, so a 1MW solar farm would require 500 racks containing 10 panels in each rack.

Assumptions

3.64 No standard methodology exists to examine the potential for Solar PV array potential as this was not included in the DECC methodology. An assessment was also not included in the East Midlands Study. For the purpose of this assessment, the following key assumptions were used:

- **Available resource** – assumed solar irradiation threshold of >800kWh/kW peak).



UK solar irradiation **-** Annual Total kWh/$\mathbf{m^2}$ banding

- **Aspect** – Assumed aspect had to be East through South to West facing slopes and that the slope was less than 15 degrees.
- **Proximity to grid** – assumed that the sites should be located within a maximum of 3km from a 33kV sub-station.
- **Exclusion areas** – the following areas were excluded:

- Local, national and international nature conservation designations
- BAP Habitats
- Local, national and international heritage designations (using revised Bosworth Battlefield boundary)
- Roads, railways and buildings
- Woodland (due to shading potential)
- Agricultural Land Grades 1 and 2 (and 3a where data available)
- Flood Risk Zones 2 and 3
- Minerals sites with a 250m buffer (due to shading caused by dust – research has shown that 98% of airborne dust settles within 250m of the emission source).
- CROW land
- Urban areas

- **Competing land use demands**– Assumed 10% of land has potential due to competing land use demands – i.e. for growing crops etc.

Results

3.65 **Table 3.6** below provides a summary of the technical potential for electricity generation from large scale solar PV arrays within the Borough.

Table 3.1: Summary of Technical Potential for Large Scale Solar PV Arrays

Technology	2020 (MW)	2020 (GWh)	2026 (MW)	2026 (GWh)
Solar arrays - electricity	158.93	139.22	158.93	139.22

3.66 The assessment estimates that there is a technical potential of around 159MW of electricity that could be generated from large scale PV arrays within the Borough. This is clearly a significant resource and a considerable overestimate of what could actually be delivered within the Borough. A summary of the areas that are constrained for solar array developments are shown in **Figures 3.12-3.13**. Essentially, there are large areas of agricultural land that could be used to accommodate large scale solar PV arrays as all of Hinckley and Bosworth exceeds the solar irradiation threshold of >800kWh/kW peak. The financial viability of these schemes has however been significantly affected by the recent government change to the Feed in Tariff rates for PV schemes above 250kW. This is discussed in more detail in **Chapter 6.**

Microgeneration

Description of Technology

3.67 There are four main microgeneration technologies:

- **Roof mounted Solar Photovoltaic (PV) cells** - Solar PV systems use solar cells to generate electricity directly from sunlight. The electricity produced can either be stored in batteries or fed into the grid via the mains supply. Solar PV cells can either be roof mounted or integrated into the roof or facades of buildings through the use of solar shingles, solar tiles/ slates, solar glass laminates and other solar building design solutions.
- **Solar thermal** - Solar thermal or solar hot water systems use solar collectors, usually placed on the roof of a building, to preheat water for use in sinks, showers and other hot water applications. They do not provide enough energy for space heating. While the UK climate is not sufficiently hot and sunny to meet all domestic hot water requirements year round, a well-designed solar thermal system should meet 50-60% of demand during May-September.

- **Heat pumps** - Ground or water source heat pump (GHSP) systems capture the energy stored in the ground surrounding (or even underneath) buildings or from water (rivers, canals, lakes or underground aquifers). Essentially, they use low grade thermal energy from the ground and a refrigeration cycle to deliver heat energy at higher temperatures, (typically 40-45°C) or low temperatures, using a reverse cycle, for cooling (typically 6-12°C). Air source heat pump (ASHP) uses the air as a heat source for heating a building.
- **Micro Wind** – For the purpose of this study, micro wind refers to domestic-sized wind turbines. There are two main types: pole mounted: these are free standing and are erected in a suitably exposed position, often around 5kW to 6kW and building mounted: these are smaller than mast mounted systems and can be installed on the roof of a home where there is a suitable wind resource. Often these are around 1kW to 2kW in size.

Assumptions

3.68 The assessment of technical potential for micro generation technologies is undertaken using a different approach to the other forms of renewables. The technical potential is linked to properties and factors such as building type, orientation, layout and surrounding landscape etc., With the exception of water source heat pumps, the resource is not geographically specific.

Building mounted Solar PV and Solar Thermal

3.69 The assessment of potential for solar energy was based on an estimation of the total number of roofs available for solar panels. Assumptions were applied relating to the percentage of residential, commercial and industrial properties that may be suitable for the installation of solar panels. The same assumptions were applied for solar PV and solar thermal as deployment of either technology is subject to the availability of suitable roof space. The key assumptions included**:**

- **Existing roof space** – various assumptions applied regarding % of domestic, commercial and industrial roof spaces available for solar installations.
- **Potential new roof spaces** – assumed 50% of all new domestic properties would have solar installations.
- **System capacity** – various assumptions were applied regarding the capacity of installations on domestic, commercial and industrial premises.

Heat Pumps

3.70 The assessment of air and **ground source heat pumps** used GIS address location data to calculate the potential for heat pumps based on property type and location. The key assumptions used included:

- **Number of suitable buildings** – influenced by the type of property (domestic, commercial).
- **Suitable new buildings** – assumed 50% of new domestic properties would be suitable.
- **Type of property** – i.e. detached, semi-detached, terraced, flats.
- **Proximity to the existing gas grid** – properties off the gas grid offer the highest potential.
- **System Capacity** - assumed domestic installations have a capacity of 5kW and commercial 100kW.

3.71 The assessment for **water source heat pumps** included the following assumptions:

- **Proximity to water body -** i.e. properties within 250m of lake, reservoir, canal or river.
- **Suitability** – assumed only 10% of commercial and industrial properties would be suitable for water source heat pumps. Excludes residential properties.
- **System Capacity** - assumed domestic installations have a capacity of 5kW and commercial 100kW.
- **Proximity to nature conservation designations -** excluded properties within 250m of a SAC/ SPA/ Ramsar or SSSI.

Micro wind (<6kW)

3.72 The assessment to identify the potential for micro wind (i.e. installations <6kW) was GIS based and involved identifying the number of properties within the areas that have a suitable wind speed. The key assumptions applied included:

- **Number of suitable properties** – i.e. with greatest potential for small scale wind i.e. community, tourism, commercial, industrial isolated residential properties.
- **Wind speed** – included all areas with wind speed .4.5m/s at 10m agl.
- **System Capacity** – assumed 6kW per address point.
- **Exclusions** – applied various constraints relating to type of area (i.e. rural, urban, suburban), heritage designations, concentration of listed buildings.

Results

3.73 **Table 3.7** below provides a summary of the technical potential for microgeneration technologies within the Borough – including solar PV and solar thermal, heat pumps and micro wind.

Table 3.7: Summary of Technical Potential for Microgneration Technologies

Technology	2020 (MW)	2020 (GWh)	2026 (MW)	2026 (GWh)
Small Scale Wind <6kW	12.70	28.81	12.70	28.81
Solar PV	36.80	29.01	40.00	31.54
Solar Thermal	29.50	12.92	32.70	14.32
Air Source/Ground Source Heat Pumps	212.22	483.35	220.22	501.57
Water source heat pumps	7.90	17.99	7.90	17.99
Total - heat	**29.5**	**12.92**	**32.7**	**14.32**
Total - electricity	**269.62**	**559.16**	**280.82**	**579.91**

Solar PV and Solar Thermal

3.74 The assessment estimates that there is a technical potential of around 36.80MW of electricity that could be generated from building related PV installations within the Borough and 29.50MW of heat from solar thermal installations. This is clearly a significant resource, although not all of this will be delivered as is discussed in **Chapter 6**. As outlined in **Chapter 2,** to date 621 solar PV installations have been commissioned in Hinckley and Bosworth, generating 2.6MW of electricity. It is not known how many solar thermal panels have been installed in the Borough.

3.75 The ideal location for solar systems in the Hinckley and Bosworth is a south facing roof angled at around 37 degrees to the horizontal. An equivalent north facing solar PV array would see a 45% drop in power output. In reality however roofs facing south west through to south east with a pitch of 20-60 degrees will also be suitable. It is important however that the panels are not shaded – i.e. from vegetation, trees or adjoining properties. Solar PV installations do have a high capital costs but they are one of the few technologies that can be used to generate electricity onsite and will be an important component in the delivery of Carbon neutral homes.

Small scale Wind <6kW

3.76 The assessment estimates that there is a technical potential of around 12.70MW of electricity that could be generated from micro wind (see **Figure 3.14**). This is likely to be a considerable overestimate of the potential that could realistically deployed as discussed in **Chapter 6.** There has been much debate about the efficiencies of micro scale wind turbines, particularly those which are attached to buildings. Studies[9] indicate that turbine performance is highly dependent upon

[9] *Location, location, location: domestic small-scale wind field trial report* (2009) Energy Savings Trust.

correct installation and the local wind speed so it is vital to accurately predict the wind speed (for at least 3 months) before installing a domestic small-scale turbine. Turbines sited in rural exposed areas free from excessive turbulence and obstructions such as trees, houses or other buildings tend to perform best. Building-integrated wind turbines can be suitable for urban locations – but findings from an EST field trial of 38 building-mounted turbines showed that performance was generally lower than expected, usually because of low wind speeds and poor positioning.

Heat Pumps

3.77 The assessment estimates that there is a technical potential of around 212.22MW of electricity that could be generated from ground and air source heat pumps within the Borough and 7.9MW from water source heat pumps (see **Figure 3.15**). This is very significant technical potential, as theoretically heat pumps could be installed on virtually all properties. In reality however, the deployable potential is likely to be significantly lower due to the economics and practical application of the technology. Properties which are located off the gas main and which have higher levels of thermal efficiency are likely to be more financially viable. This is considered further in **Chapter 6.**

Key Conclusions

3.78 The assessment of potential has highlighted that the technical potential for renewable and low carbon energy within the Borough is substantial. **Figure 3.16** and **Figure 3.17** summarise the results of the analysis for electricity and heat generation.

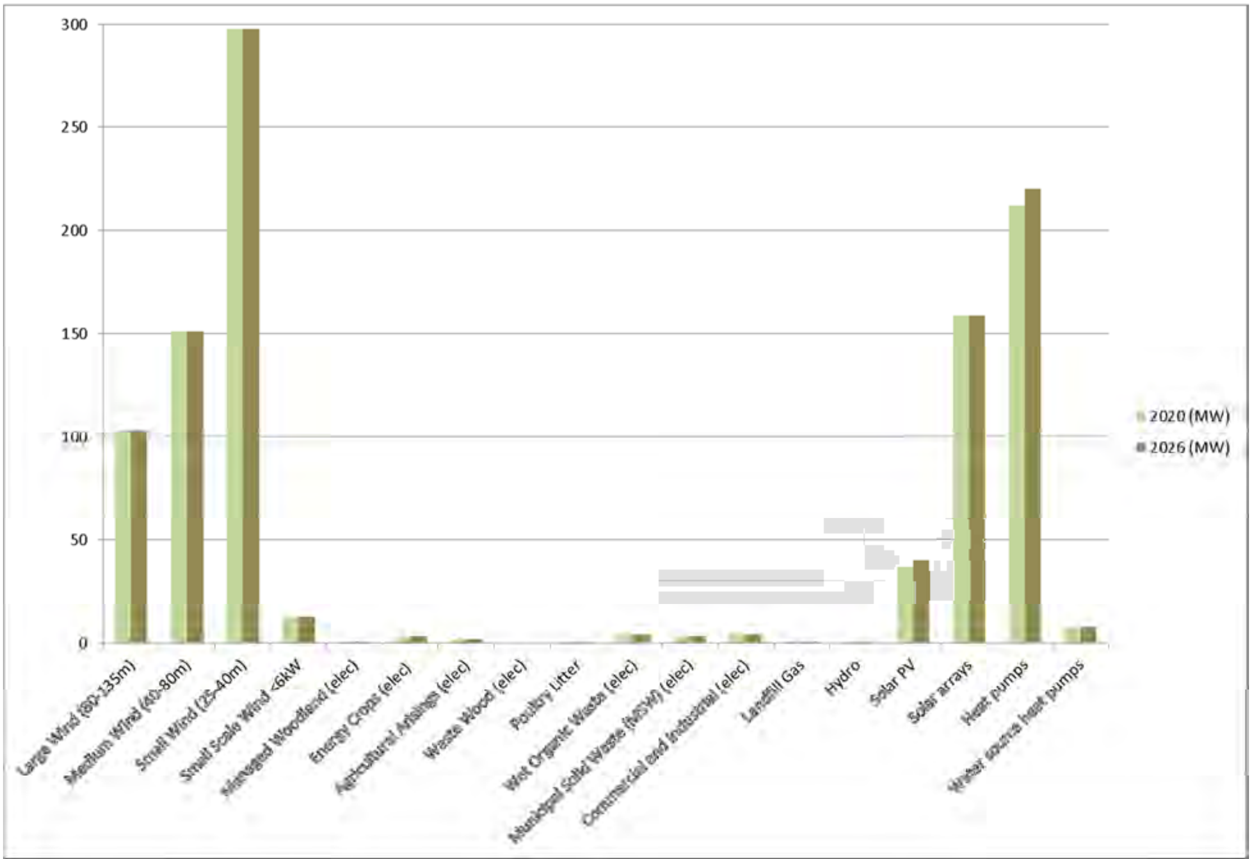


Figure 3.16: Technical Renewable Energy Resource Potential within Hinckley and Bosworth (Electricity)

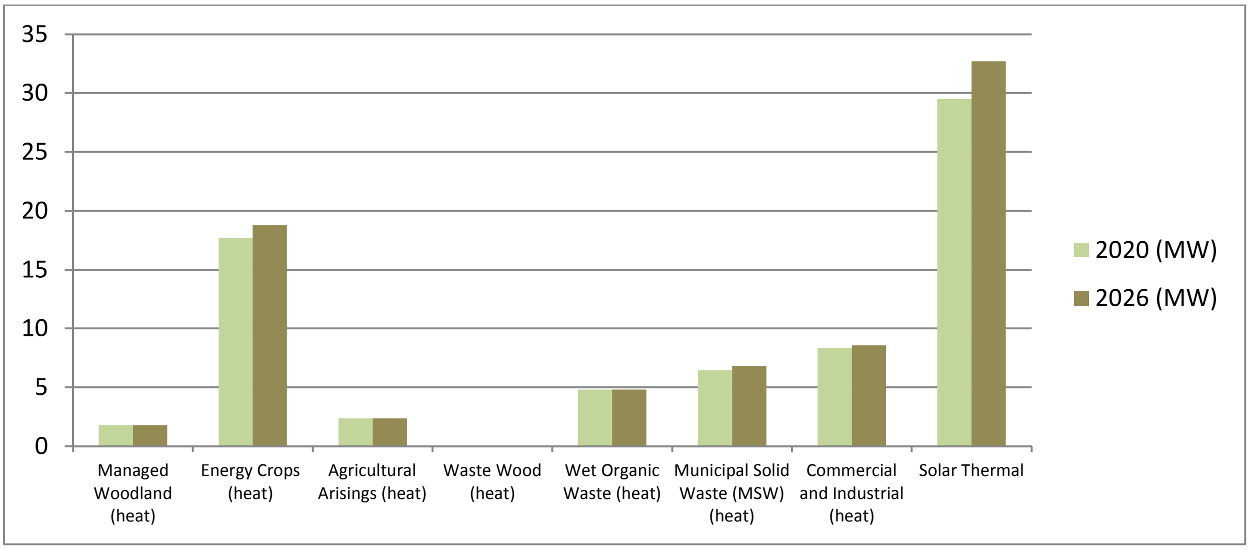
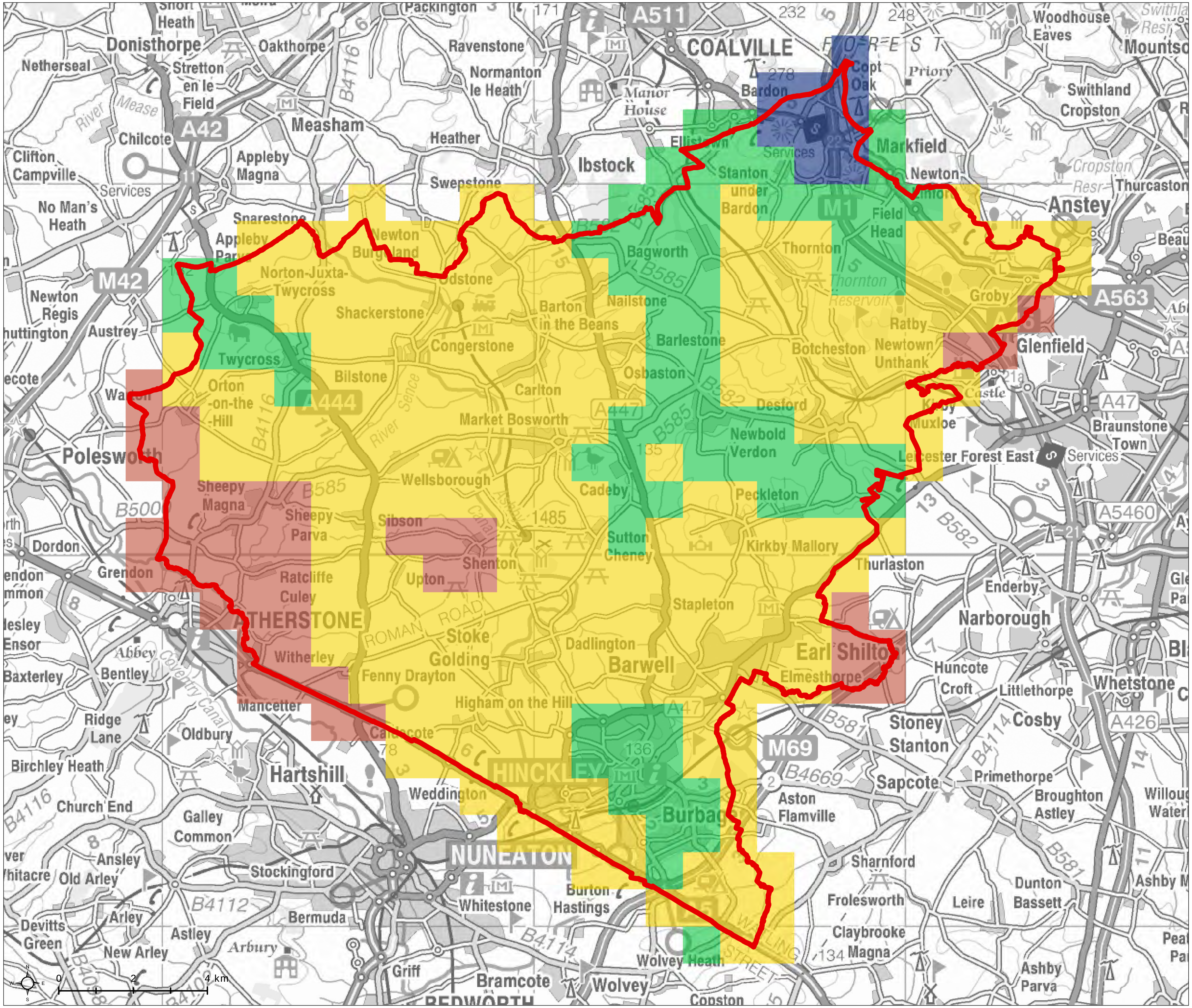


Figure 3.17: Technical Renewable Energy Resource Potential within Hinckley and Bosworth (Heat)

3.79 It is evident from **Figure 3.17** that the technologies with the greatest technical resource for electricity generation are wind, solar PV (particularly solar arrays) and heat pumps. For heat, solar thermal, energy crops and waste present the greatest opportunities. These results however represent the technical potential; **Chapter 6** considers the wide range of other factors such as economic viability, supply chain constraints, cumulative issues, environmental and regulatory constraints and public perception that ultimately affect how much of this technical potential could realistically be delivered within the Borough.



Hinckley & Bosworth Renewable Energy Capacity Study

Figure 3.1

Windspeed at 45m above ground level

Hinckley and Bosworth boundary

Windspeed m/s at 45m agl

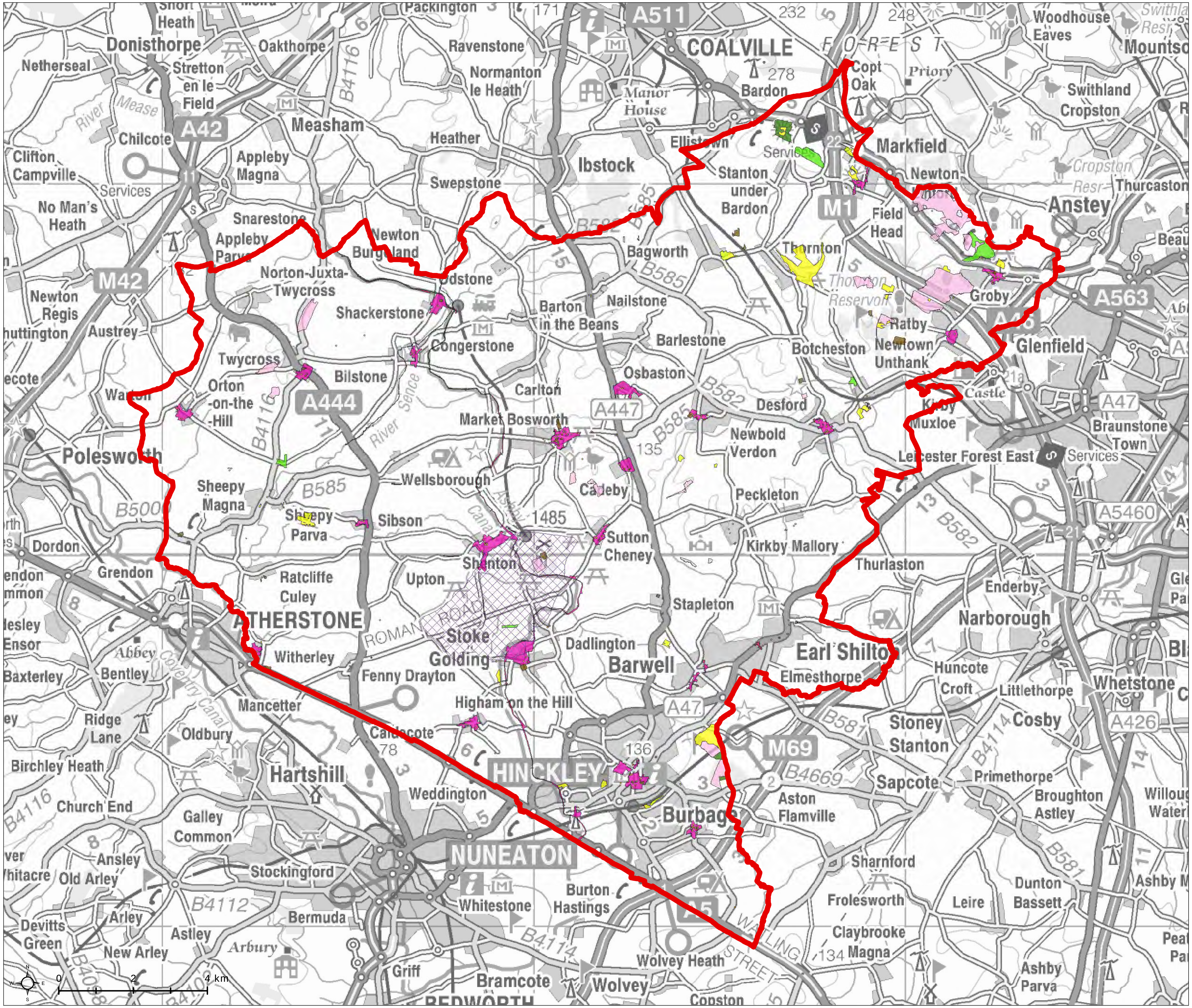
- 5.6 - 6.0
- 6.1 - 6.5
- 6.6 - 7.0
- 7.1 - 7.6

Map Scale @ A3:1:100,000

LUC

LUC LDN 5582-01_015_Commercial_windspeed 13/02/2013

Source: Ordnance Survey, NOABL



Hinckley & Bosworth Renewable Energy Capacity Study

Figure 3.2

Nature conservation and heritage designations

Hinckley and Bosworth boundary

Nature conservation

- Ancient Woodland
- Local Wildlife Sites
- Local Nature Reserve
- Sites of Special Scientific Interest

Heritage conservation

- Listed Building
- Revised Bosworth Battlefield boundary
- Conservation Areas
- Scheduled Monument

Map Scale @ A3:1:100,000

LUC

LUC LDN 5582-01_017_Commercial_wind_designations 13/02/2013

Source: Ordnance Survey, Natural England, English Heritage, Hinckley & Bosworth

Hinckley & Bosworth Renewable Energy Capacity Study

Figure 3.3

Physical infrastructure, recreation and noise constraints

- Hinckley and Bosworth boundary
- Sustainable Urban Extensions

Constraints for large-scale commercial turbines

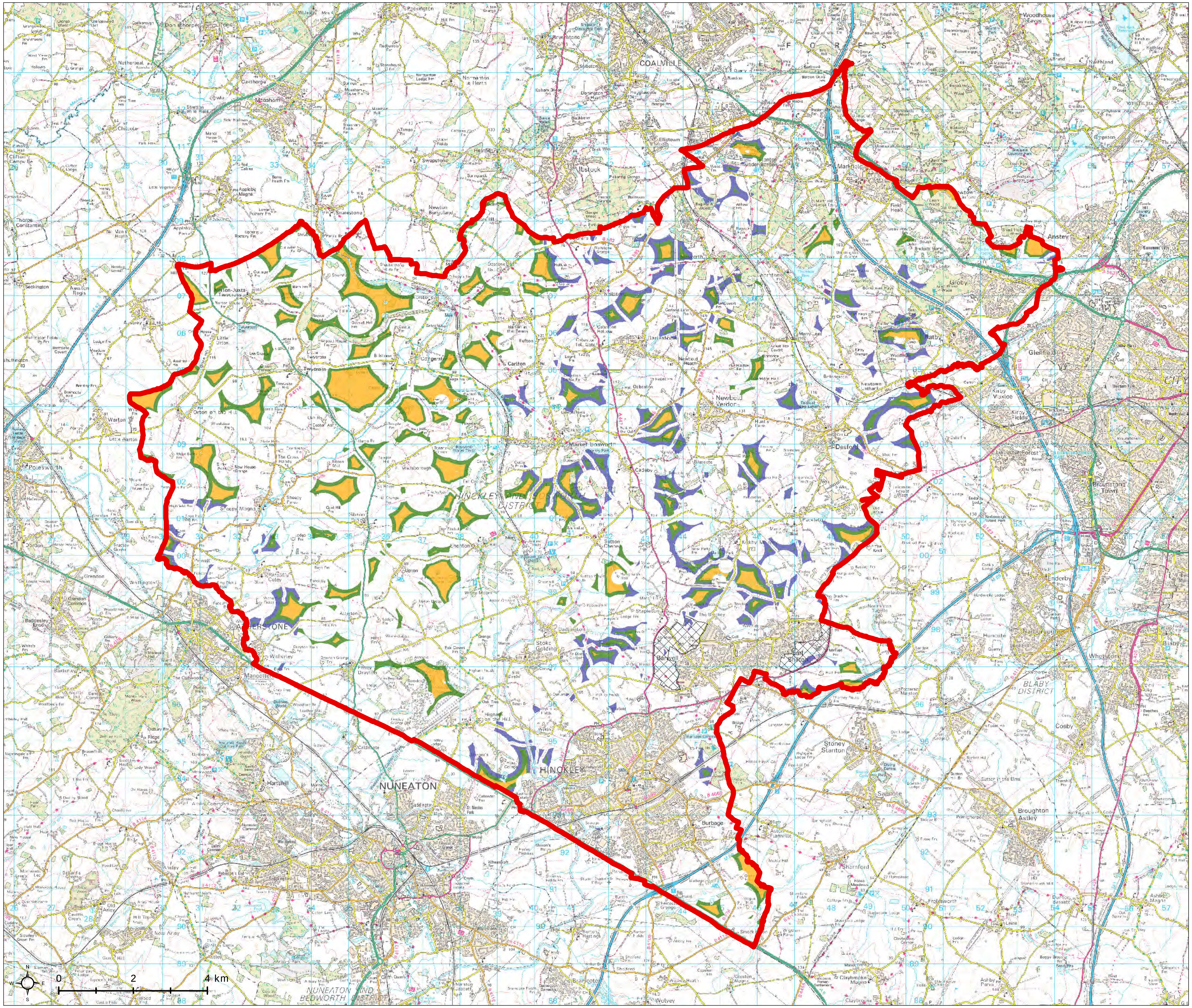
- Roads with topple distance
- Railways with topple distance
- Overhead lines with topple distance
- PROW with topple distance
- Slopes >= 15 degrees
- Waterbodies
- Property noise buffers

Map Scale @ A3:1:100,000

LUC

LUC LDN 5582-01_016_Commercial_win_non_access_RevA 04/04/2013

Source: Ordnance Survey, National Grid, Hinckley & Bosworth, NLPG



Hinckley & Bosworth Renewable Energy Capacity Study

Figure 3.4

Opportunities for small, medium and large-scale wind energy development

- Hinckley and Bosworth boundary
- Sustainable Urban Extensions

Opportunity areas for wind energy development

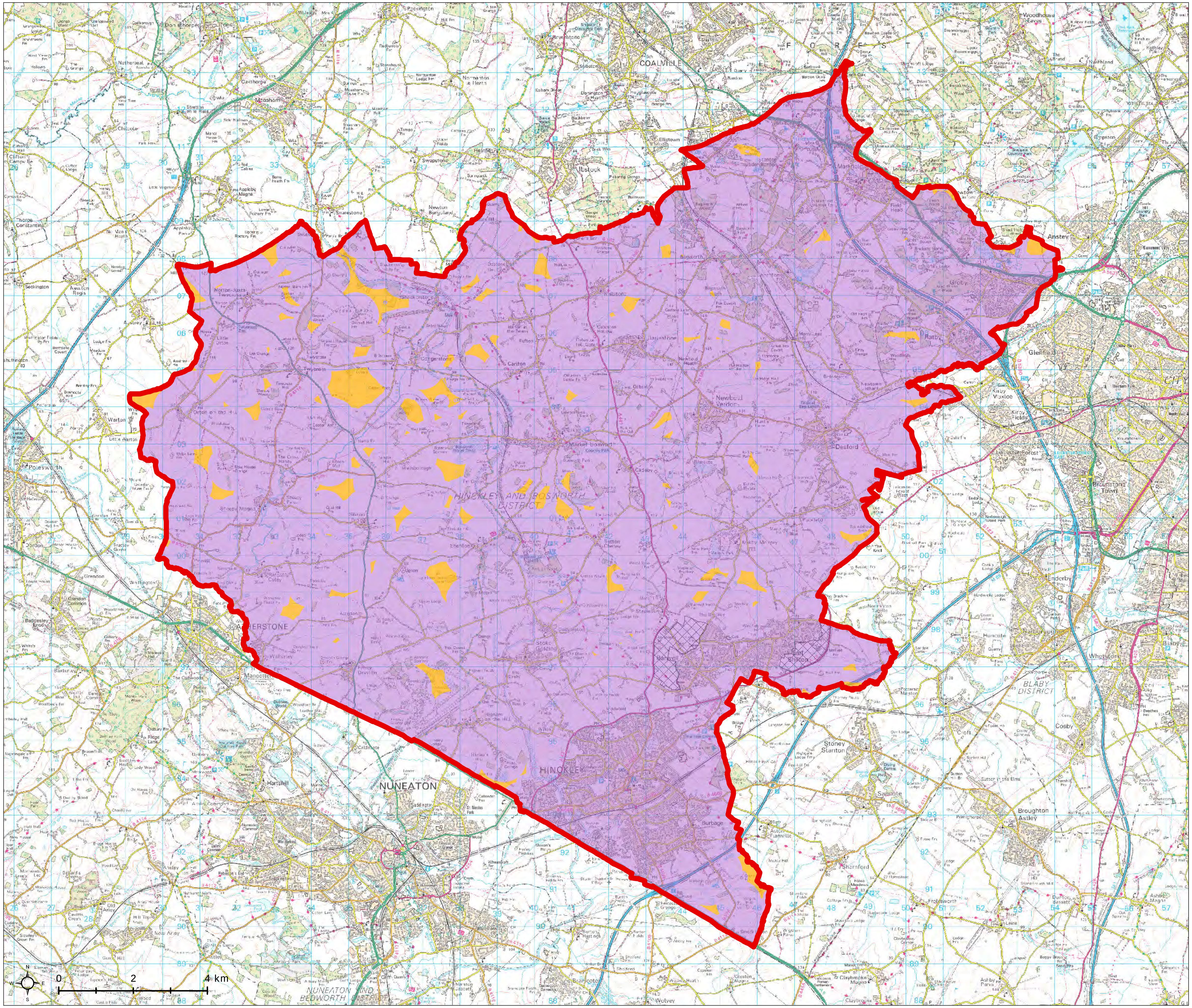
- Large turbines (80 to 135m)
- Medium turbines (40 to 80m)
- Small turbines (15 to 40m)

Map Scale @ A3:1:100,000

LUC

LUC LDN 5582-01_021_Commercial_wind_results_RevA 04/04/2013

Source: Ordnance Survey, Natural England, English Heritage, Hinckley & Bosworth, NLPG, National Grid



Hinckley & Bosworth Renewable Energy Capacity Study

Figure 3.5

Opportunities and constraints for large-scale wind energy development

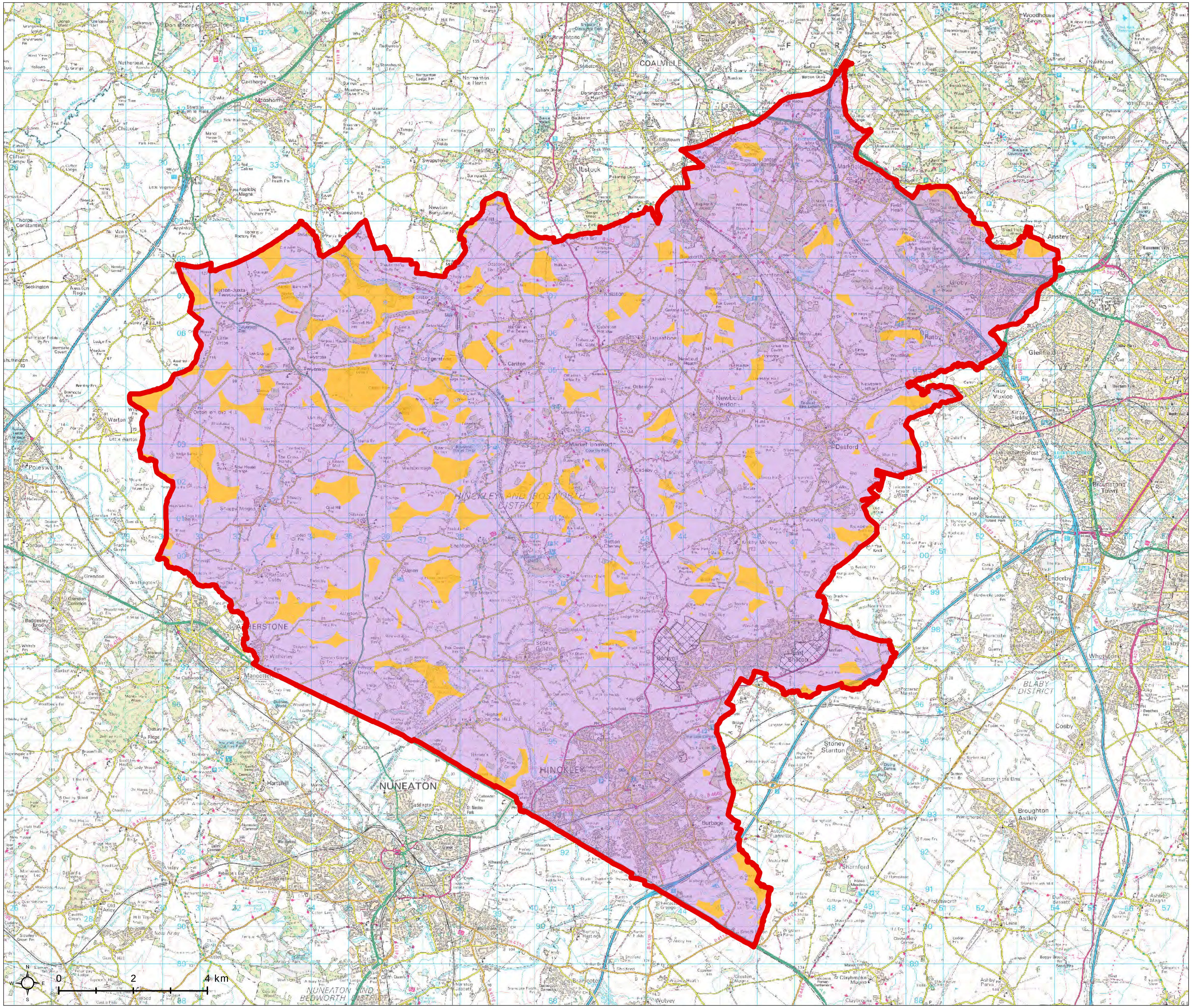
- Hinckley and Bosworth boundary
- Sustainable Urban Extensions
- Unconstrained areas for large-scale wind energy development
- Constraints for large-scale wind energy development

Map Scale @ A3:1:100,000

LUC

LUC LDN 5582-01_018_Commercial_wind_constraints_large 04/04/2013

Source: Ordnance Survey, Natural England, English Heritage, Hinckley & Bosworth, NLPG, National Grid



Hinckley & Bosworth Renewable Energy Capacity Study

Figure 3.6

Opportunities and constraints for medium-scale wind energy development

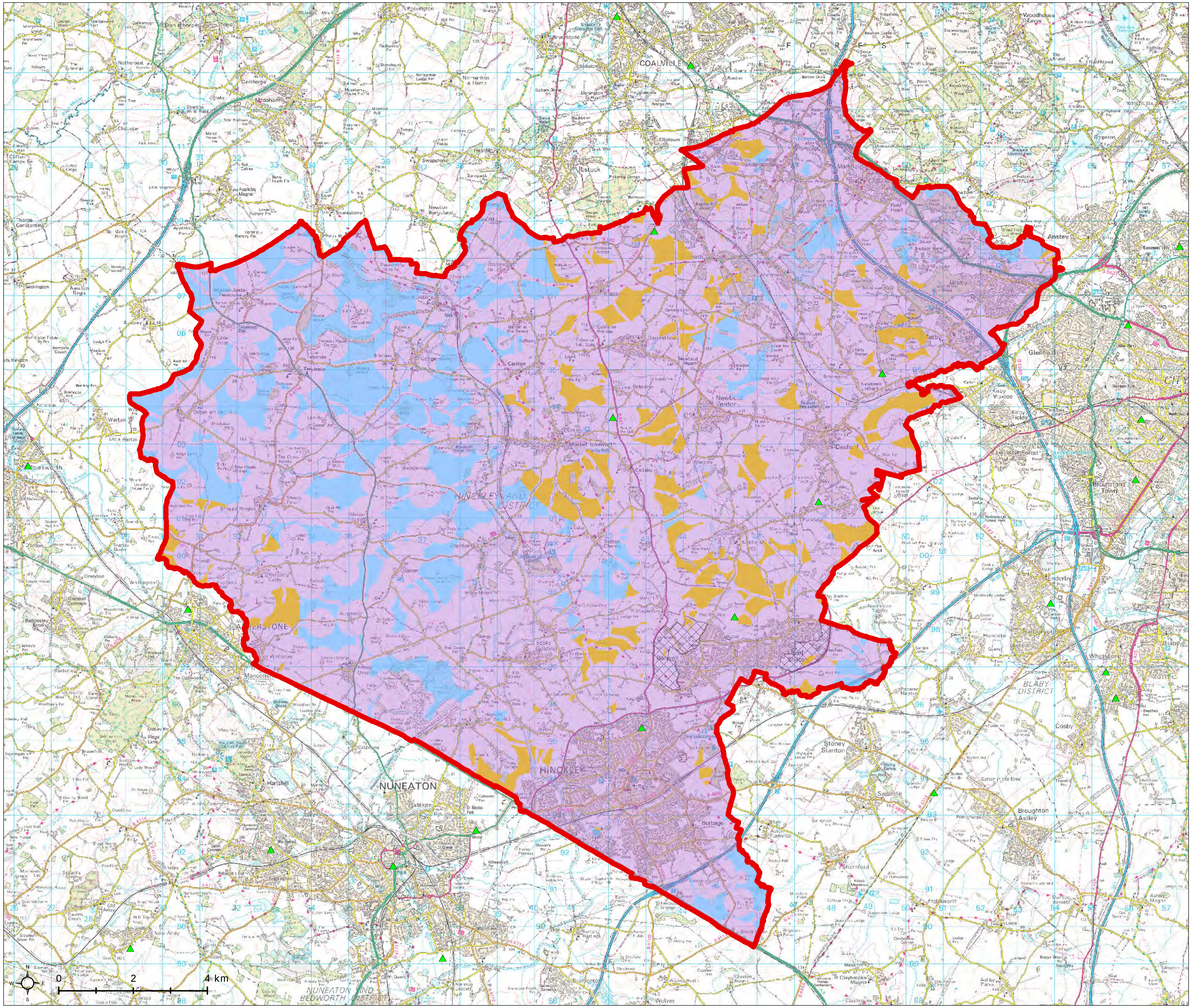
- Hinckley and Bosworth boundary
- Sustainable Urban Extensions
- Constraints for medium-scale wind energy development
- Unconstrained areas for medium-scale wind energy development

Map Scale @ A3:1:100,000

LUC

LUC LDN 5582-01_019_Commercial_wind_constraints_medium 04/04/2013

Source: Ordnance Survey, Natural England, English Heritage, Hinckley & Bosworth, NLPG, National Grid



Hinckley & Bosworth Renewable Energy Capacity Study

Figure 3.7

Opportunities and constraints for small-scale wind energy development

Hinckley and Bosworth boundary

Sustainable Urban Extensions

Western Power 33kV substations

Unconstrained areas for small-scale wind energy development

Unconstrained areas for small-scale wind energy development (> 3km from 33kV substation)

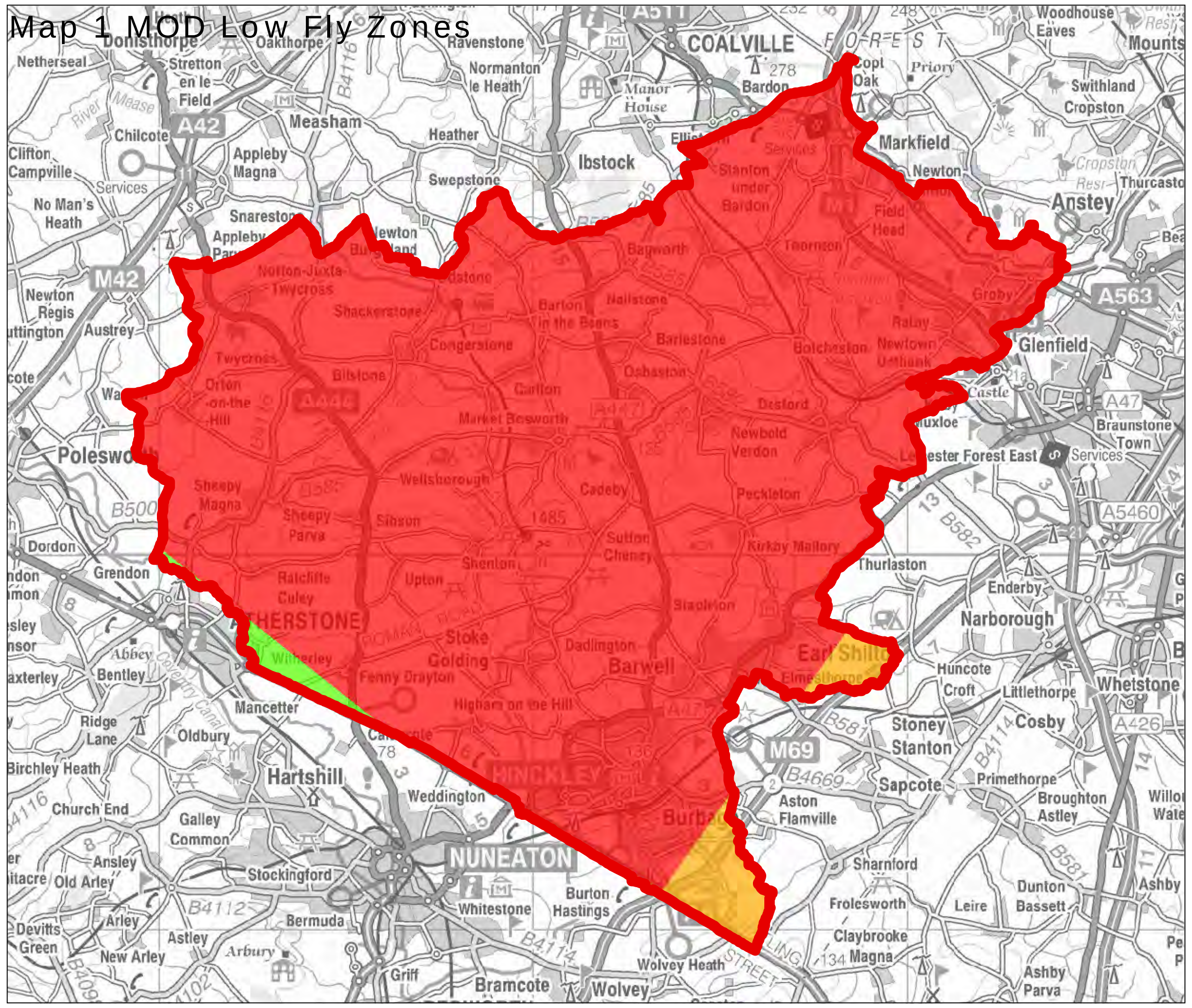
Constraints for small-scale wind energy development

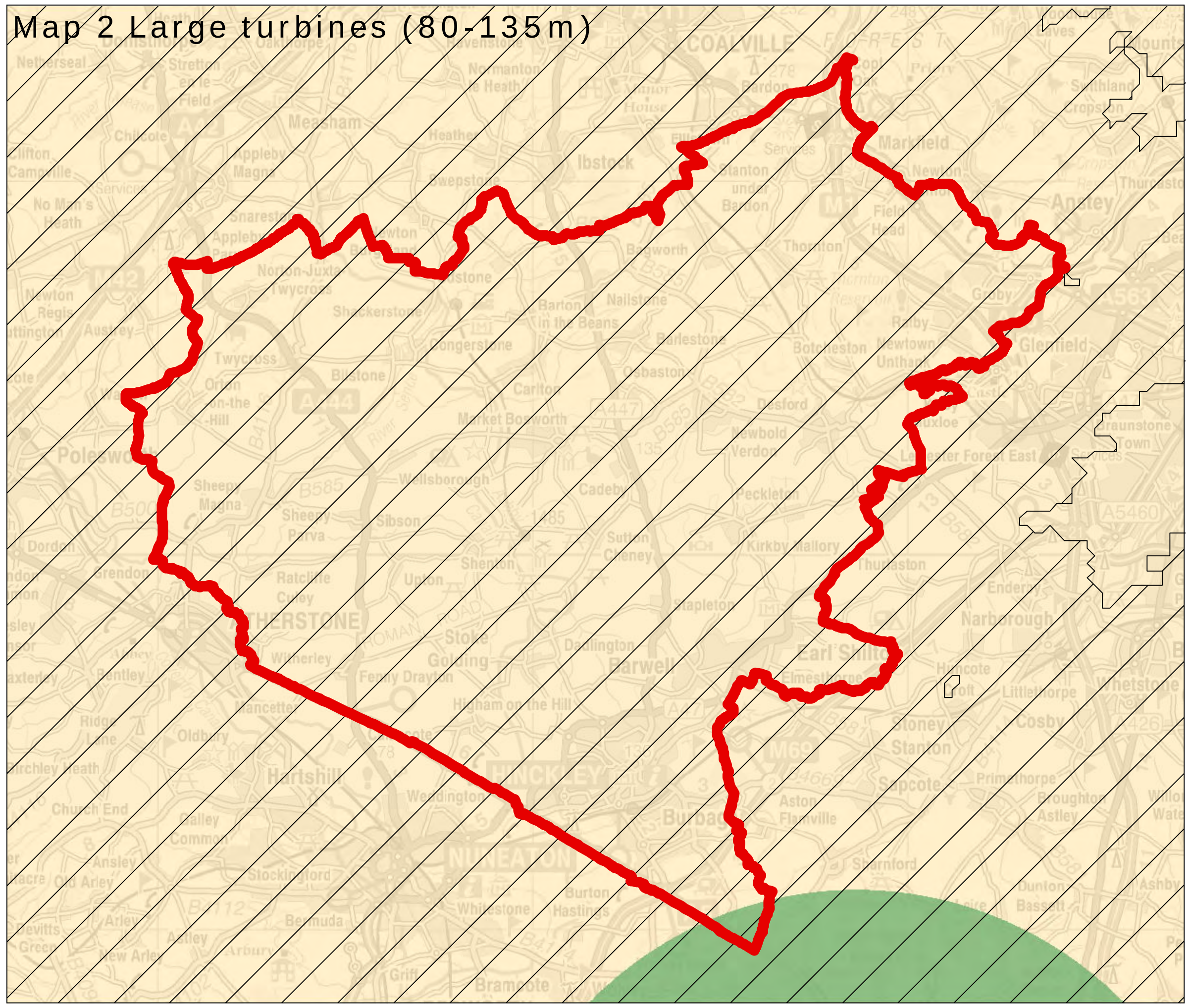
Map Scale @ A3:1:100,000

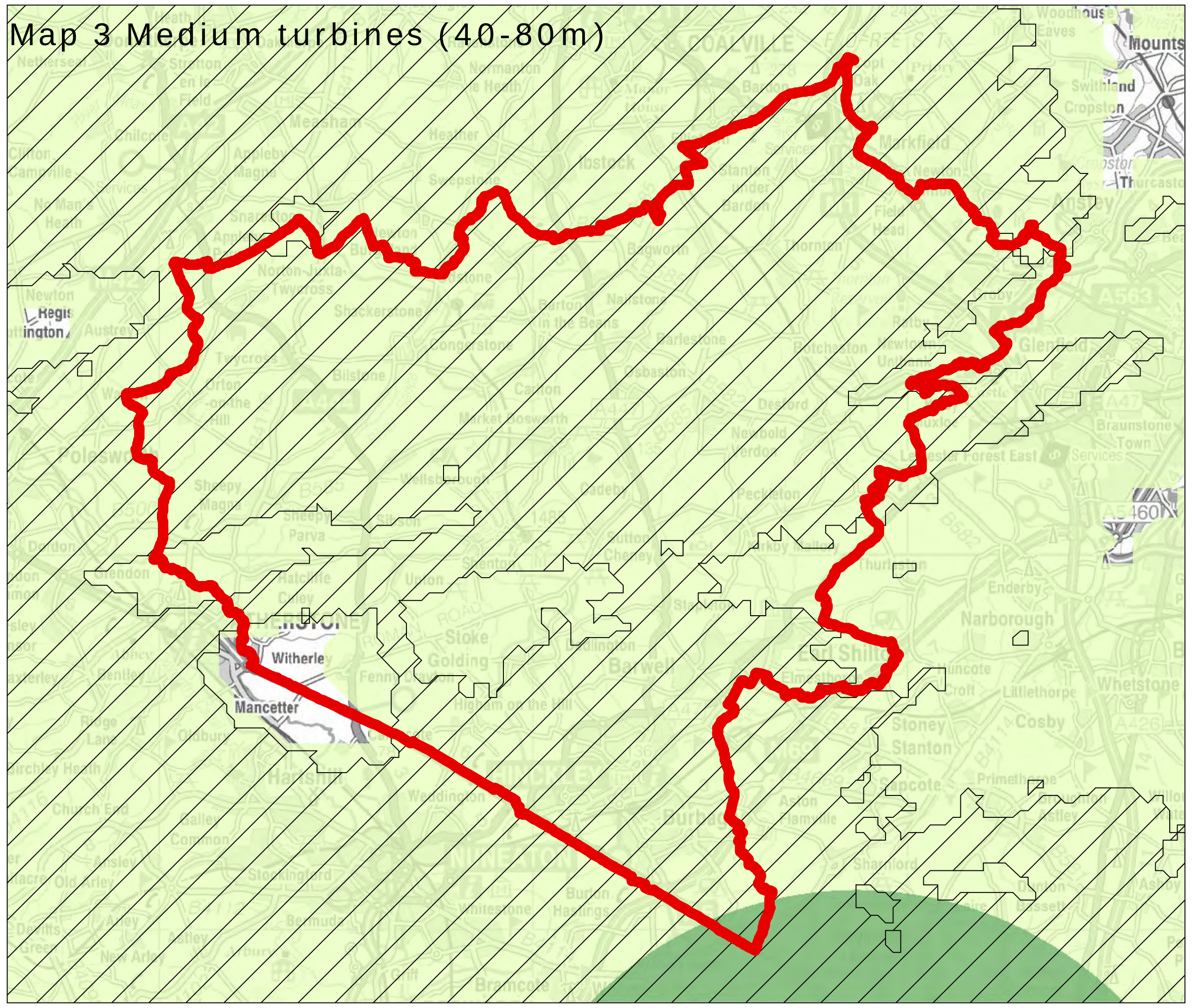
LUC

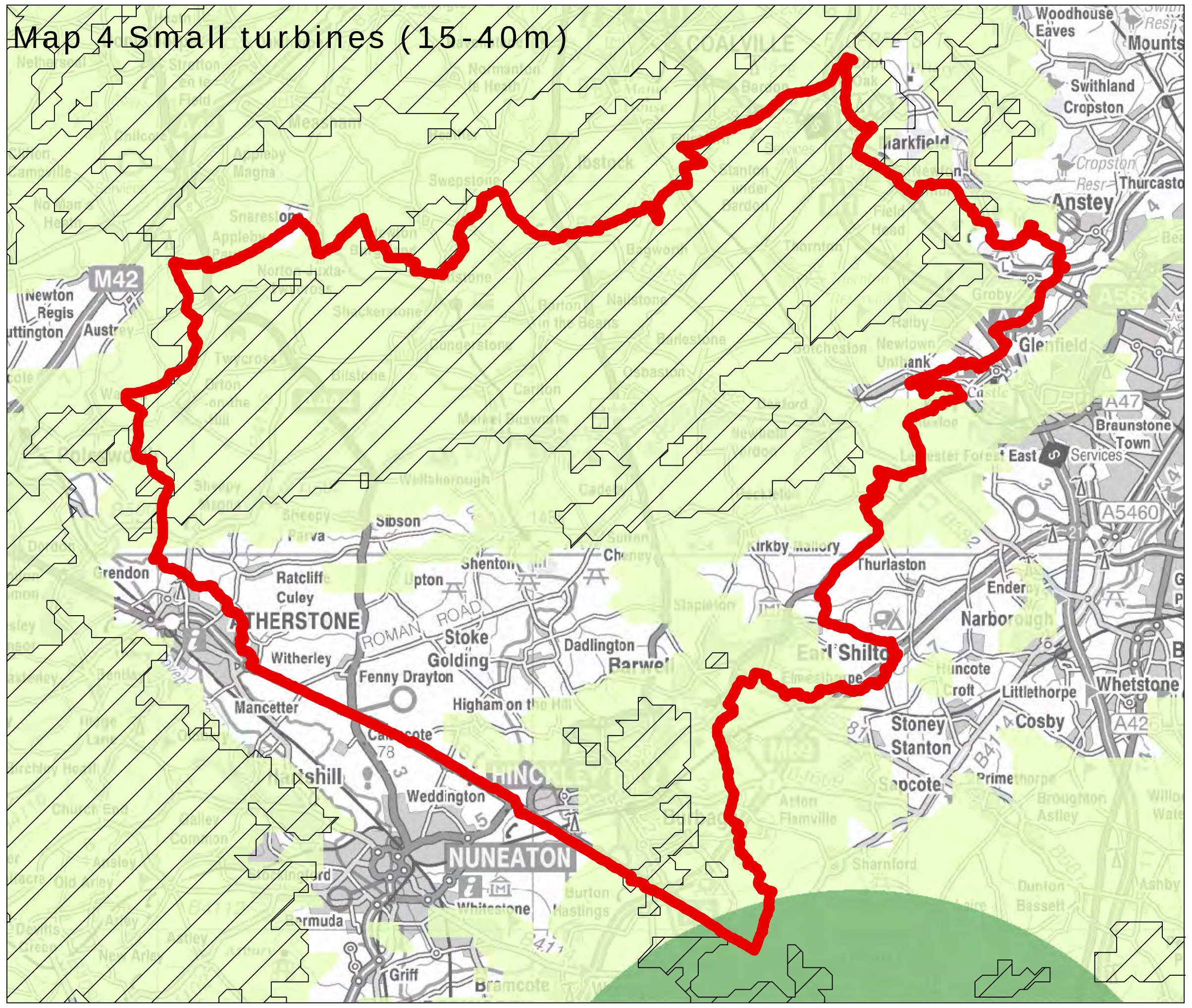
LUC LDN 5582-01_020_Commercial_wind_constraints_small 04/04/2013

Source: Ordnance Survey, Natural England, English Heritage, Hinckley & Bosworth, NLPG, National Grid









Hinckley & Bosworth Renewable Energy Capacity Study

Figure 3.8

Aviation safeguarding considerations

Key for Map 1

Hinckley and Bosworth boundary

MOD Low Fly Zones

Area with no military low flying concerns

Low priority military low flying areas less likely to raise concerns

Regular military low flying area where mitigation may be necessary to resolve concerns

Key for Maps 2 - 4

Hinckley and Bosworth boundary

Primary Surveillance Radar*

Air-ground-air communications

Radar*

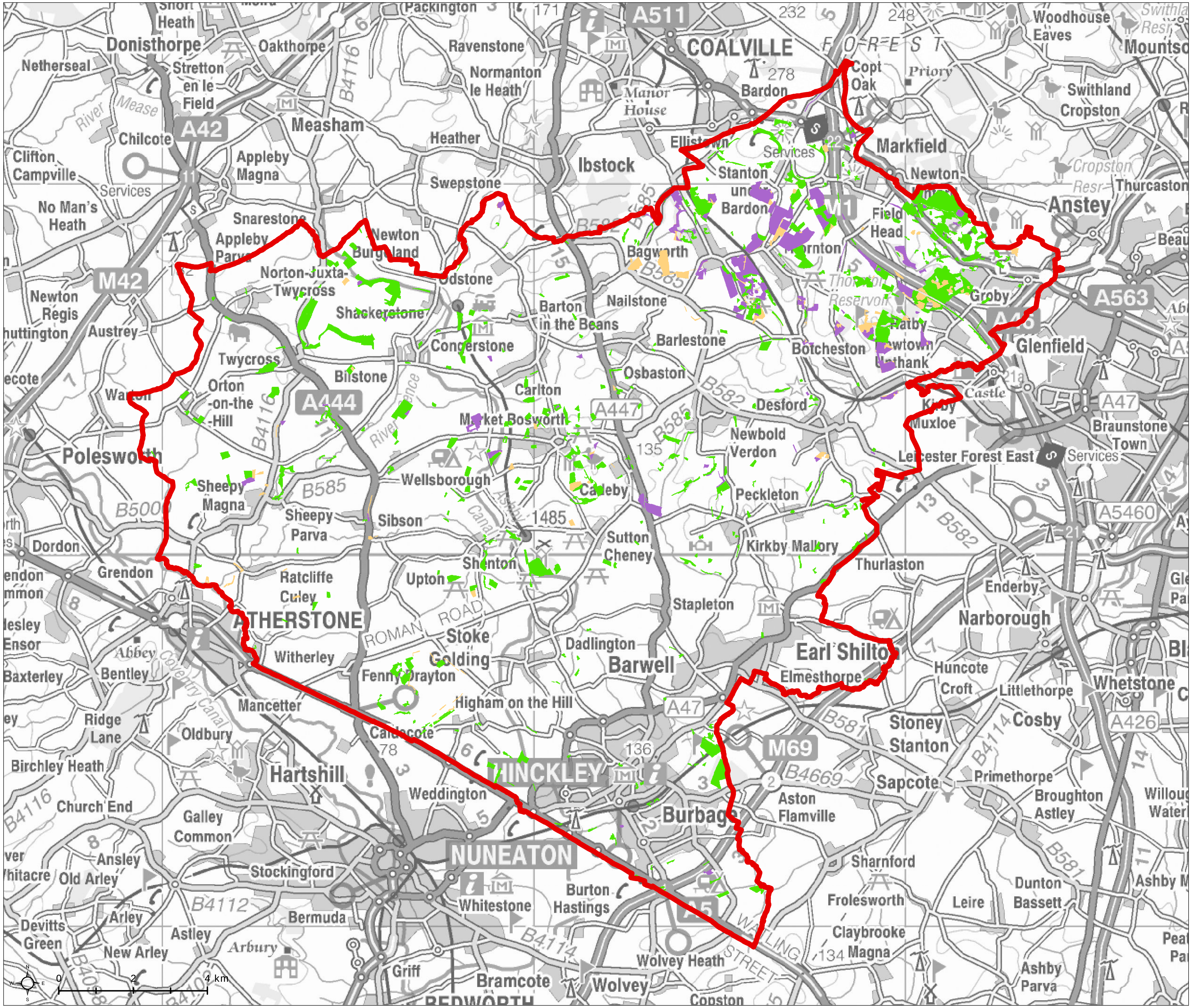
* Radar heights displayed are 120m for large turbines, 80m for medium turbines and 40m for small turbines

Map Scale @ A3:1:200,000

LUC

LUC LDN 5582-01_029_MOD_restats 13/02/2013

Source: MOD, NATS/NERL



Hinckley & Bosworth Renewable Energy Capacity Study

Figure 3.9

Type of woodland

Hinckley and Bosworth boundary

Broad woodland type (IFT)

- Broadleaved
- Coniferous
- Mixed
- Assumed mixed
- Other*

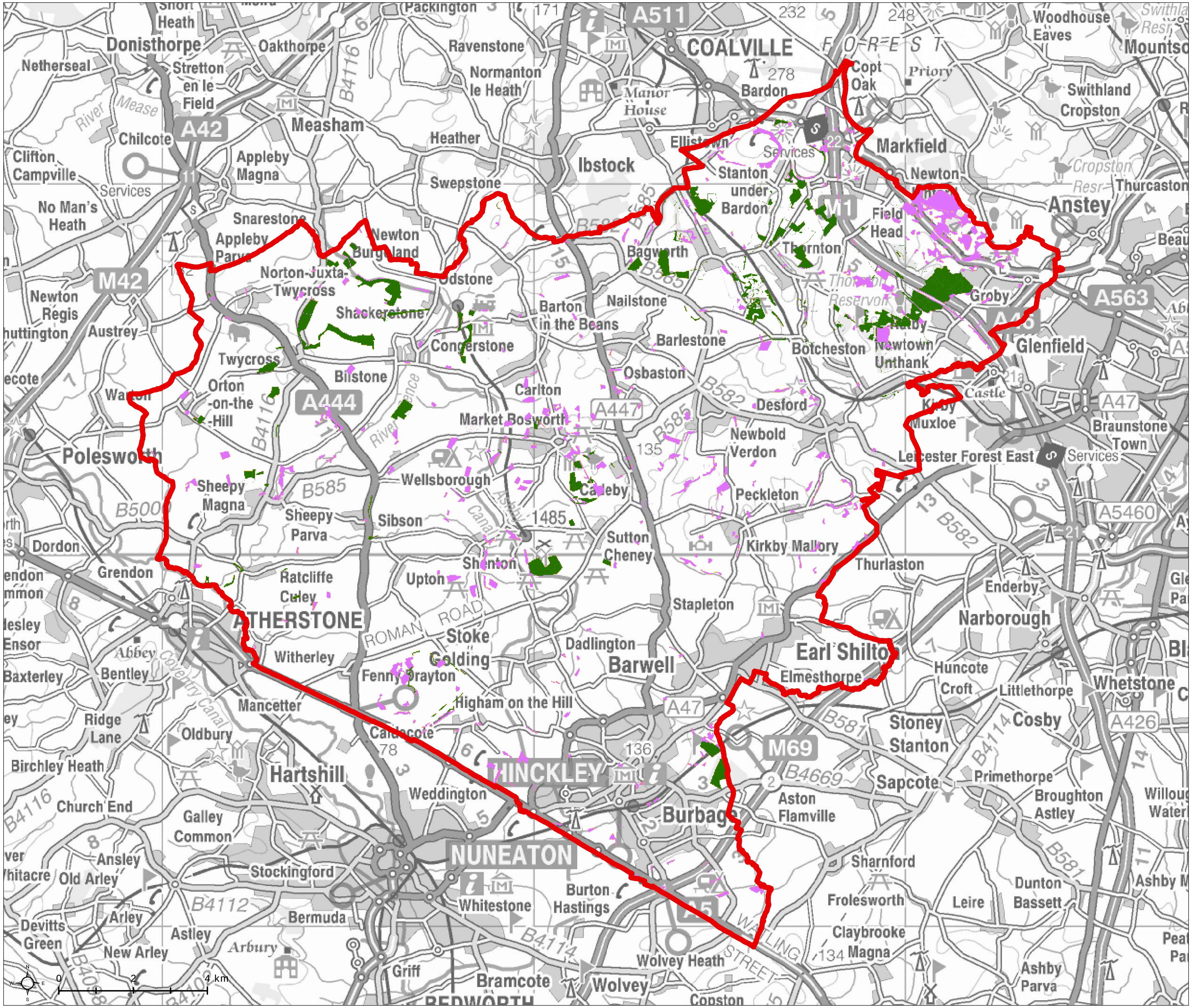
*Includes shrub, felled areas, ground perpared for planting, young trees and interpreted open land from the NFI

Map Scale @ A3:1:100,000

LUC

Source: Forestry Commission

LUC LDN 5582-01_023_Managed_woodland 13/02/2013



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LUC LDN 5582-01_024_Managed_woodland_management 13/02/2013

Hinckley & Bosworth Renewable Energy Capacity Study

Figure 3.10

Management of woodland

Hinckley and Bosworth boundary

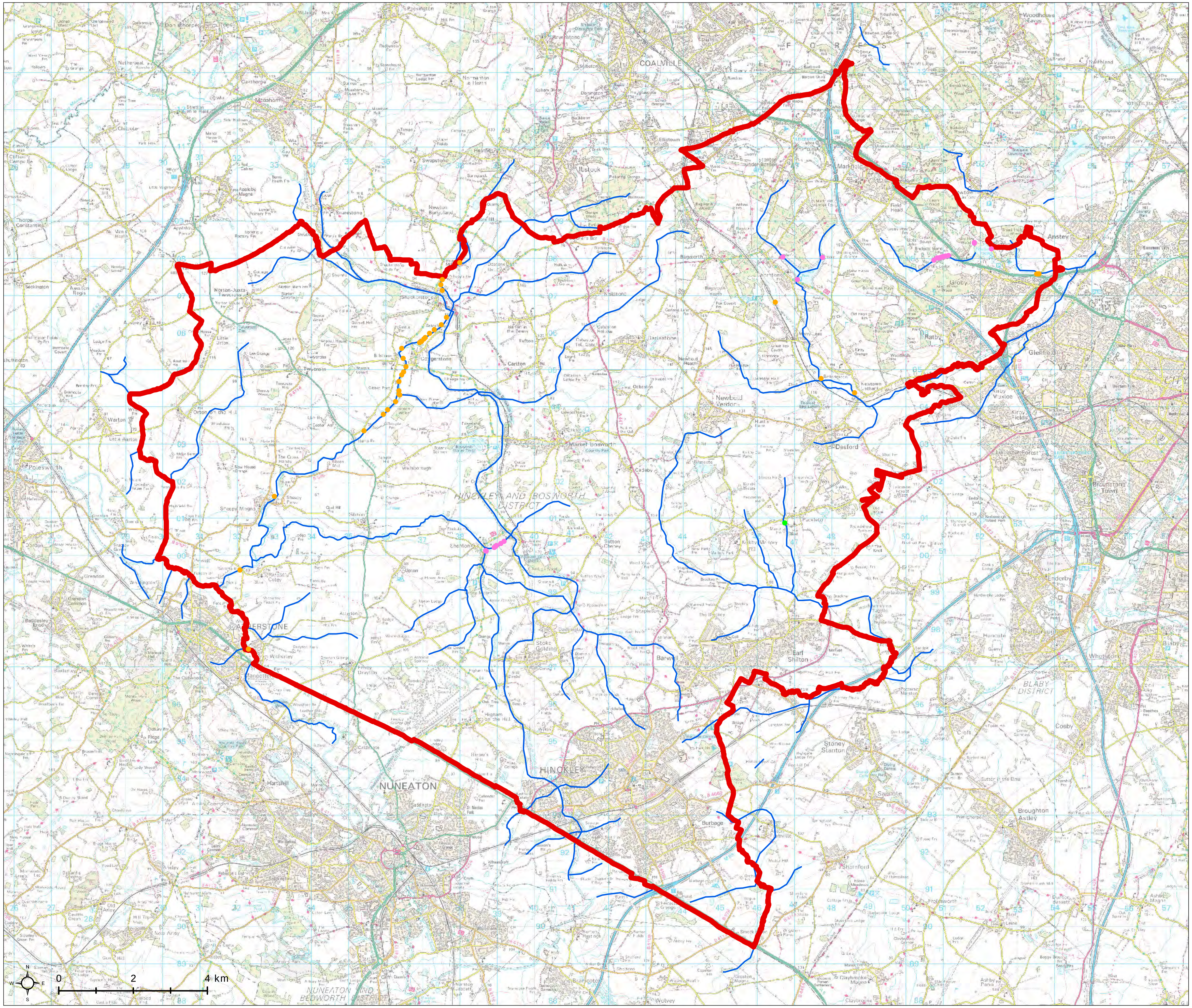
Managment

Actively managed
Unmanaged
Management unknown

Map Scale @ A3:1:100,000

LUC

Source: Forestry Commission



Hinckley & Bosworth Renewable Energy Capacity Study

Figure 3.11

Environment Agency study hydropower barriers and sensitivity

Hinckley and Bosworth boundary

Rivers and canals

Sensitivity category

High (none)

Medium

Low

Unknown

Map Scale @ A3:1:100,000

LUC

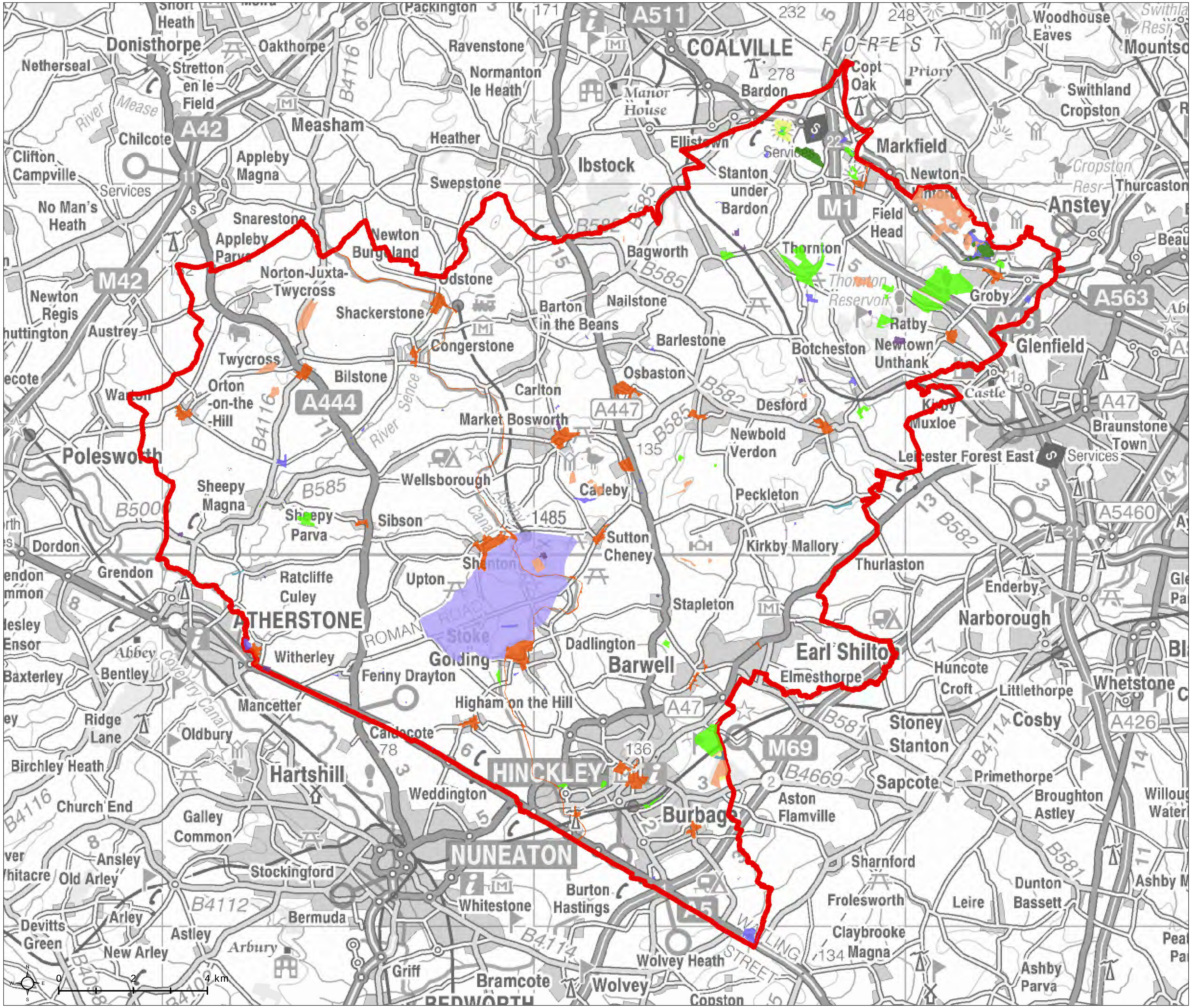
LUC LDN 5582-01_025_Hydropower 13/02/2013

Source: Environment Agency, Ordnance Survey

Hinckley & Bosworth Renewable Energy Capacity Study

Figure 3.12

Nature conservation, heritage and recreation constraints for solar arrays



Hinckley and Bosworth boundary

Recreation

- CROW Land

Heritage constraints

- Conservation Areas
- Listed Buildings
- Scheduled Monument
- Revised Bosworth Battlefield boundary

Nature conservation

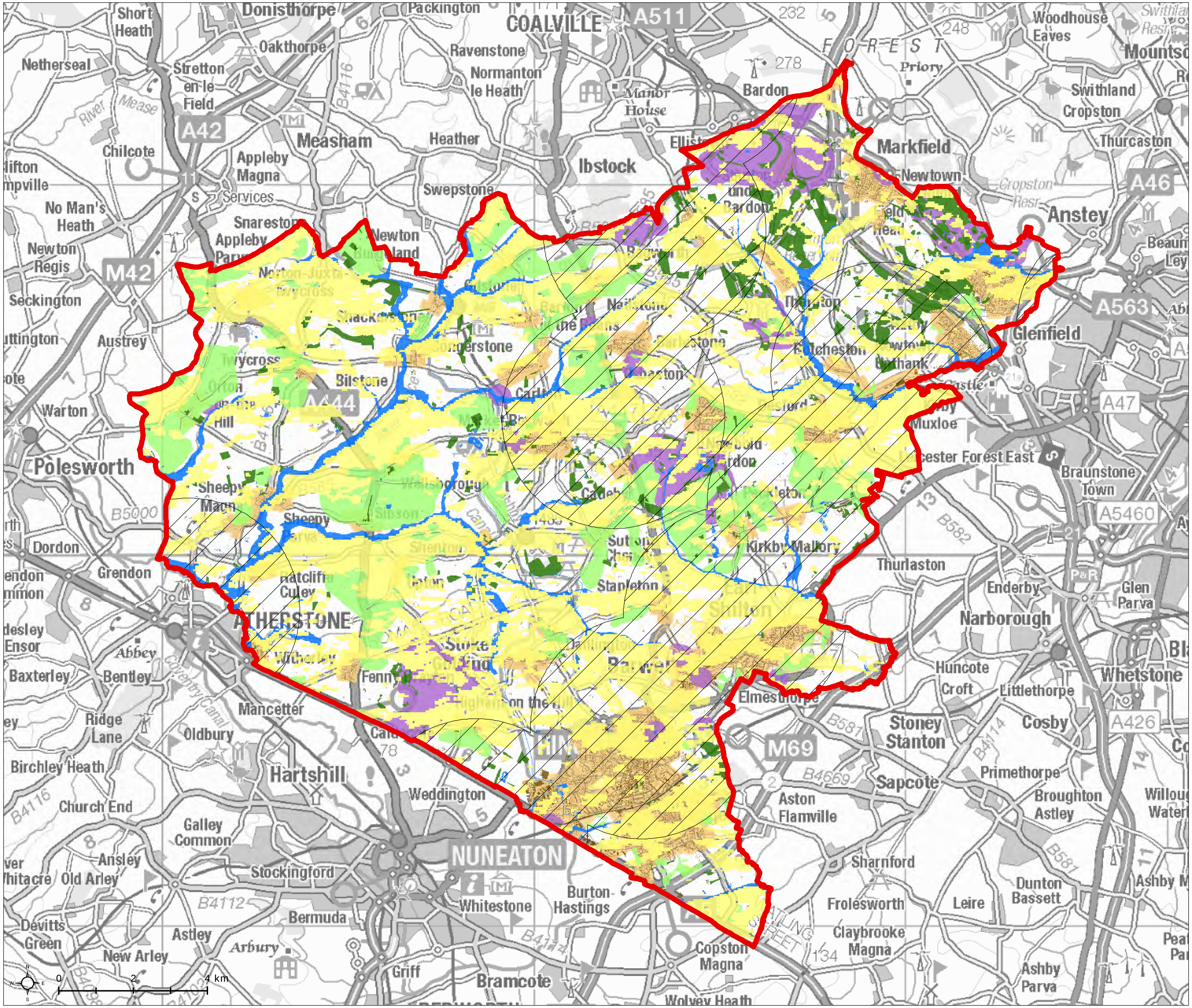
- Ancient Woodland
- BAP Habitat
- Local Nature Reserve
- Local Wildlife Site
- SSSI

Map Scale @ A3:1:100,000

LUC

LUC LDN 5582-01_027_Solar_arrays_natural 13/02/2013

Source: Natural England, English Heritage, H&B



Hinckley & Bosworth Renewable Energy Capacity Study

Figure 3.13

Land use, physical and infrastructure constraints for solar arrays

Hinckley and Bosworth boundary
Sustainable Urban Extensions
Within 3km of a 33kV substation

Constraints

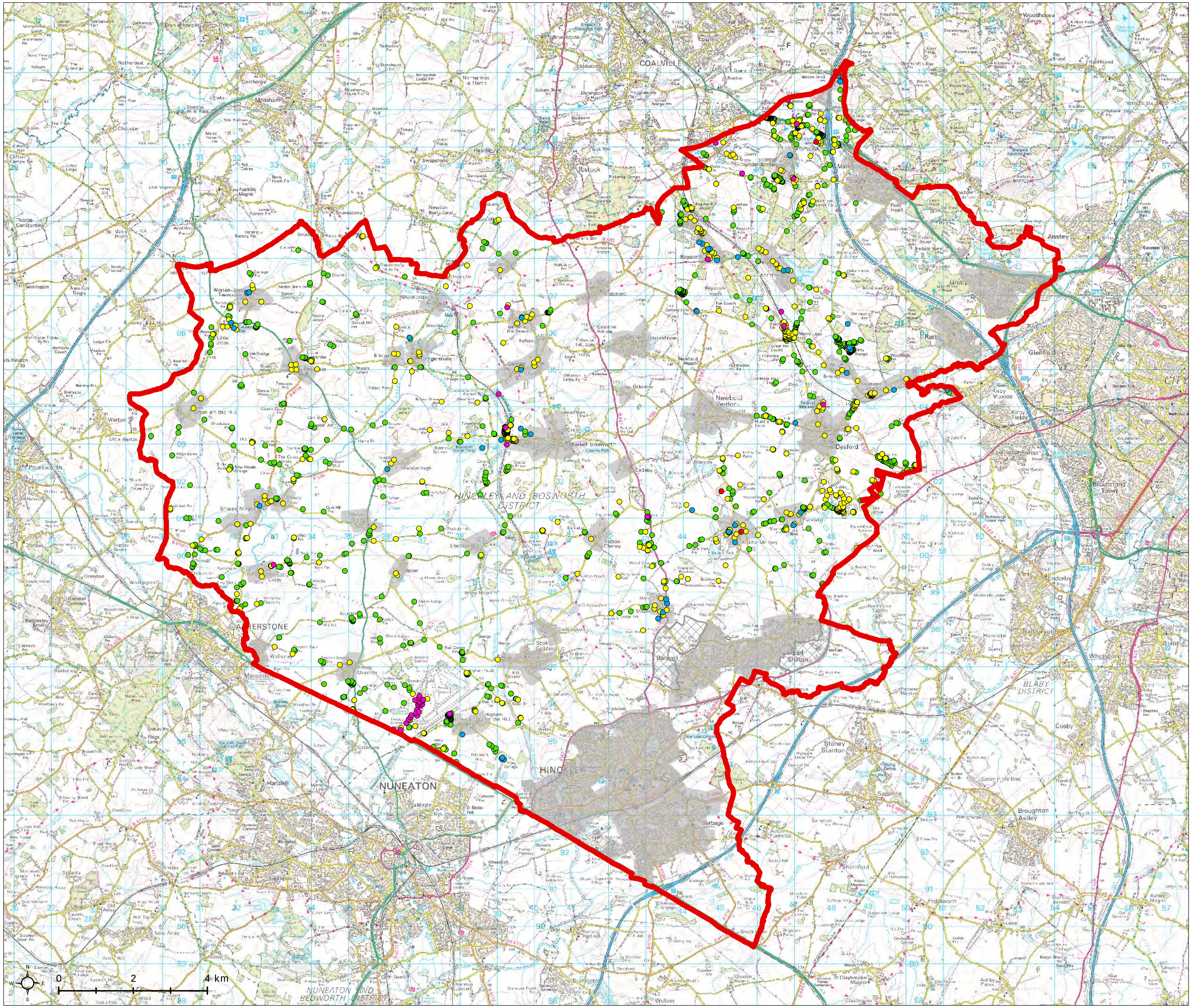
Buildings
West through North to East facing slope
Water and flood risk zones 2 and 3
Grade 2 ALC (and 3a where available)
Mineral Extraction sites 250m buffer
Roads
Railway
Slope >= 15 degrees
Woodland
Urban areas

Map Scale @ A3:1:100,000

LUC

LUC LDN 5582-01_026_Solar_arrays_physical_UPDATED_DEC2014 28/11/2014

Source: Environment Agency, OS, DEFRA, Forestry Commission, H&B, Western Power



Hinckley & Bosworth Renewable Energy Capacity Study

Figure 3.14

Properties with the highest potential for micro-wind turbines

- Hinckley and Bosworth boundary
- Sustainable Urban Extensions
- Urban areas

Type of property with potential

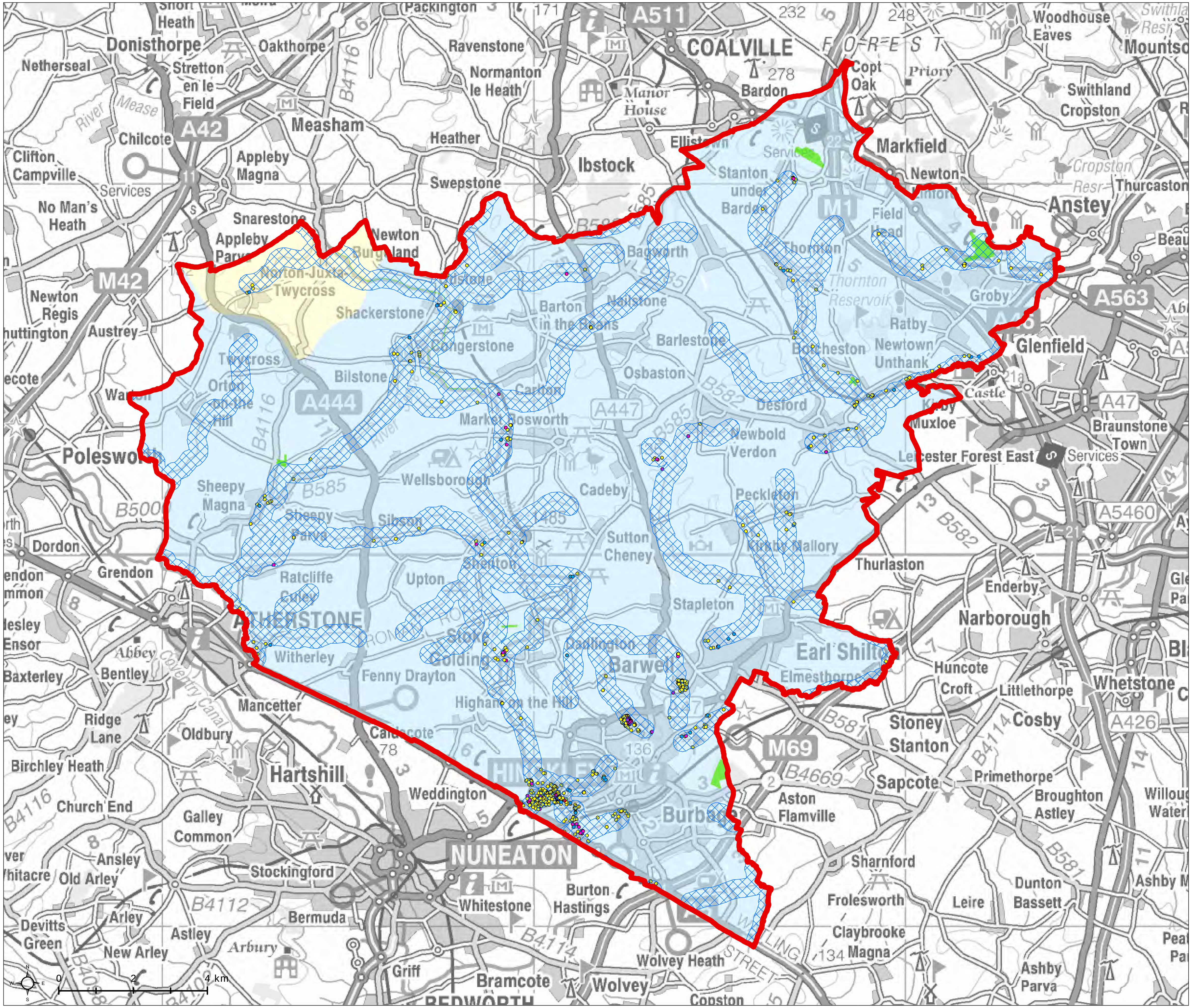
- Commercial
- Community
- Industrial
- Residential (isolated)
- Tourism

Map Scale @ A3:1:100,000

LUC

Source: Ordnance Survey, NLPG

LUC LDN 5582-01_022_Micro_wind_results 04/04/2013



Hinckley & Bosworth Renewable Energy Capacity Study

Figure 3.15

Potential locations for installation of water source heat pumps

- Hinckley and Bosworth boundary
- Sites of Special Scientific Interest
- Within 250m of a waterbody

Environment Agency status

- No water available
- Water available

Type of property with potential

- Commercial
- Community
- Industrial
- Tourism

Map Scale @ A3:1:100,000

LUC

LUC LDN 5582-01_028_GWSHP 13/02/2013

Source: OS, NLPG, Natural England, Environment Agency

4 Technical Resource Potential for District Heating

Introduction

28 This chapter sets out the results of the assessment of the technical potential for district heating within Hinckley and Bosworth. District heating, sometimes referred to as heat networks, supply heat from a central source directly to homes and businesses through a network of pipes carrying hot water. This means that individual homes and business do not need to generate their own heat on site.

29 District heating can offer increased efficiencies and carbon savings over multiple boiler plants in serving the same heat demand. Heat from a district heating plant can be generated from a range of fuels including gas and biomass, and can be produced from a boiler or in conjunction with electricity in a combined heat and power unit. Using the data behind the National Heat Map, heat demand across the Borough has been analysed and mapped as GIS layers to determine spatial heat demand density from existing buildings. A set of criteria has then been applied to the areas of high demand to narrow down the locations thought to have the most potential for district heating. This information can then be used to define areas or clusters of buildings worthy of more detailed feasibility studies for district heating.

Background

4.1 CSE produced the National Heat Map for the Department of Energy and Climate Change.[10.] The National Heat Map shows heat demand across England at a range of scales from national to local. Behind the heat map is a database of modelled heat demand for every address in the country (and actual heat demand for buildings which have Display Energy Certificates). This enables users to locate and investigate areas of high heat demand which may be suitable for district heating.

4.2 The purpose of the map is to support planning and deployment of local low-carbon energy projects in England, by providing publicly accessible high-resolution web-based maps of heat demand by area. The most useful way to visualise heat map data is in the form of a heat demand density layer. This shows heat demand per unit of land area (typically kWh heat / square metre). Areas with high concentrations of heat demand have higher spatial density values. This is intuitively easy to understand when seen on a map. **Figure 4.1** shows an example heat density map[11] overlaid on the address points from which it originates. The address points are scaled so that those with higher heat demand are represented by larger points. Heat density (the coloured base-map) is shown from blue to red, with blue areas being low density and red areas high density. Areas in which there are more and/or larger point heat demands close together, have higher heat densities.

4.3 It is useful to understand how the heat demand maps are produced so that the map legends can be correctly interpreted. The heat demand maps consist of many 'cells', which can be any size. The size chosen depends on the area that the map covers - the smaller the cells, the more will be needed for a given area and this requires more computer processing power and storage. In this report the cell size used is between 5 and 10 metres squared, and there are around 2-3 million cells in each map. When the heat density map is created, each cell is assigned a value by creating a weighted average of the heat demand of the address points within and around it. This value is

[10] See http://ceo.decc.gov.uk/nationalheatmap/

[11] This is an example area which is not within Hinckley and Bosworth

given in kWh per metre squared, no matter what the cell size, and so the legend always shows values in kWh per metre squared.

4.4 The heat demand map can be presented in many different ways, and so care should be taken when comparing two different maps because the same colour may mean different things on different maps. This chapter uses two different types of legend in the heat maps:

- Deciles: Here the legend is divided into ten classes. The cells with no heat demand value (covering areas where there are no address points with heat demand) are excluded, and then the remaining cells are divided into classes in such a way that 10% of the cells are represented in each class. In practice this is normally an approximation because it may not be possible to size each class exactly. For example, if half of the cells in the map all have the same value, one class will contain 50% of the land area, while the other nine classes will have to share the rest of the land area among themselves. If there are ten classes in the legend and each class has a different width, then deciles are being used.
- Standard: Here the legend is divided into classes which are normally of equal width (for example 50kWh), although the lowest class may be smaller if some lower values are not shown on the map, and the highest class may be wider to include some very high values which only appear in a few cells.

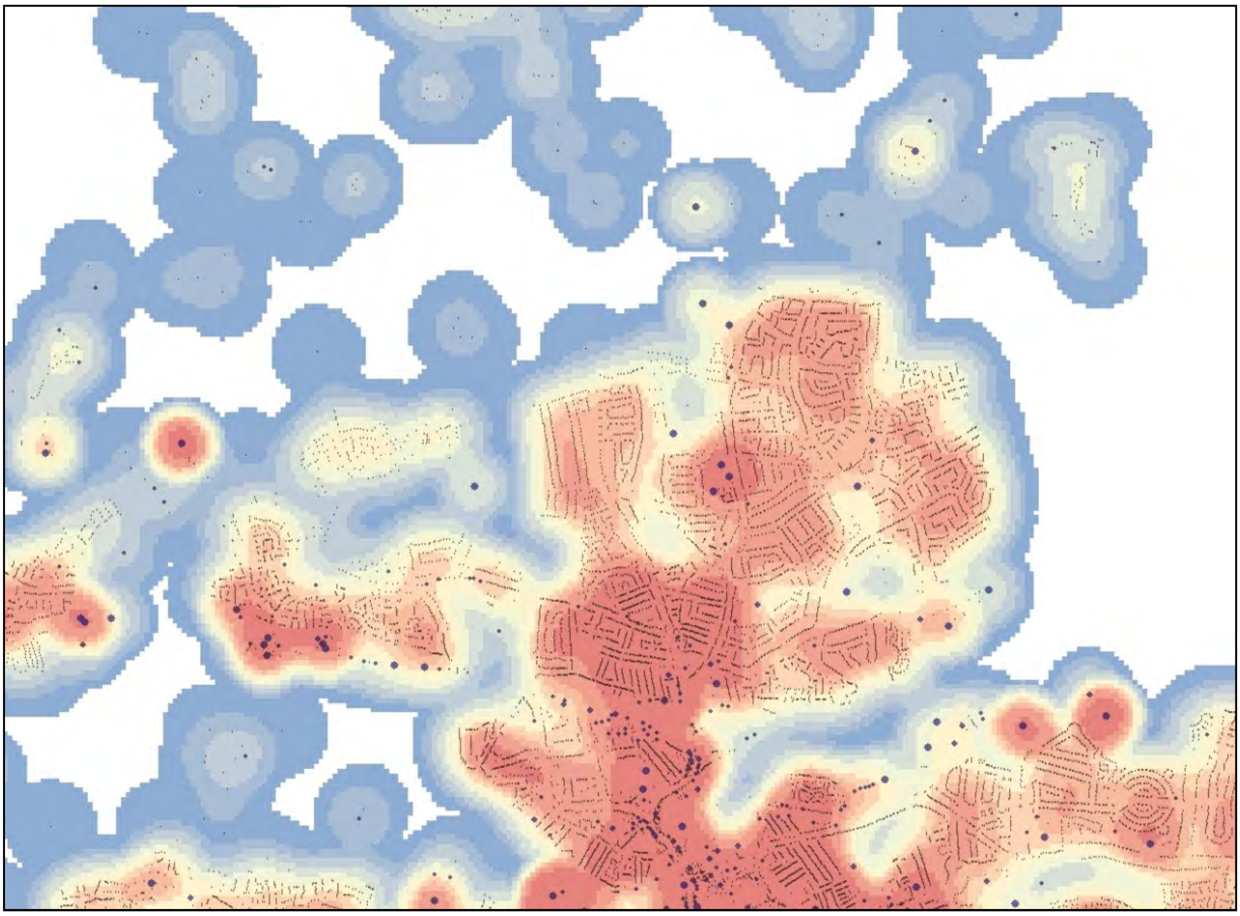


Figure 4.1: Example of heat density map

Heat Demand in Hinckley and Bosworth

4.5 The first three maps in this section show heat demand across the whole of Hinckley and Bosworth. They all use the same legend categories so that they can easily be compared. **Figure 4.2** shows heat demand across all sectors, while **Figure 4.3** shows heat demand in the residential sector only. These two are very similar, which suggests that most heat demand in the Borough is residential. **Figure 4.4** shows non-residential heat demand, which is concentrated in a few areas. Total modelled heat demand in the Borough is 914,389 MWh per year, 35% of which is from non-domestic sources, with 65% coming from residential sources. Approximately 44% of the Borough's heat demand comes from the Hinckley / Burbage area to the south, and 15% comes from the Earl Shilton / Barwell area.

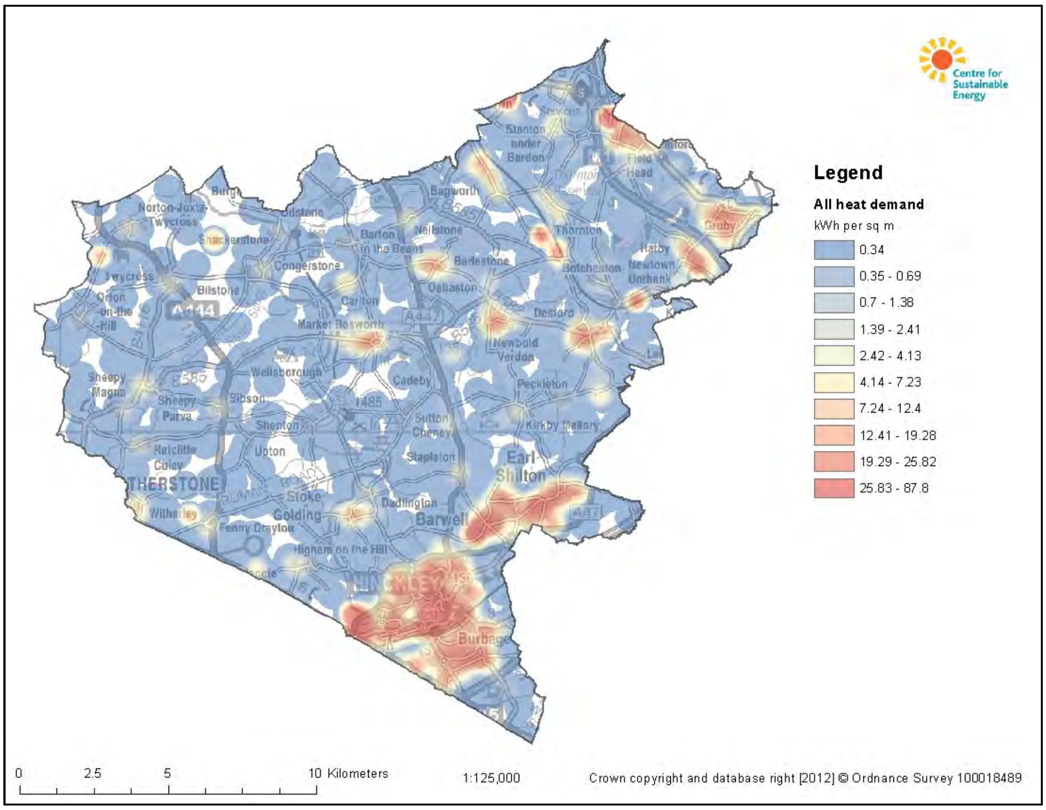


Figure 4.2: Heat density, all sectors

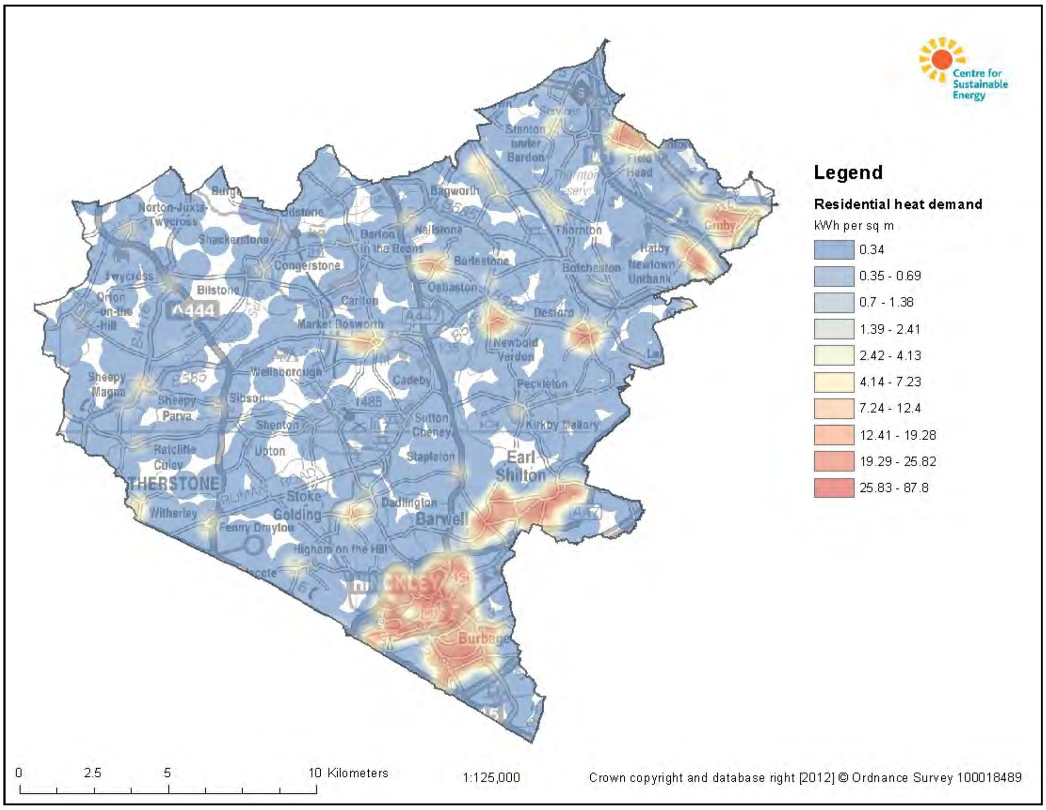


Figure 4.3: Heat density, residential sector

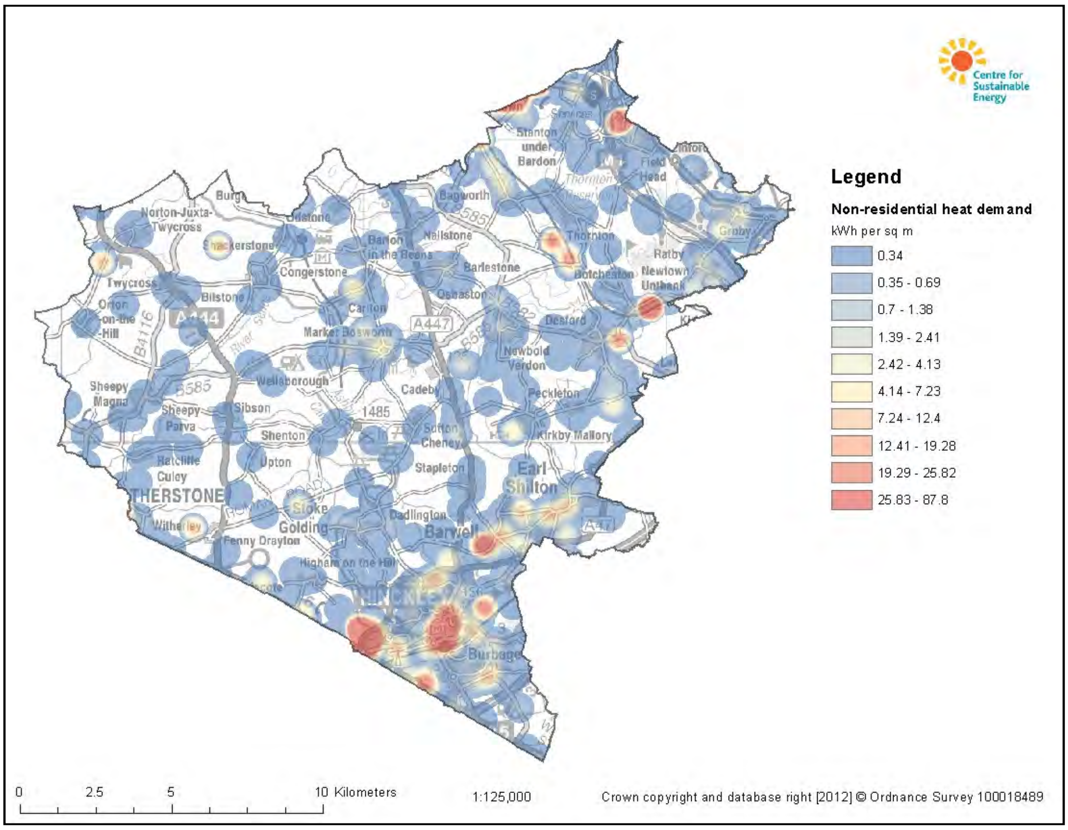


Figure 4.4: Heat density, non-residential sector

Identification of areas for further investigation for district heating potential

4.6 One of the main constraints to district heating is the need to identify a sufficient heat demand density. Urban areas with high population densities offer the most potential. The civil works associated with laying heat mains and establishing connections to individual buildings are 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.

4.7 Linear heat density is the critical factor in heat distribution economics, but this can only be calculated at the stage when a route has been defined. A route can only be defined when the participant buildings have been identified, and so when searching a large area for opportunities, a different approach must be taken. As a proxy for linear heat density, spatial heat density can be used to find areas most likely to contain high concentrations of heat demand.

4.8 As well as looking for areas of high heat demand, the heat map can be used to identify other characteristics which might make an area suitable for district heating. Two key characteristics are the presence of anchor loads and large domestic loads, normally large blocks of social housing. Anchor heat loads are high, stable sources of heat demand. For example, a large hotel or hospital consumes a high amount of heat, and the heat used does not vary much during a day. This is a useful load to 'anchor' a district heating system around because it can provide a large proportion of the initial customer base required to justify the upfront cost of the investment. Other smaller sources of heat demand can be added on around this anchor load. Large public sector heat loads (e.g. council offices, council-owned leisure centres) are particularly good as anchor loads, as development of district heating is often public sector-driven.

4.9 The general approach used in this chapter is to apply conditions to the whole Borough, to identify a long list of places which may have potential for district heating. This longlist is then analysed in more detail, leading to the exclusion of unsuitable areas and the production of a shortlist which are the most promising areas. These are then described in further detail.

4.10 Any areas identified as having potential would then require detailed feasibility studies carried out by a consulting engineer. District heating schemes can be heat-only, or they can include electricity through the use of Combined Heat and Power (CHP). District heating schemes using CHP are sized on heat demand, with the electricity output being a useful additional output, rather than being designed to provide a demand for electricity and treating the heat production as a secondary output, as this would be less efficient. Whether a heat-only or CHP system is chosen depends on the ratio between heat demand and electricity demand from the buildings connected, which would be assessed within the detailed feasibility study.

4.11 One approach to identifying a longlist of areas to look at in more detail is to find places where a set of criteria coincide. This is termed an 'overlay analysis' here as it can be thought of as laying several layers over each other and finding the places where those layers overlap. The layers used here are defined by characteristics identified as being favourable to district heating: high heat demand, presence of anchor loads, and presence of large domestic properties (flats or estates). More precisely, the layers used for this analysis are listed below and illustrated in the following maps.

- Areas within the top decile of heat demand, where heat demand is smoothed over a relatively wide area (**Figure 4.4**);
- Areas within 200m of an anchor load **(Figure 4.5**). These are types of buildings which are likely to have relatively high and stable heat demands and/or be in sectors more likely to participate in heat distribution projects. These categories are from the National Heat Map:
    - Hotels
    - Health (hospitals, health centres, etc.)
    - Education (schools, colleges)
    - 'Recreational' buildings (leisure centres, gyms, etc.)
    - Government buildings (e.g. local authority offices)
    - Public buildings (buildings with a floor area of over 1,000sq m that are occupied (in part or in whole) by public authorities or institutions providing public services, which are frequently visited by the public and must therefore have a display energy certificate). This includes local authority-owned leisure centres;
- Areas within 200m of residential blocks or estates with a combined annual heat demand of more than 100,000kWh per year (these could in theory be single dwellings but in practice only blocks of flats tend to have heat demand this high). (**Figure 4.6**)

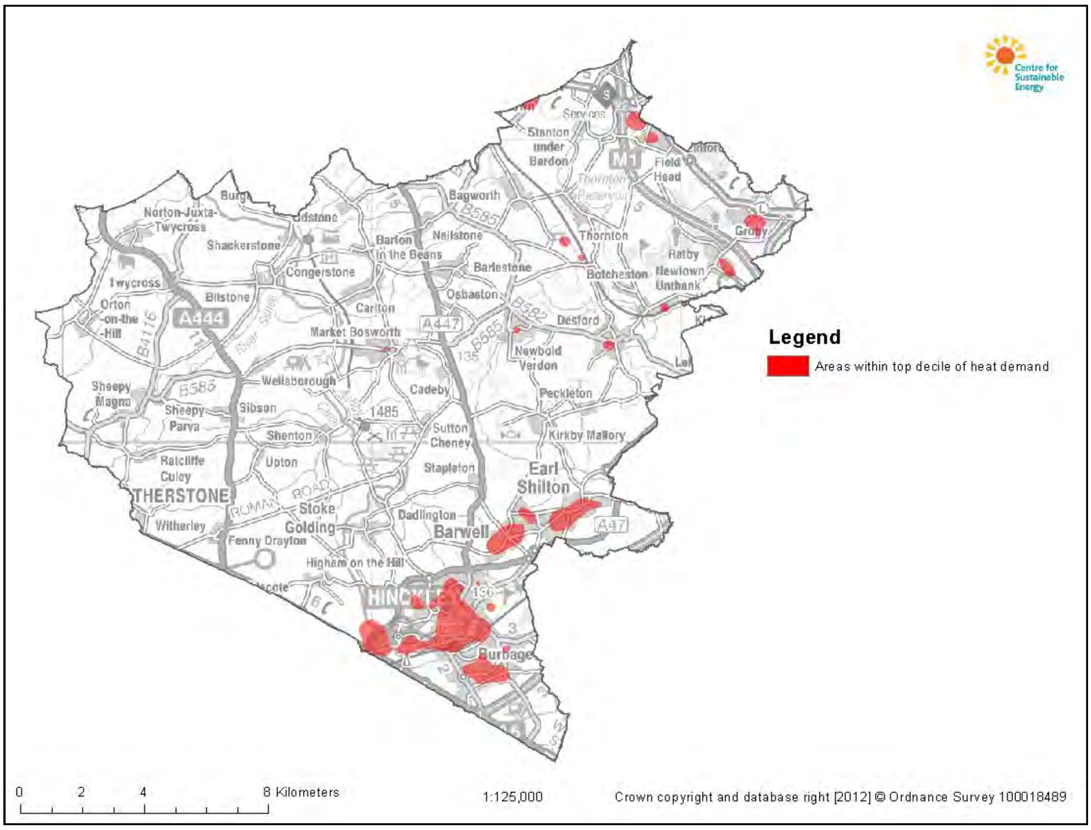


Figure 4.4: Areas in the top decile of heat demand

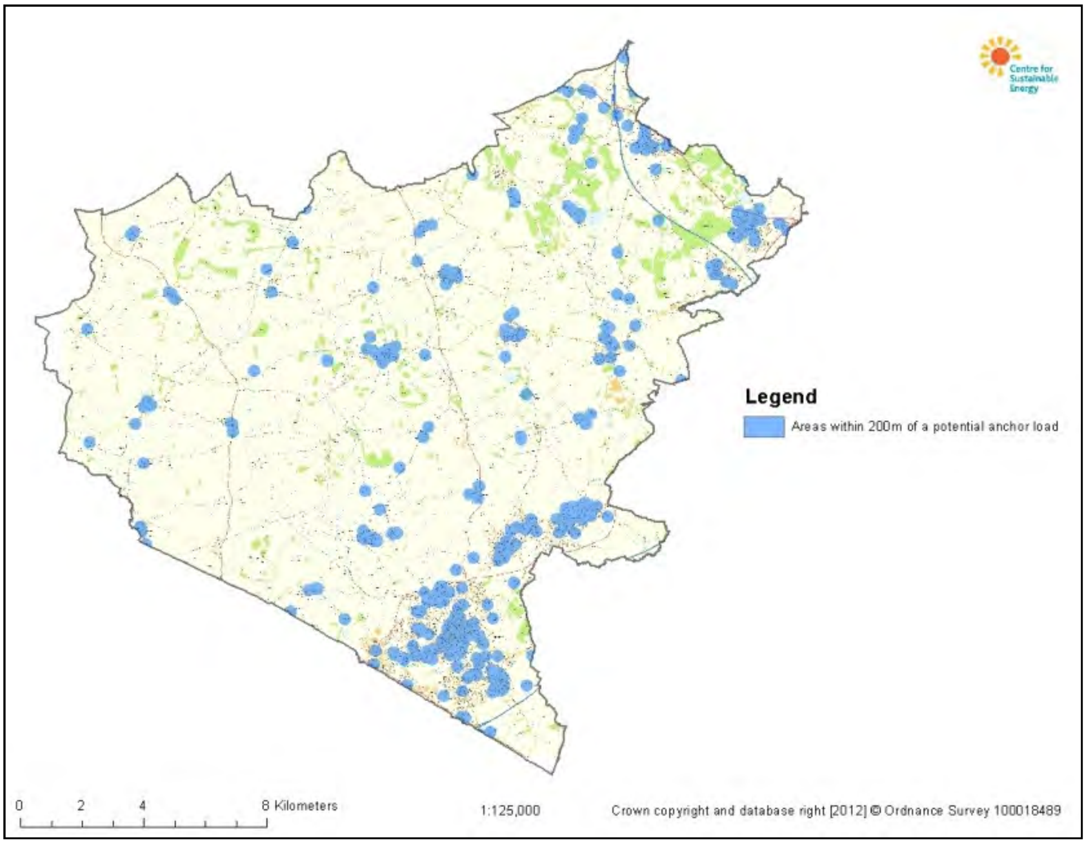


Figure 4.5: Areas within 200m of a potential anchor load

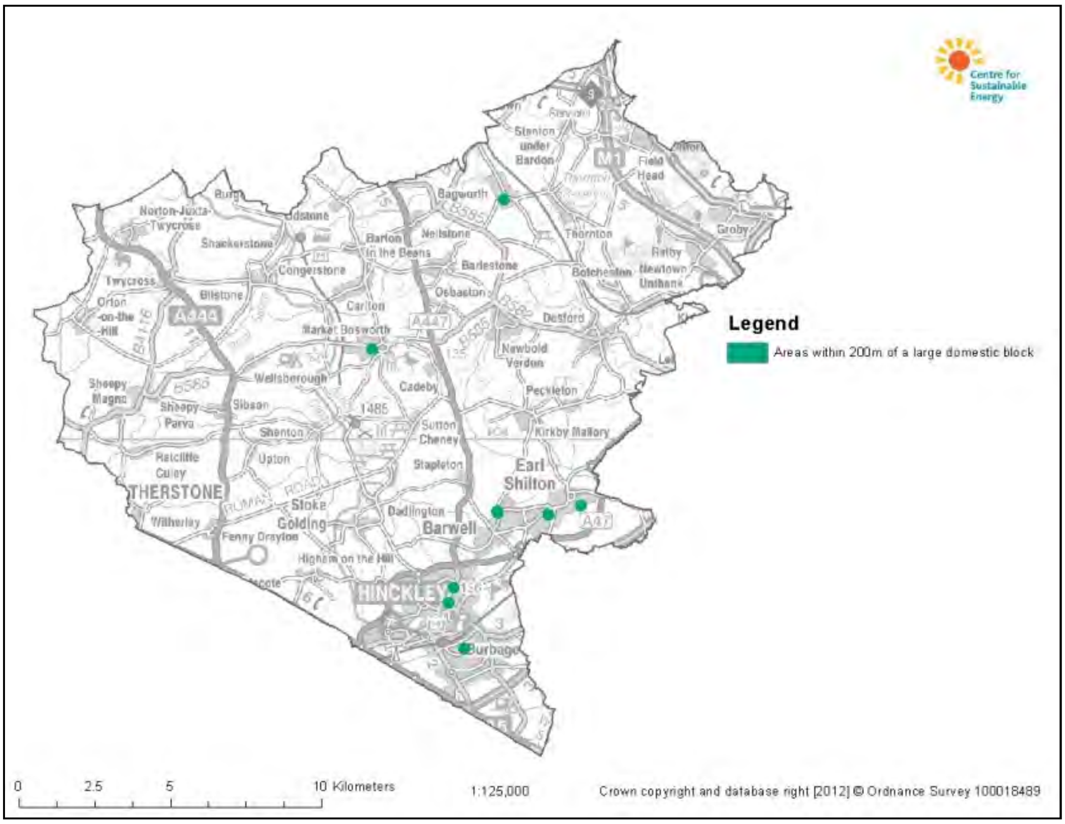


Figure 4.6: Areas within 200m of a large domestic block

4.12 There are very few areas where all of these layers coincide. These are illustrated in **Figure 4.7**

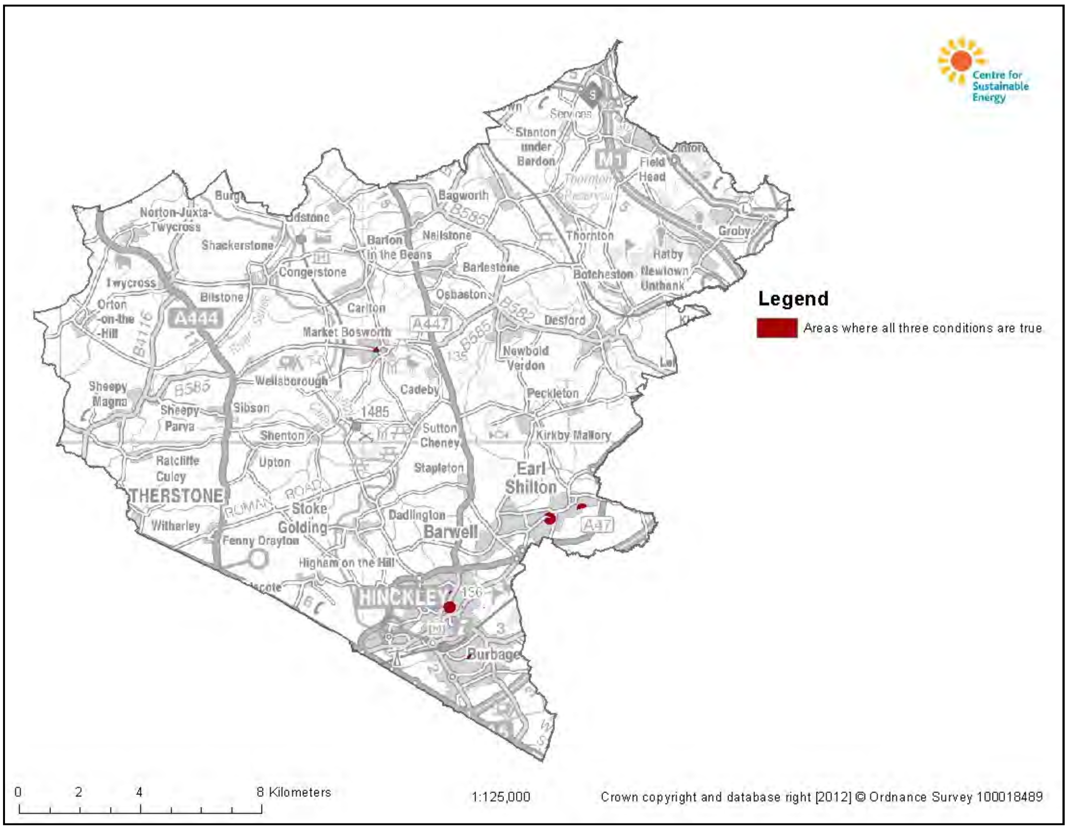


Figure 4.7: Areas where all three criteria are met

4.13 To widen the area of search, the condition was loosened so that only two of three criteria needed to be met, and the resulting areas are shown in **Figure 4.8**

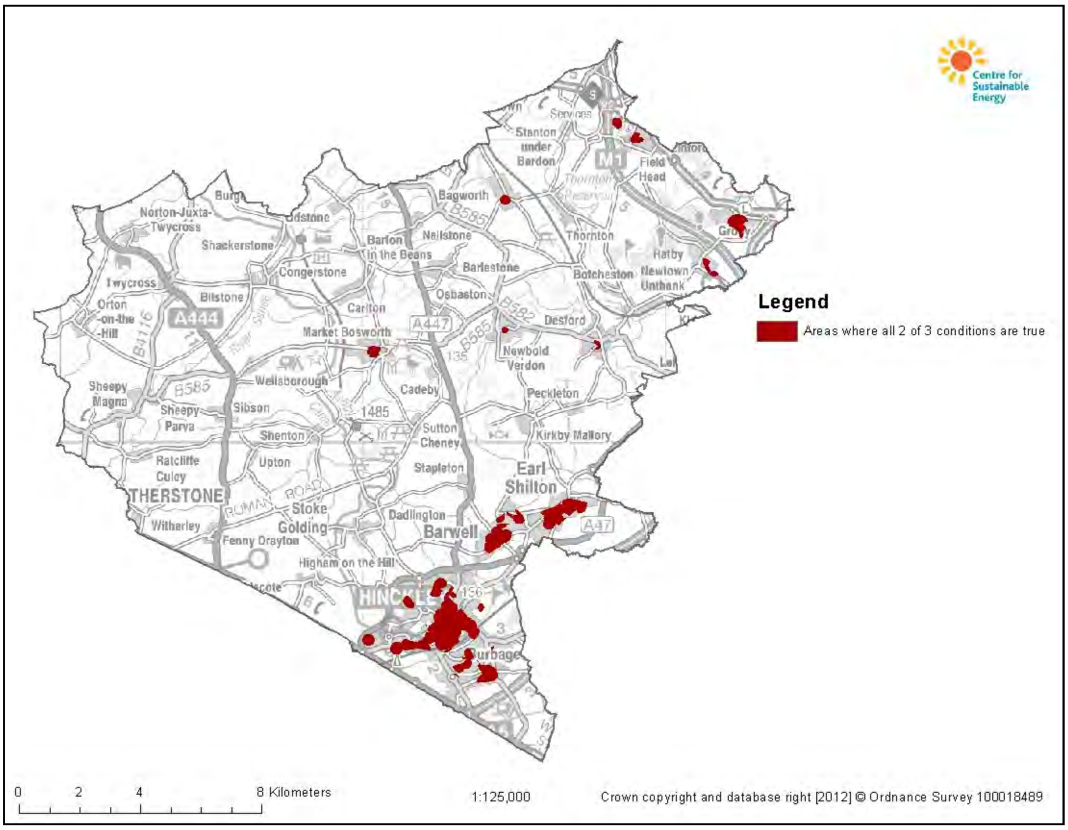


Figure 4.8: Areas where two out of three criteria are met

4.14 The resulting areas can be grouped as follows:

- Hinckley
- Burbage
- Barwell and Earl Shilton wards
- Market Bosworth
- Newbold Verdon
- Desford
- Ratby
- Groby
- Markfield

4.15 At this point it should be reiterated that this is simply the first stage to identify a long list of areas for further investigation - not all of these areas will be suitable for district heating.

4.16 For example, at the Borough level there are over 1,000 potential anchor loads. These are identified using very broad categories and probably less than half will actually be suitable as anchor loads, but with so many at Borough level it is not possible to look at individual ones. Once the areas for further investigation have been identified, it is possible to look at the addresses of these, which often contain information about what kind of building it is and its function. They can also be mapped in Google Earth, which allows viewing of the outside of the building using Google Streetview, but whether it is possible to do this exhaustively really depends on the size of the area under consideration.

4.17 For this analysis the addresses of buildings identified as potential anchor loads, in each area from **Figure 4.8** plus a buffer of 200m around each area were scanned through, to identify which were most likely to be good anchor loads. Following this they were also viewed in Google Streetview.

4.18 From this further investigation of anchor loads it was possible to rule out the following areas. In general, the reasons for ruling them out were that potential anchor loads were actually too small and spaced too far apart when looked at in detail (many of them could work if they were linked to larger loads, but there were no larger loads available), and where demand was high this tended to be due to groupings of a large number of small sources of demand, which are not ideal for district heating.

- Burbage: Buildings identified as potential anchor loads looked unsuitable.
- Market Bosworth: High heat demand caused by many small high street commercial properties. There are some potential anchor loads although these are schools which have very seasonal demand. One large domestic block.
- Newbold Verdon: This area has high heat demand but this is mainly caused by many residential addresses, each of which has a relatively small heat demand. There are no large domestic heat loads. The loads initially identified as potential anchor loads are actually small loads - a school, a community hall, a library and a working man's club, which are too far apart to make a viable grouping of loads.
- Desford: There is a school with quite a high heat demand but there are no other suitable loads. The other buildings initially identified as potential anchor loads are too small and widely spaced.
- Ratby: The heat demand is mainly made up of many small residential heat loads. There is no large domestic heat load. The potential anchor loads initially identified are too small: a school and community halls.
- Groby - The heat demand is mainly made up of many small residential heat loads. There is no large domestic heat load. The potential anchor loads are too small to support a district heating system.
- Markfield - High heat demand due to many small residential loads. Potential anchor loads are very small scale.

4.19 This leaves a shortlist of two areas: Hinckley, and Barwell & Earl Shilton.

Detailed Analysis of Hinckley and Barwell & Earl Shilton

4.20 In this section the remaining areas of Hinckley and Barwell and Earl Shilton are mapped and looked at in more detail.

4.21 The smaller scale maps tend to have much higher heat demand values per cell than the Borough-wide maps earlier in this chapter. This is because the heat density is calculated using a volume-preserving form of weighted average over a radius around each location on the map. Larger radii are typically used for larger scale, less detailed maps. Conversely, smaller radii are used on smaller scale, more detailed maps. In the larger scale maps, areas with no heat demand at all are averaged together with areas which do have heat demand, bringing down the heat demand value for the cell as a whole. As the level of detail increases and the search radius gets smaller, many areas with no heat demand end up in their own cells with a value of zero, which means that other cells end up with higher values. Heat demand is constrained into smaller areas, so the density values naturally increase. This is something to bear in mind when comparing maps of quite different scales.

Hinckley

4.22 **Figure 4.9**[12] shows heat demand divided into equal intervals rather than deciles, which were shown in the first, district-wide map. Areas with heat demand under 20kWh per m^2 per year have been removed. The map shows heat demand from both residential and non-residential sources. All of the potential anchor loads were examined, first by address and then by viewing on Google Earth / Streetview, and those that would be most suitable as anchor loads were chosen. On the

[12] The base map includes the old North Warwickshire and Hinckley college site, which has been redeveloped as housing, as there is no more up to date version available. However, heat demand for this building has been removed from the analysis.

map they are split into those loads with a demand of more than 1MWh and those with less than 1MWh.

4.23 The leisure centre has the highest heat demand. Other potential anchor loads over 1MWh are around 500-600m away from the leisure centre, but the redevelopment of the bus station area as it becomes The Crescent may introduce another high heat load near to the leisure centre. The high heat demand in the centre of the map is caused by commercial properties along Regent Street and there is another hot spot along Castle Street, again caused by commercial properties.

4.24 The area shown here (the coloured area) is approximately 4.2 square kilometres, which is a larger area than would likely be covered by any district heating scheme. The total heat demand in the area shown is 172,500 MWh per year, equal to an average heat density of 0.04 MWh per square metre. This is too low for a district heating system, but there are zones within this which have higher heat demand.

4.25 Within the mapped area, the most promising zones for feasibility studies are:

- The grouping of the Council Offices, General Hospital and the smaller potential anchor loads in this area, which are Hinckley Health Centre, Castlemead Health Centre, and the Masonic Hall. These could potentially be linked with the commercial properties in Castle Street. Current heat demand in this area is approximately 2,305 MWh per year, not including Castle Street, with a heat density approximately 0.7 MWh per square metre. In summer 2013 the Council Offices will be moving south to Hawley Road. However, the leisure centre will be relocated to the current Council Offices, meaning that the heat demand in this area is likely to increase, as the leisure centre has higher heat demand than the Council Offices.
- The Magistrates Court and Police Station. Also in this area are the Hinckley campus of North Warwickshire and Hinckley College, and the Atkins building, both of which are newly occupied, meaning that the National Heat Map predates them and so they were not included in the heat mapping. However they are both potential anchor loads and are in an area where the heat demand is relatively high already. These four larger heat loads (the court, the police station, the college and the Atkins building) could be joined to smaller loads in the area: Empire Fitness on Druid Street, the Concordia Theatre, Hinckley Working Men's Club, and Holliers Walk Primary School. Current heat demand in this area is around 3,700 MWh per year, with density of approximately 0.08 MWh per square metre.
- Currently, the area around the leisure centre, in particular linking this to commercial properties in Regent Street and The Crescent would also hold potential. Current heat demand in this area is 6,590 MWh per year, at a heat density of approximately 0.14 MWh per square metre. However, the leisure centre will be moving to where the Council Offices are currently located, and so this area will lose its largest source of heat demand.

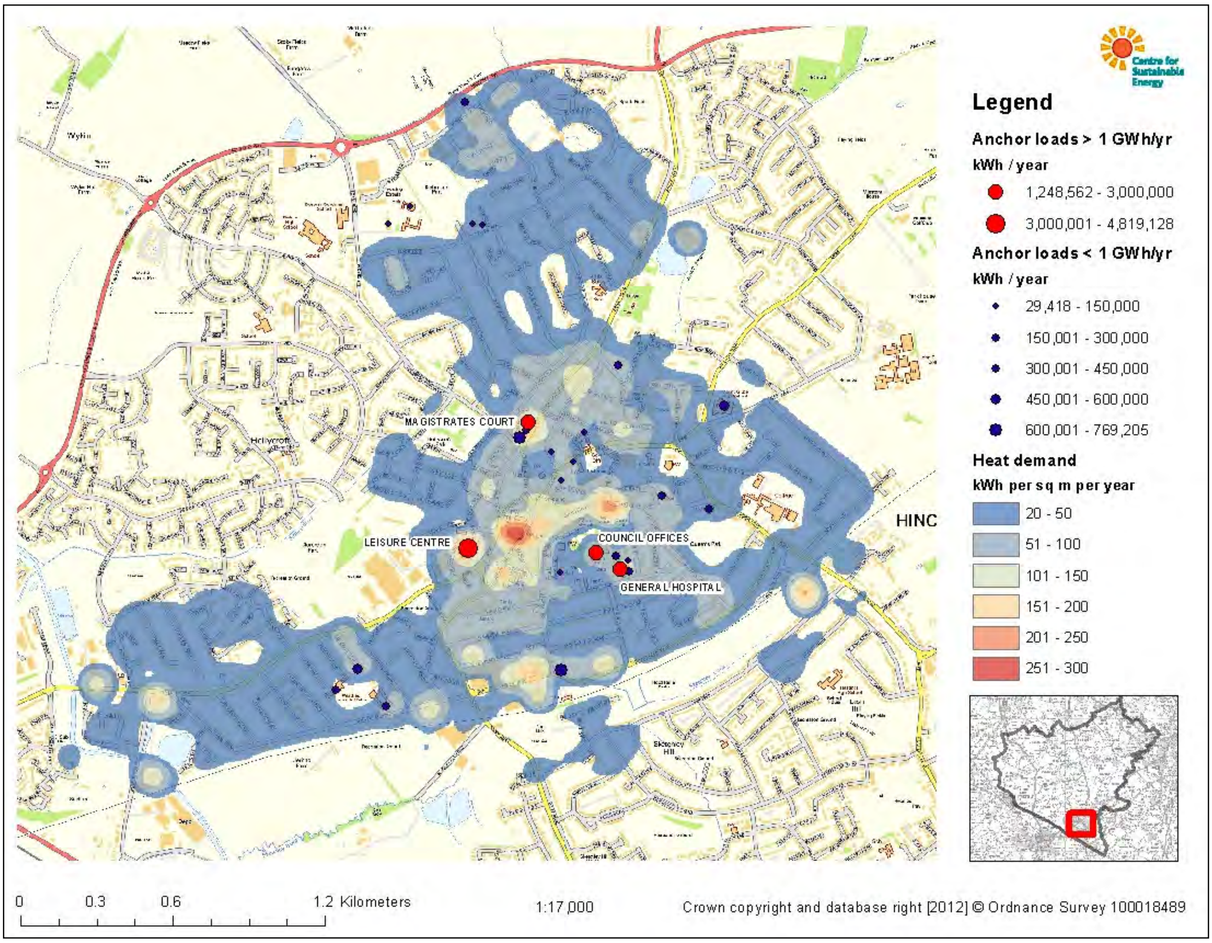


Figure 4.9: Detailed heat demand in Hinckley

4.26 There is also a large sheltered housing block to the north of this area, on Ashby Road. This kind of building is a good candidate for joining to a district heating system, as it has a high heat demand and is a public sector building. However this particular building is located quite far from the clusters of anchor loads and there does not appear to be any nearby buildings to which it can be connected.

4.27 It should be noted that although these groupings have been identified as the most suitable in the area, district heating systems are normally found in more densely populated urban areas. This report cannot recommend that resources should be dedicated to carrying out feasibility studies in the above areas; however if the Council wishes to pursue district heating in Hinckley, these would be the most suitable places to start.

Barwell and Earl Shilton wards

4.28 The map in **Figure 4.10** shows heat demand from all sources, divided into the same intervals as on the previous map of Hinckley, and again with anything under 20kWh per m^2 removed. The locations of the Sustainable Urban Extensions (SUEs) are also shown.

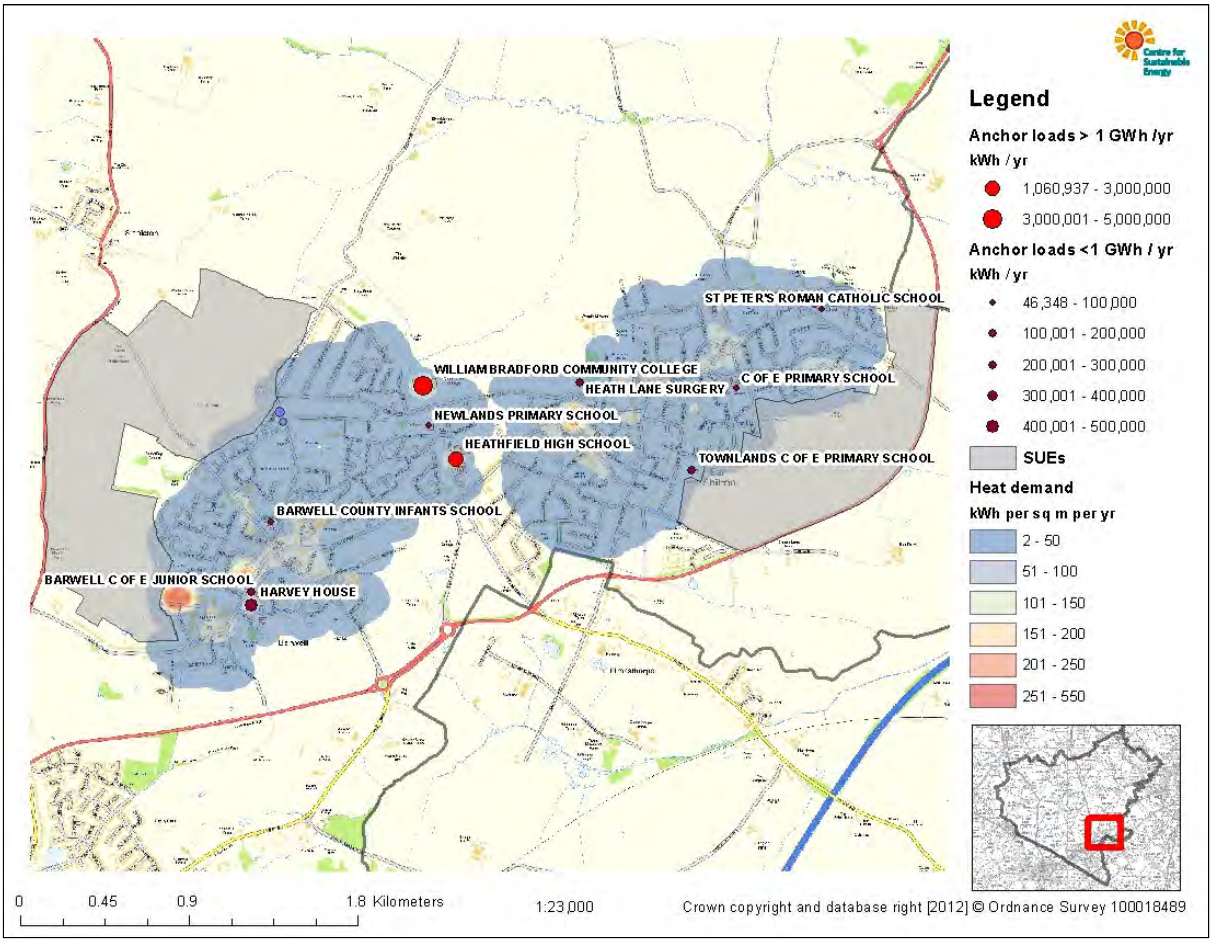


Figure 4.10: Detailed heat demand in Earl Shilton and Barwell

4.29 In the area shown, total heat demand is around 113,880 MWh per year, in a total area of 3.68 square kilometres. This equates to an average heat density of approximately 0.3 MWh per metre squared. Two Sustainable Urban Extensions (SUEs) are planned for this area, as shown, which will increase the heat demand considerably.

4.30 The higher heat demand found in the south west of the coloured area of the map is an industrial estate. Heat demand for the industrial estate is modelled based on the floor area of the buildings and their likely use, but when the site is viewed in Google Earth it seems likely that heat demand is slightly lower than that modelled. While the highest heat demand in this map is higher than in the Hinckley map, the higher figures come only from this industrial estate.

4.31 The most promising areas for feasibility studies here are:

- The grouping of Harvey House (small sheltered housing), Barwell C of E Junior School, and potentially some industrial buildings. The smaller area of high heat demand in this area is the Bradgate Products factory.
- William Bradford Community College, Newlands Primary School, and Heathfield Primary School. This grouping has the highest heat load in the area, but all three buildings are schools, which have very seasonal heat demand - it is preferable to have one school in a mixture of other building types to smooth out load.

4.32 These areas are only likely to be worth further investigation if they could link to a larger system in the development of the Sustainable Urban Extensions. There is however very limited opportunity for this to occur as these developments are in the later stages of design, with the application for the Barwell SUE already submitted.

Key Conclusions

4.33 The key conclusions are as follows:

- Total modelled heat demand in the Borough is 914,389 MWh per year, 35% of which is from non-domestic sources, with 65% coming from residential sources. Approximately 44% of the Borough's heat demand comes from the Hinckley / Burbage area to the south, and 15% comes from the Earl Shilton / Barwell area.
- Overlaying areas of high heat demand, locations of anchor loads and large domestic loads can flag areas with higher potential for district heating. It was found however that all three rarely coincide within the Borough. Areas where at least two of these criteria coincide were therefore identified at nine locations and these were subsequently reduced to three following further analysis: Hinckley, and Barwell & Earl Shilton.
- Further analysis of the Hinckley area identified an average heat density of 0.04 MWh per square metre, which is normally too low for a district heating system, but there are zones within the area which have higher heat demand. The areas around the council offices grouping (particularly with the future relocation of the leisure centre) and the Magistrates Court are the most promising in Hinckley and may be worth further study. Similarly, the most promising areas for further study within Barwell & Earl Shilton include the area around Barwell C of E Junior School and William Bradford Community College.
- Both of these areas by themselves are only likely to be marginal in terms of suitability for district heating as most systems are found in more densely populated urban areas. More promising opportunities could have offered however if they e linked to a larger system in the development of the Sustainable Urban Extensions to the west of Barwell and the south of Earl Shilton. There is however very limited opportunity for this to occur as these developments are in the later stages of design, with the application for the Barwell SUE already submitted.
- As greater carbon savings from district heating schemes can be achieved by use of biomass-fired plant, any further studies actioned on the areas identified should consider this option and refer to the biomass resources described in **Chapter 6.**

5 Landscape Sensitivity Assessment

Introduction

5.1 This chapter sets out the results of an assessment of the sensitivity of Hinckley and Bosworth's landscape to large, medium and small scale wind energy turbines. As outlined in **Chapter 3**, wind turbines have the technical potential to deliver a significant amount of electricity within the Borough. However, one of the key factors determining the acceptability or otherwise of wind turbines is their potential impacts on the local landscape – this is due to their height and the movement they introduce into the landscape (i.e. rotating blades). This assessment was therefore undertaken to:

- provide a consistent and spatially comprehensive evidence base to inform the assessment of deployable potential;
- provide guidance for those seeking to identify suitable areas for the location of wind turbines and for the Council in providing an initial response to such proposals;
- help in the formulation of criteria against which specific proposals may be assessed in relation to landscape impacts.

5.2 A number of important points should be borne in mind concerning the scope and use of this landscape sensitivity assessment, as follows:

- this chapter only considers landscape character considerations, clearly there are many other factors which will influence decisions including impacts on visual amenity;
- the study provides strategic guidance at the landscape character area level - local variations in character will also need to be considered in relation to individual applications;
- the study does not negate the need for detailed consideration of landscape and visual impact on a case-by-case basis in relation to an individual application or as part of an environmental statement.

Approach to Assessment

Development Types Considered

5.3 This assessment considers the relative sensitivity of Hinckley and Bosworth's landscapes to three scales of wind turbine (all are assumed to be the standard horizontal-axis 3 bladed type). The turbine heights are based on three height bandings to match the technical assessment in **Chapter 3**:

- small scale turbines (typically 15m - 40m to blade tip);
- medium scale turbines (typically 40m - 80m to blade tip);
- large scale turbines (typically 80m -135m to blade tip).

5.4 Turbines under 15m are not covered in this assessment as it is not possible to draw general conclusions on the sensitivity of landscape to turbines of this small size.

5.5 Ancillary elements may include access tracks, transformers, substations, power lines, control buildings and anemometer masts.

Evaluating Landscape Sensitivity

5.6 There is currently no published method for evaluating sensitivity or capacity of different types of landscape. However, the approach taken in this study builds on current guidance published by the Countryside Agency and Scottish Natural Heritage including the Landscape Character

Assessment: Guidance for England and Scotland[13] and Topic Paper 6 that accompanies the Guidance[14], as well as LUC's considerable experience from previous and ongoing studies of a similar nature.

5.7 Para 4.2 of Topic Paper 6 states that:

'Judging landscape character sensitivity requires professional judgement about the degree to which the landscape in question is robust, in that it is able to accommodate change without adverse impacts on character. This involves making decisions about whether or not significant characteristic elements of the landscape will be liable to loss... and whether important aesthetic aspects of character will be liable to change'

5.8 In this study the following definition of sensitivity has been used:

Sensitivity is the relative extent to which the character and quality of the landscape is susceptible to change as a result of wind energy development.

5.9 This landscape sensitivity assessment is based on an assessment of landscape character using carefully defined criteria.

Landscape Character

5.10 Since landscape character forms the basis of the approach to the landscape sensitivity assessment, the assessment is based on the existing landscape character assessment for Hinckley and Bosworth which identifies 10 landscape character areas[15] as listed in **Table 5.1** below and mapped in **Figure 5.1**. It is important that landscape character is conserved as far as possible when siting renewable energy development.

Table 5.1: Hinckley and Bosworth Landscape Character Areas

Character Areas
A: Charnwood Fringe Character Area
B: Forest Hills Character Area
C: Market Bosworth Parkland Character Area
D: Desford Vales Character Area
E: Stoke Golding Vales Character Area
F: Hinckley, Barwell and Burbage Fringe Character
G: Fen Lanes Character Area
H: Upper Mease Character Area
I: Gospall Parkland Character Area
J: Upper Sence Character Area

5.11 Information on their character is provided in the 2006 report *'Landscape Character Assessment: Hinckley and Bosworth'* and is summarised in **Appendix 5.1.** This information has been used to inform the sensitivity assessments.

Landscape Quality

5.12 The Borough does not contain any statutory landscape designations.

5.13 There are a number of ecological and historic designations which, although they do not affect overall landscape character sensitivity, will need to be taken into account in the siting and design of wind energy development. These include Conservation Areas and Bosworth Registered Battlefield.

Assessment Criteria

5.14 In line with the recommendations in Topic Paper 6, this landscape sensitivity assessment is based on an assessment of landscape character using carefully defined criteria. Criteria for determining landscape sensitivity to wind energy development are based on attributes of the landscape most likely to be affected. **Table 5.2** sets out the criteria that were used for the assessment of

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[13] Countryside Agency and Scottish Natural Heritage (2002) *Landscape Character Assessment: Guidance for England and Scotland* CAX 84.

[14] The Countryside Agency and Scottish Natural Heritage (2004). *Topic Paper 6: Techniques and Criteria for Judging Capacity and Sensitivity.*

[15] Hinckley and Bosworth Borough Council (2006) Landscape Character Assessment: Hinckley and Bosworth.

landscape sensitivity to wind energy development. These have been informed by our review of other studies.

5.15 In order to understand landscape sensitivity it is important to understand both the shape and scale of the underlying landform and the nature and scale of the overlying landscape pattern. The former is covered by the first criterion and the latter by the second.

Table 5.2: Criteria for Assessing Landscape Sensitivity to Wind Turbines

Landform and scale				
A smooth, convex or flat landform is likely to be less sensitive to wind energy development than a landscape with a dramatic rugged landform, distinct landform features or pronounced undulations; and larger scale landforms are likely to be less sensitive than smaller scale landforms - because turbines may appear out of scale, detract from visually important landforms or appear confusing (due to turbines being at varying heights) in the latter types of landscapes.				
Examples of sensitivity ratings				
Lower sensitivity		⟷	**Higher sensitivity**	
e.g. an extensive lowland flat landscape or elevated plateau, often a larger scale landform	e.g. a simple gently rolling landscape, likely to be a medium-large scale landform	e.g. a landscape with distinct convex hills, perhaps also incised by valleys, likely to be a medium scale landform	e.g. a landscape with distinct landform features, and/or irregular in topographic appearance (which may be large in scale), or a smaller scale landform	e.g. a landscape with a rugged landform or dramatic landform features (which may be large in scale), or a small scale landform
Land cover pattern and presence of human scale features				
Simple, regular landscapes with extensive areas of consistent ground cover are likely to be less sensitive to wind energy development than landscapes with more complex or irregular land cover patterns, smaller and / or irregular field sizes and landscapes with frequent human scale features that are traditional of the landscape, such as scattered farmsteads and small farm woodlands [16]. This is because large features such as wind turbines may dominate smaller scale traditional features within the landscape.				
Examples of sensitivity ratings				
Lower sensitivity		⟷	**Higher sensitivity**	
e.g. a very large-scale landscape with uniform groundcover and lacking in human scale features	e.g. a landscape with large-scale fields, little variety in land cover and occasional human scale features such as trees and domestic buildings	e.g. a landscape with medium sized fields, some variations in land cover and presence of human scale features such as trees, domestic buildings	e.g. a landscape with irregular small-scale fields, variety in land cover and presence of human scale features such as trees, domestic buildings	e.g. a landscape with a strong variety in land cover and small-scale / irregular in appearance containing numerous human scale features

[16] Human scale features are aspects of land cover such as stone walls, hedges, buildings which give a 'human scale' to the landscape

Tracks / transport pattern				
Landscapes that are devoid of tracks will be particularly sensitive to wind energy development because it will be more difficult to absorb permanent new tracks into the landscape without change to character in these areas.				
Examples of sensitivity ratings				
Lower sensitivity		↔	**Higher sensitivity**	
e.g. a landscape containing existing roads and vehicular tracks	e.g. a landscape containing existing roads and vehicular tracks	e.g. a landscape containing some existing roads and vehicular tracks	e.g. a landscape containing few lanes or vehicular tracks	e.g. a landscape devoid of roads or vehicular tracks
Skylines				
Prominent and distinctive skylines, or skylines with important landmark features that are identified in the landscape character assessment, are likely to be more sensitive to wind energy development because turbines may detract from these skylines as features in the landscape, or draw attention away from existing landform or landmark features on skylines. These include the skylines of elevated hill ranges. Important landmark features on the skyline might include historic features or monuments. The presence or absence of existing structures such as pylons or turbines does not influence sensitivity.				
Examples of sensitivity ratings				
Lower sensitivity		↔	**Higher sensitivity**	
e.g. a large-scale flat or plateau landscape where skylines are not prominent and/or there are no important landmark features on the skyline	e.g. a large-scale landscape where skylines are not prominent and/or there are very few landmark features on the skyline – other skylines in adjacent LCTs are more prominent	e.g. a landscape with some prominent skylines, but these are not particularly distinctive. There may be some landmark features on the skyline.	e.g. a landscape with prominent skylines that may form an important backdrop to views from settlements or important viewpoints, and/or with many landmark features on the skyline	e.g. a landscape comprising prominent or distinctive skylines and/or with particularly important landmark features on the skyline
Perceptual qualities and man-made influence				
Landscapes that are relatively remote or tranquil (due to freedom from human activity and disturbance and having a perceived naturalness or a strong feel of traditional rurality with few modern human influences) tend to increase levels of sensitivity to wind energy development compared to landscapes that contain signs of modern development (as the development will introduce new and uncharacteristic features which may detract from a sense of tranquillity and or remoteness/ naturalness).				
Examples of sensitivity ratings				
Lower sensitivity		↔	**Higher sensitivity**	
e.g. a landscape with much human activity and development such as industrial areas	e.g. a rural landscape with much human activity and dispersed modern development	e.g. a rural landscape with some modern development and human activity	e.g. a more naturalistic landscape and / or one with little modern human influence and development	e.g. a remote or 'wild' landscape with little or no signs of current human activity and development

Inherent Capacity and Sensitivity for LCAs[17]				
Inherent landscape sensitivity and capacity is assessed in the Hinckley and Bosworth LCA and this has been used to feed into this sensitivity assessment. Landscapes with a lower sensitivity and higher capacity for change include changing and evolving landscapes or landscapes largely influenced by development features such as quarries or industrial development. Landscapes with a higher sensitivity and thus a limited capacity to change include those described as 'distinctive and attractive' with many important landscape features or landscapes with a distinctly rural and largely tranquil character.				
Examples of sensitivity ratings				
Lower sensitivity		⟷	**Higher sensitivity**	
Identified as being of low sensitivity in the LCA		Identified as being of medium sensitivity in the LCA		Identified as being of high sensitivity in the LCA

Undertaking the Landscape Sensitivity Assessment

5.16 The above criteria were used to assess the relative sensitivity of each landscape character area to wind energy development across the study area. Fieldwork was also undertaken to verify the results and add information that is not readily available from the desk based study. The results are recorded on a five point scale as follows:

Table 5.3: Definitions of Sensitivity

Sensitivity Level	Definition
High	Key characteristics and qualities of the landscape are highly vulnerable to change from wind turbines. Such development would result in a significant change in character.
Moderate-high	Key characteristics and qualities of the landscape are vulnerable to change from wind turbines. There may be some limited opportunity to accommodate the wind turbines without changing landscape character. Great care would be needed in locating turbines.
Moderate	Some of the key characteristics and qualities of the landscape are vulnerable to change from wind turbines. Although the landscape may have some ability to absorb some development, it is likely to cause some change in character. Care would be needed in locating turbines.
Moderate-low	Few of the key characteristics and qualities of the landscape are vulnerable to change from wind turbines. The landscape is likely to be able to accommodate turbines with only minor change in character. Care is still needed when locating turbines to avoid adversely affecting key characteristics.
Low	Key characteristics and qualities of the landscape are robust in that they can withstand change from introduction of wind turbines. The landscape is likely to be able to accommodate wind turbines without a significant change in character. Care is still needed when locating wind turbines to ensure best fit with the landscape.

Results

5.17 The full landscape sensitivity assessments for each of the landscape character areas (LCAs) are presented in tabular format in **Appendix 5.1**. The tables in **Appendix 5.1** provide:

- a summary description of the LCA against each of the assessment criteria;
- an overall discussion on landscape sensitivity for the LCA;
- a list of key landscape attributes that would be sensitive to wind energy development;
- sensitivity ratings for different turbine heights;
- observations on landscape sensitivity to different cluster sizes.

17 As set out in Landscape Character Assessment (July 2006) Hinckley and Bosworth Borough.

5.18 A summary of the results of the assessment is provided in Table 5.4 below. The results are also summarised on the maps in Figures 5.2-5.4.

5.19 Although the results are quite similar across the different character areas, the reasons for the ratings vary – therefore it is important to refer to the full tables provided in **Appendix 5.1** (which contain specific information relating to different sensitivities within the LCAs) when interpreting the summary table and maps.

Table 5.4: Summary of sensitivity ratings for LCAs

Landscape Character Area	Small scale wind turbines (25-40m)	Medium scale wind turbines (40-80m)	Large scale wind turbines (80-135m)
A: Charnwood Fringe Character Area	Low-moderate	Moderate	Moderate-high
B: Forest Hills Character Area	Low	Low-moderate	Moderate
C: Market Bosworth Parkland Character Area	Low-moderate	Moderate	Moderate-high
D: Desford Vales Character Area	Low	Moderate	Moderate-high
E: Stoke Golding Vales Character Area	Low-moderate	Moderate	Moderate-high
F: Hinckley, Barwell and Burbage Fringe Character Area	Low	Low-moderate	Moderate
G: Fen Lanes Character Area	Low	Low-moderate	Moderate
H: Upper Mease Character Area	Low	Low-moderate	Moderate
I: Gospall Parkland Character Area	Low-moderate	Moderate	Moderate-high
J: Upper Sence Character Area	Low-moderate	Moderate	Moderate-high

5.20 It should be noted that the 'large' size category includes turbines between 80m and 135m – this is a large size range and the landscape will be more sensitive to turbines at the upper end of this range.

A note on scale

5.21 The landscapes in Hinckley and Bosworth tend to have a medium scale landform and landscape pattern and contain scattered human scale features (such as farmsteads, historic villages and trees). As a result sensitivity is generally higher to larger scale turbines. Conversely, there is generally lower sensitivity to small scale turbines across the study area (i.e. those up to 40m to tip) – especially where these smaller scale turbines form part of farm complexes or businesses.

5.22 Some of the larger scale landscapes may be more able to accommodate turbines at the lower end of the 'large' size group e.g. Character Area B: Forest Hills, Character Area F: Hinckley, Barwell and Burbage Fringe, Character Area G: Fen Lanes and Character Area H: Upper Mease.

A note on cumulative effects

5.23 Although most landscapes will be able to accommodate some renewable energy development of some scale, they are likely to become progressively more sensitive to development of a large number of wind energy developments. **It is not possible to provide a generic limit on numbers or distances between turbines or wind energy developments and each proposal will need to consider cumulative impacts on a case by case basis.** Appendix 5.2 provides generic guidance on the siting and design of wind energy developments. The guidance on designing for multiple wind energy developments set out in **Appendix 5.2** will assist in minimising adverse cumulative impacts.

Limitations

5.24 **While this assessment provides an initial indication of the relative landscape sensitivity of different areas to wind turbine development, it should not be interpreted as a definitive statement on the suitability of a particular landscape for a particular development. It is not a replacement for detailed studies for specific siting and design and all developments will need to be assessed on their individual merits.**

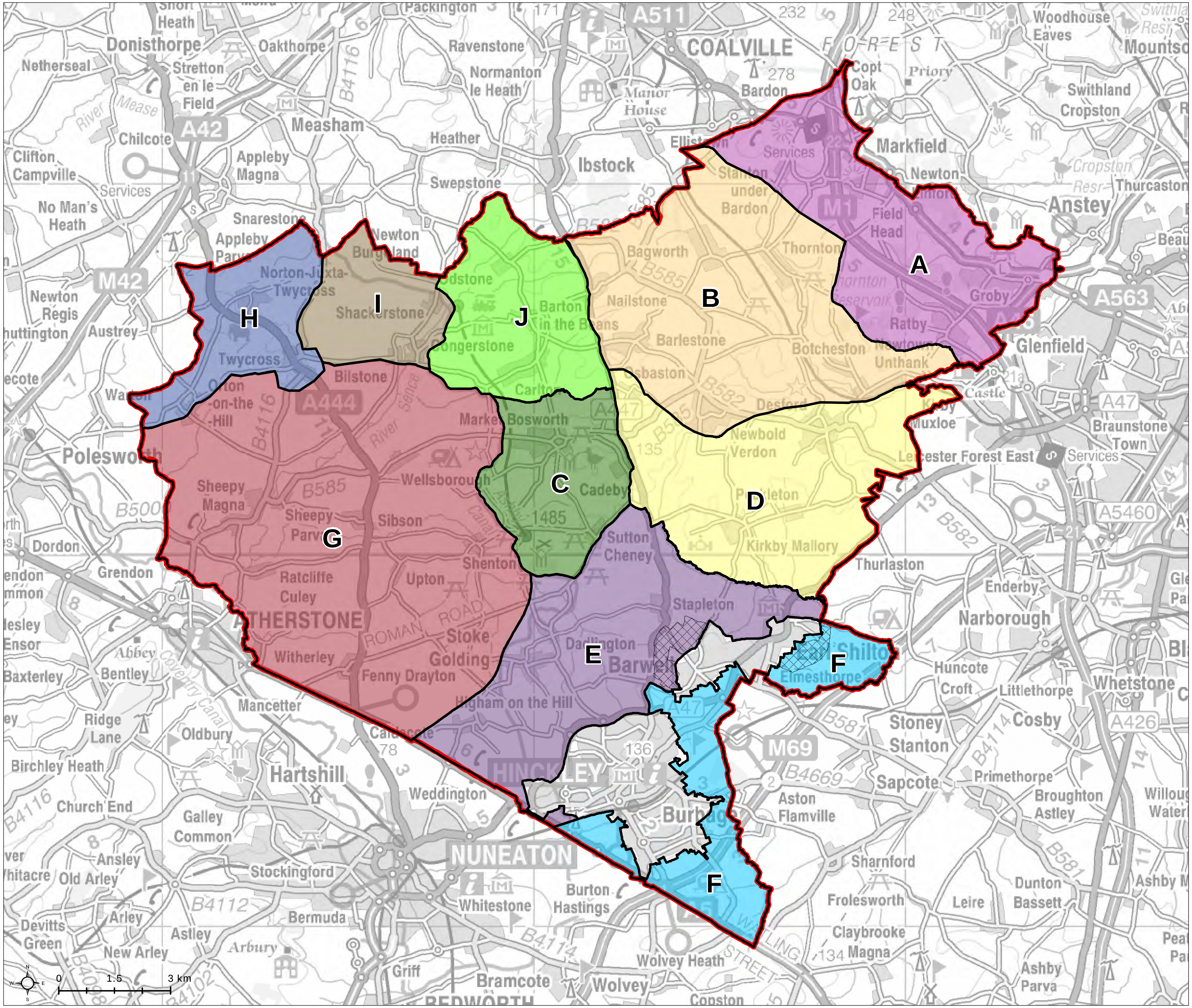
5.25 This *landscape character* sensitivity assessment is based on key characteristics of the landscape across Hinckley and Bosworth and does not cover specific ecological issues associated with nature conservation designations or bird flight paths, or specific cultural heritage/archaeological issues associated with specific archaeological features or listed buildings, or visual amenity issues (these are issues that will also need to be taken into account at the time when individual proposals are being put forward).

5.26 The landscape sensitivity ratings do not equate to levels of acceptability. For example, a particular site in an area of high sensitivity may be found to be acceptable, or a particular site in an area of low sensitivity may be found to be unacceptable. The judgement about whether this change is acceptable or not is a separate planning judgement that will need to be made in the round, taking into account other planning issues.

Key Conclusions

5.27 The landscape sensitivity assessment concludes:

- The landscapes in Hinckley and Bosworth have a moderate/ moderate-high sensitivity to large scale turbines (up to 135m to tip). A low/moderate/ moderate sensitivity to medium scale turbines (40-80m to tip) and a low/ low-moderate sensitivity to small turbines (i.e. those up to 40m to tip).
- Some of the larger scale landscapes may be more able to accommodate turbines at the lower end of the 'large' size group e.g. Character Area B: Forest Hills, Character Area F: Hinckley, Barwell and Burbage Fringe, Character Area G: Fen Lanes and Character Area H: Upper Mease.



Hinckley & Bosworth Renewable Energy Capacity Study

Figure 5.1

Landscape Character Areas

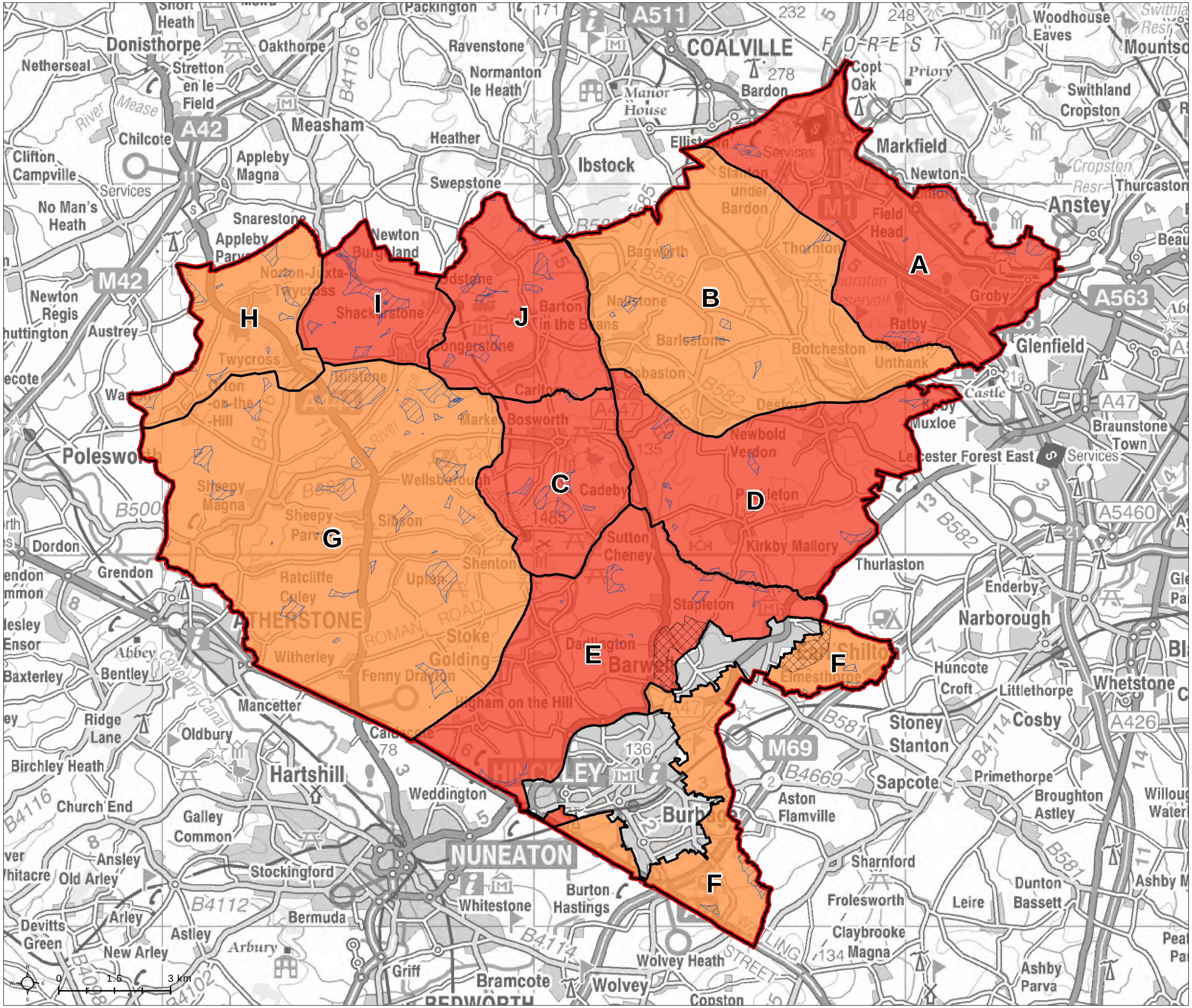
- Hinckley and Bosworth boundary
- Sustainable Urban Extensions
- Landscape Character Areas
- A: Charnwood Fringe
- B: Forest Hills
- C: Market Bosworth Parkland
- D: Desford Vales
- E: Stoke Golding
- F: Hinckley, Barwell and Burbage Fringe
- G: Fen Lanes
- H: Upper Mease
- I: Gopsall Parkland
- J: Upper Sense

Map Scale @ A3:1:100,000

LUC

LUC LDN 5582-01_010_Landscape_character_areas_RevA 03/04/2013

Source: H&B



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LUC LDN 5582-01_013_Landscape_sensitivity_to_lrg_turbines_RevB 04/04/2013

Hinckley & Bosworth Renewable Energy Capacity Study

Figure 5.2

Landscape sensitivity to large turbines (80-135m to tip)

- Hinckley and Bosworth boundary
- Sustainable Urban Extensions
- Suitable for large turbines

Landscape sensitivity to large turbines

- Moderate
- Moderate-high

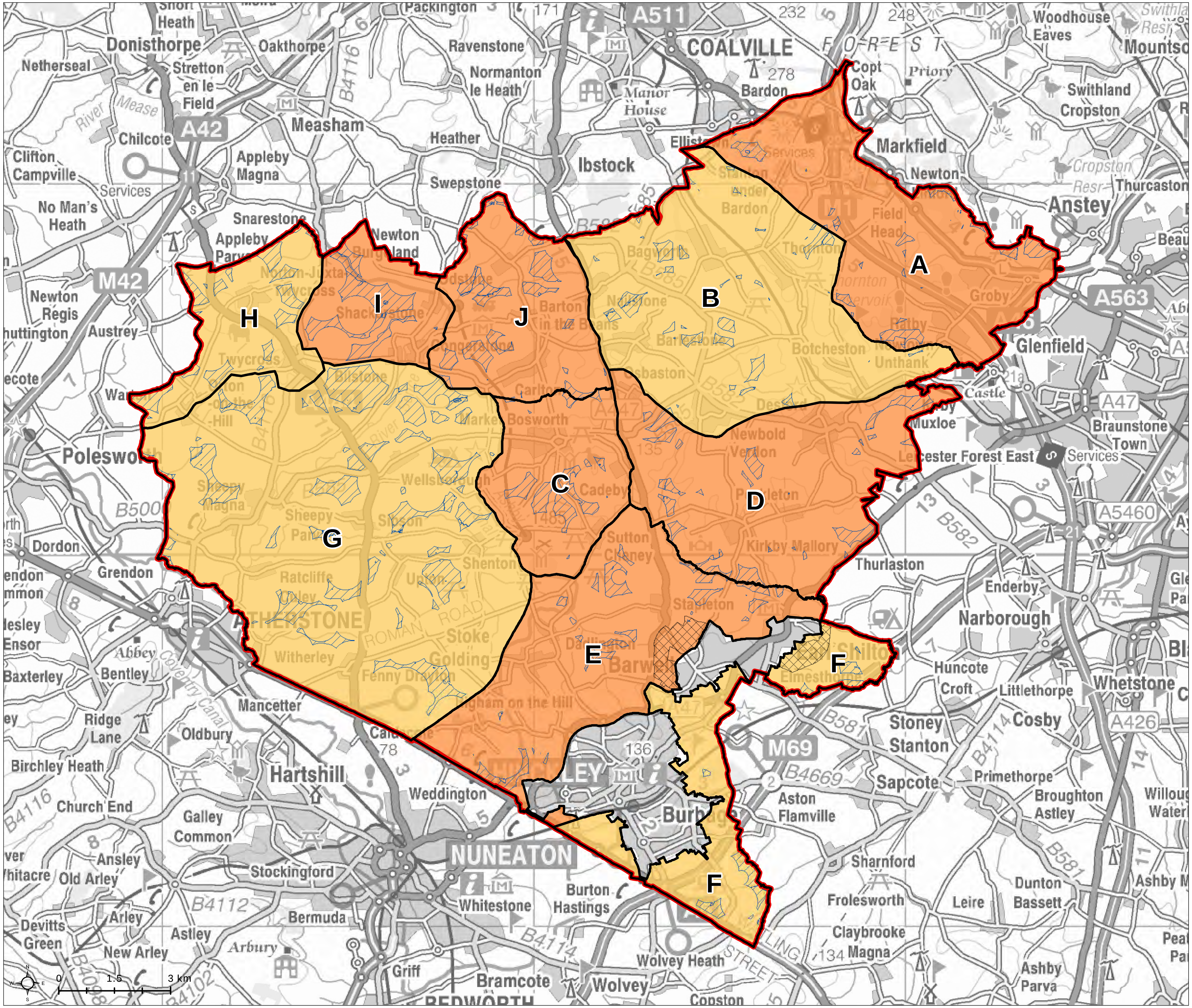
- Landscape Character Areas

A: Charnwood Fringe
B: Forest Hills
C: Market Bosworth Parkland
D: Desford Vales
E: Stoke Golding
F: Hinckley, Barwell and Burbage Fringe
G: Fen Lanes
H: Upper Mease
I: Gopsall Parkland
J: Upper Sense

Map Scale @ A3:1:100,000

LUC

Source:



Hinckley & Bosworth Renewable Energy Capacity Study

Figure 5.3

Landscape sensitivity to medium turbines (40-80m to tip)

- Hinckley and Bosworth boundary
- Sustainable Urban Extensions
- Suitable for medium turbines

Landscape sensitivity to medium turbines

- Low-moderate
- Moderate
- Landscape Character Areas

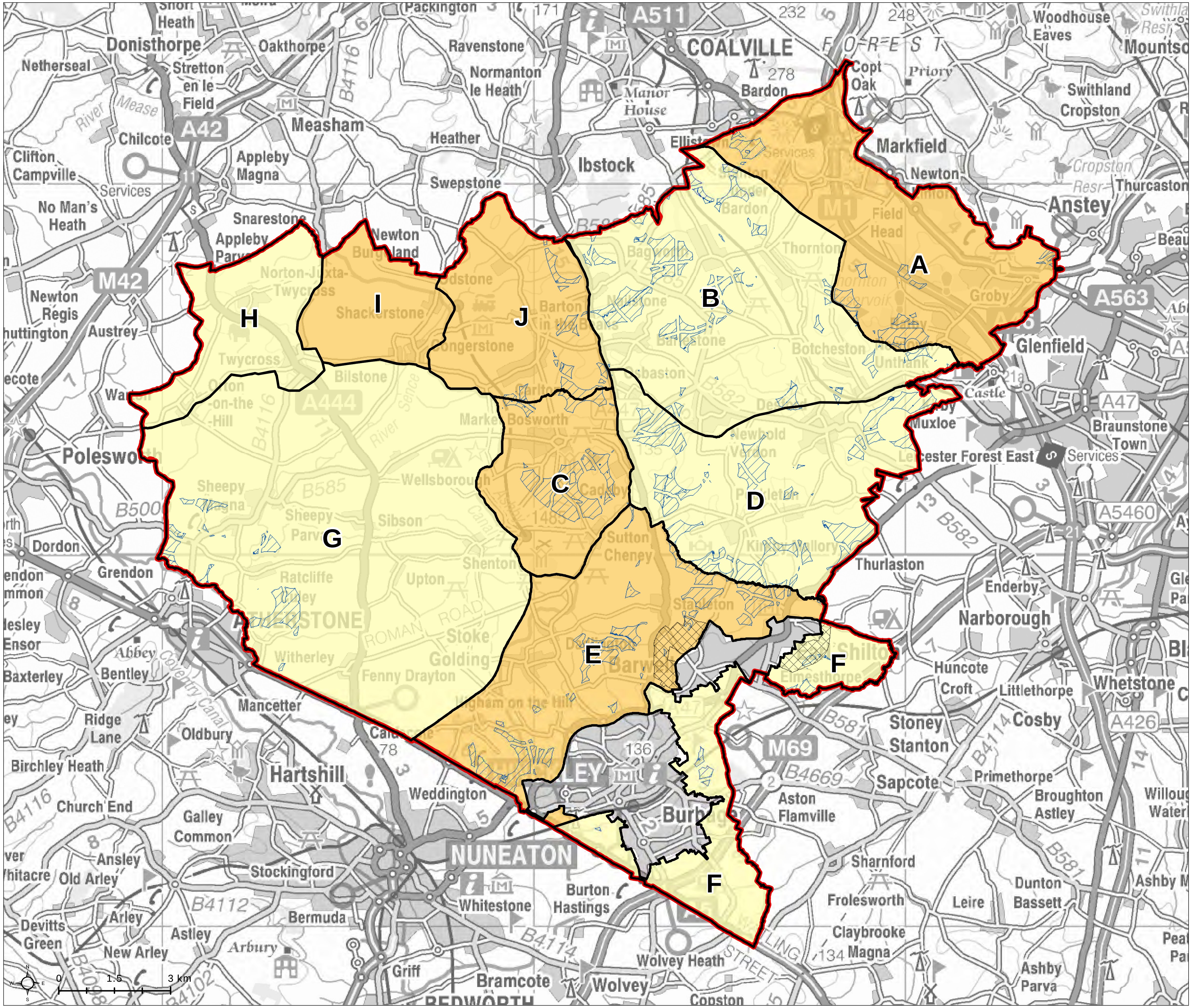
A: Charnwood Fringe
B: Forest Hills
C: Market Bosworth Parkland
D: Desford Vales
E: Stoke Golding
F: Hinckley, Barwell and Burbage Fringe
G: Fen Lanes
H: Upper Mease
I: Gopsall Parkland
J: Upper Sense

Map Scale @ A3:1:100,000

LUC

LUC LDN 5582-01_012_Landscape_sensitivity_to_med_turbines_RevB 03/04/2013

Source:



Hinckley & Bosworth Renewable Energy Capacity Study

Figure 5.4

Landscape sensitivity to small turbines (15-40m tip)

Hinckley and Bosworth boundary

Sustainable Urban Extensions

Suitable for small turbines

Landscape sensitivity to small turbines

Low

Low-moderate

Landscape Character Areas

A: Charnwood Fringe
B: Forest Hills
C: Market Bosworth Parkland
D: Desford Vales
E: Stoke Golding
F: Hinckley, Barwell and Burbage Fringe
G: Fen Lanes
H: Upper Mease
I: Gopsall Parkland
J: Upper Sense

Map Scale @ A3:1:100,000

LUC

LUC LDN 5582-01_011_Landscape_sensitivity_to_sml_turbines_RevB 04/04/2013

Source:

6 Assessment of Deployable Potential and Setting a Target

Introduction

6.1 The technical resource assessment presented in **Chapter 3** provides a theoretical upper limit for renewable energy deployment across the Borough and therefore sets a useful context against which to consider a more realistic or practical renewables target. The process of researching and setting out the deployable potential is however not straightforward; there are no standard methodologies for doing this and the extent to which targets are achievable within a certain timeframe will largely depend on future national policy incentives, site specific factors and the will of local organisations and their effectiveness in facilitating the local actions required.

6.2 The approach taken here therefore attempts to further refine the context of target setting by first considering two levels of implementation described as follows:

- '**Business as Usual**': this projects forward to 2020 and 2026 by assuming a low level of renewables is implemented with little increase on the present level of deployment within the Borough, which as a baseline is already notably low (see **Chapter 2**). Although there are a significant number of opportunities for most technologies, growth is very limited based on historical trends in the Borough and tends to be below average in terms of county and national trends;
- '**15% renewables**': this level of implementation explores the options for the Borough to source 15% of its total heat and electricity consumption from renewables by 2020. This aligns with the national commitment of delivering 15% of energy demand from renewable sources by 2020, but unlike the national target does not include energy used for transport, as this falls beyond the scope of the study.

6.3 These levels of implementation along with the technical potential then set the context on which to make recommendations regarding an appropriate renewables target for the periods up to 2020 and 2026, known here as the '**Recommended Target Potential**'. These are suggested as realistic targets but will rely on Hinckley and Bosworth Council adopting suitably conducive policies to facilitate their achievement.

6.4 The sections below set out the assumptions made across the technologies for each level of deployment. For each technology, the impacts of the most likely constraints not previously considered in the technical potential analysis were evaluated. These constraints broadly relate to one or more of the following elements of project development: national trends and supply chains, technical and economic issues, and planning constraints.

Results of Analysis

6.5 **Table 6.1** below summarises the review of existing energy generation capacity within Hinckley and Bosworth as described in **Chapter 2** and suggests how this may change up to 2020 and 2026 under a **Business as Usual approach.**

6.6 **Table 6.2** then presents two illustrative technology mixes that could achieve the **15% renewables level of deployment**. This compares two mixes, Option A, which draws **significantly** on the wind power resource and Option B which focuses solely on non-wind technologies. The corresponding proportion of the technical resource (see **Chapter 3**) for each technology is also given alongside the selected MW capacities.

6.7 **Table 6.3** then suggests the **Recommended Target Potential** that Hinckley and Bosworth Council could consider for target setting purposes.

Table 6.1: Business as Usual

Technology	2012 existing capacity in H&B (MW)	% of technical resource delivered	2020 (MW)	2020 (GWh)	% of technical resource delivered	2026 (MW)	2026 (GWh)
Business As Usual							
Large wind	0	0.0%	0.00	0.00	0.0%	0.00	0.00
Medium wind	0	1.0%	1.51	3.43	1.0%	1.51	3.43
Small wind	0.024	1.0%	2.98	6.75	1.0%	2.98	6.75
Micro Scale Wind <6kW	0	1.0%	0.13	0.29	1.0%	0.13	0.29
Managed Woodland (heat)	0	50.0%	0.90	3.55	75.0%	1.35	5.32
Managed Woodland (elec)	0	0.0%	0.00	0.00	0.0%	0.00	0.00
Energy Crops (heat)	0	0.5%	0.09	0.35	1.0%	0.19	0.74
Energy Crops (elec)	0	0.0%	0.00	0.00	0.0%	0.00	0.00
Agricultural Arisings (heat)	0	0.0%	0.00	0.00	0.0%	0.00	0.00
Agricultural Arisings (elec)	0	0.0%	0.00	0.00	0.0%	0.00	0.00
Poultry Litter (elec)	0	0.0%	0.00	0.00	0.0%	0.00	0.00
Wet Organic Waste (heat)	0	0.0%	0.00	0.00	7.0%	0.34	2.37
Wet Organic Waste (elec)	0	0.0%	0.00	0.00	7.0%	0.28	1.48
Municipal Solid Waste (heat)	0	0.0%	0.00	0.00	0.0%	0.00	0.00
Municipal Solid Waste (elec)	0	0.0%	0.00	0.00	0.0%	0.00	0.00
Commercial and Industrial (heat)	0	0.0%	0.00	0.00	0.0%	0.00	0.00
Commercial and Industrial (elec)	0	0.0%	0.00	0.00	0.0%	0.00	0.00
Landfill Gas	2.64	100.0%	1.05	5.20	100.0%	0.71	3.50
Hydro	0	0.0%	0.00	0.00	0.0%	0.00	0.00
Solar PV	2.6	10.0%	3.68	2.90	11.3%	4.52	3.56
Solar Thermal	unknown	1.8%	0.53	0.23	2.9%	0.95	0.42
Solar arrays	0	2.0%	3.18	2.78	2.0%	3.18	2.78
Heat Pumps	0	0.6%	1.27	2.90	2.2%	4.84	11.03
Water source heat pumps	0	0.0%	0.00	0.00	0.0%	0.00	0.00
Total (GWh)	–			**28.39**	–		**41.68**
Predicted energy demand in Borough (GWh)	–			**1,249**	–		**1,294**
Proportion of Borough energy use supplied by renewables (%)	–			**2.27%**	–		**3.22%**

Table 6.2: 15% Renewables by 2020

15% RE by 2020	Option A (High wind deployment)			Option B (No wind deployment)		
Technology	% of technical resource delivered	2020 (MW)	2020 (GWh)	% of technical resource delivered	2020 (MW)	2020 (GWh)
Large wind	12.0%	12.42	28.17	0.0%	0.00	0.00
Medium wind	9.0%	13.61	30.88	0.0%	0.00	0.00
Small wind	8.0%	23.81	54.03	0.0%	0.00	0.00
Micro Scale Wind <6kW	1.0%	0.13	0.29	1.0%	0.13	0.29
Managed Woodland (heat)	100.0%	1.80	7.10	400.0%[18]	7.20	28.38
Managed Woodland (elec)	0.0%	0.00	0.00	0.0%	0.00	0.00
Energy Crops (heat)	20.0%	3.54	13.96	30.0%	5.31	20.94
Energy Crops (elec)	20.0%	0.61	4.58	30.0%	0.91	6.87
Agricultural Arisings (heat)	0.0%	0.00	0.00	50.0%	1.18	4.65
Agricultural Arisings (elec)	0.0%	0.00	0.00	0.0%	0.00	0.00
Poultry Litter (elec)	0.0%	0.00	0.00	0.0%	0.00	0.00
Wet Organic Waste (heat)	20.0%	0.96	6.76	50.0%	2.41	16.90
Wet Organic Waste (elec)	20.0%	0.80	4.23	50.0%	2.01	10.56
Municipal Solid Waste (heat)	0.0%	0.00	0.00	0.0%	0.00	0.00
Municipal Solid Waste (elec)	0.0%	0.00	0.00	0.0%	0.00	0.00
Commercial and Industrial (heat)	0.0%	0.00	0.00	0.0%	0.00	0.00
Commercial and Industrial (elec)	0.0%	0.00	0.00	0.0%	0.00	0.00
Landfill Gas	100.0%	1.05	5.20	100.0%	1.05	5.20
Hydro	25.0%	0.03	0.16	25.0%	0.03	0.16
Solar PV	11.0%	4.05	3.19	40.0%	14.72	11.61
Solar Thermal	10.0%	2.95	1.29	50.0%	14.75	6.46
Solar arrays	3.0%	4.77	4.18	10.0%	15.89	13.92
Heat Pumps	4.0%	8.49	19.33	13.0%	27.59	62.84
Water source heat pumps	2.5%	0.20	0.45	12.5%	0.99	2.25
Total (GWh)	–		**183.79**	–		**191.03**
Predicted energy demand in Borough (GWh)	–		**1,249**	–		**1,249**
Proportion of Borough energy use supplied by renewables (%)	–		**14.72**	–		**15.30**

[18] This assumes that wood is imported into the Borough from neighbouring authorities.

Table 6.3: Recommended Target Potential

Recommended Target Potential Technology	% of technical resource delivered	2020 (MW)	2020 (GWh)	% of technical resource delivered	2026 (MW)	2026 (GWh)
Large wind	3.5%	3.62	8.22	7.0%	7.24	16.43
Medium wind	5.0%	7.56	17.16	7.5%	11.34	25.73
Small wind	2.0%	5.95	13.51	2.0%	5.95	13.51
Micro Scale Wind <6kW	1.0%	0.13	0.29	2.0%	0.25	0.58
Managed Woodland (heat)	200.0%	3.60	14.19	400.0%	7.20	28.38
Managed Woodland (elec)	0.0%	0.00	0.00	0.0%	0.00	0.00
Energy Crops (heat)	7.0%	1.24	4.89	13.0%	2.44	9.62
Energy Crops (elec)	0.0%	0.00	0.00	0.0%	0.00	0.00
Agricultural Arisings (heat)	10.0%	0.24	0.93	20.0%	0.47	1.86
Agricultural Arisings (elec)	0.0%	0.00	0.00	0.0%	0.00	0.00
Poultry Litter (elec)	0.0%	0.00	0.00	0.0%	0.00	0.00
Wet Organic Waste (heat)	7.0%	0.34	2.37	20.0%	0.96	6.76
Wet Organic Waste (elec)	7.0%	0.28	1.48	20.0%	0.80	4.23
Municipal Solid Waste (heat)	0.0%	0.00	0.00	0.0%	0.00	0.00
Municipal Solid Waste (elec)	0.0%	0.00	0.00	0.0%	0.00	0.00
Commercial and Industrial (heat)	0.0%	0.00	0.00	0.0%	0.00	0.00
Commercial and Industrial (elec)	0.0%	0.00	0.00	0.0%	0.00	0.00
Landfill Gas	100.0%	1.05	5.20	100.0%	0.71	3.50
Hydro	25.0%	0.03	0.16	25.0%	0.03	0.16
Solar PV	11.0%	4.05	3.19	18.7%	7.48	5.90
Solar Thermal	2.7%	0.80	0.35	4.3%	1.41	0.62
Solar arrays	2.0%	3.18	2.78	4.0%	6.36	5.57
Heat Pumps	2.7%	5.73	13.05	10.5%	23.12	52.67
Water source heat pumps	2.5%	0.20	0.45	7.5%	0.59	1.35
Total (GWh)	–		**88.20**	–		**176.85**
Predicted energy demand in Borough (GWh)	–		**1,249**	–		**1,294**
Proportion of Borough energy use supplied by renewables (%)	–		**7.06**	–		**13.67**

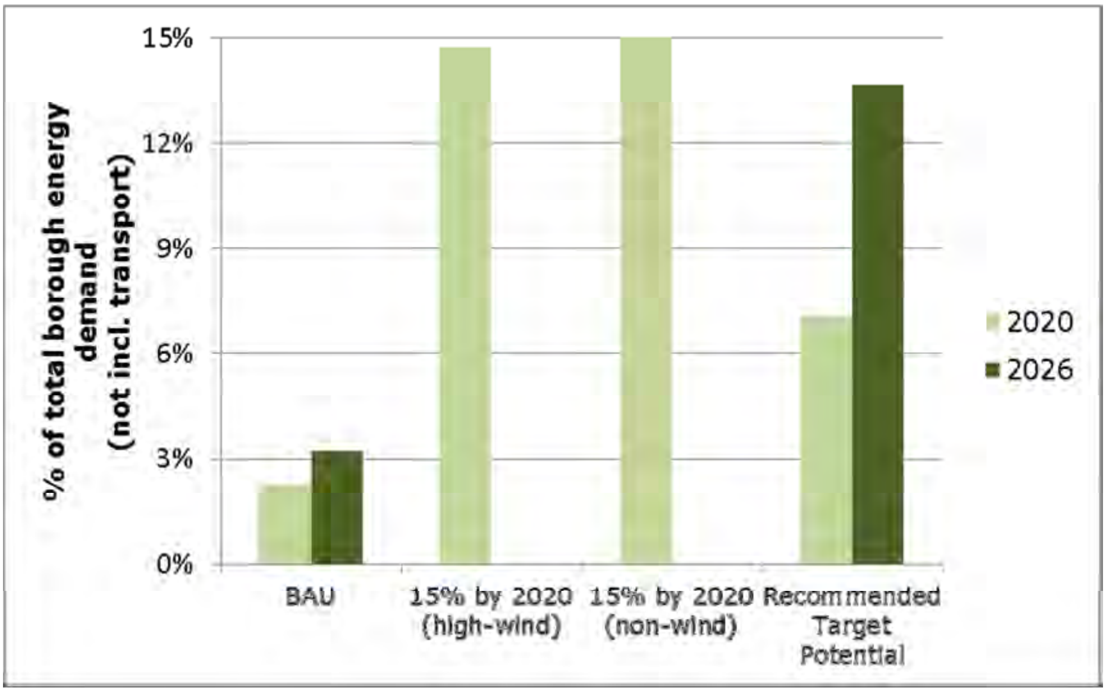


Figure 6.1: Summary of Deployable Potential analysis results

Discussion of Results

Wind turbines (large, medium, small and micro)

6.8 **National trends and supply chains** - wind power is a rapidly growing industry and has now become the largest contributor to the UK renewables mix through the deployment of large commercial scale projects. Based on current levels of growth, it will be powering the equivalent of one in ten homes in two years' time. DECC's projections for onshore wind see capacity increasing from the current level of 5.6GW up to 13GW by 2020[19], which would supply **approximately** 17% of the UK's current electricity generation capacity. Most equipment is currently sourced overseas but there are currently little or no concerns on supply chains and there is huge potential for a UK-based supply market. Deployment of medium to small scale wind is still relatively low but is becoming more popular with community groups and landowners.

6.9 **Technical deployment constraints** - the results of the technical assessment in **Chapter 3** indicate that Hinckley and Bosworth still has a significant wind resource potential after most technical constraints have been applied. Evaluation of more site-specific constraints such as grid connection **and** site access are beyond the scope of this study but for medium/large scale wind the Borough's size and geography in relation to transport and 11/33/132kV transmission networks are not expected to have a major impact on the technical resource.

6.10 **Economic constraints** - costs are not expected to be a significant future barrier to wind power over the periods considered. With financial incentives in place for the short and medium term from **ROCs** and FiTs, wind generally presents a commercially viable technology at sites where wind speeds, site access and grid connection conditions are favourable. A consultation in 2012 indicated that capital costs for onshore wind are expected to fall by 3.6% between 2011/12 and 2015/16[20]. Economy of scale however is likely to mean that small scale wind projects will not reach the same levels of commercial viability as medium/large scale turbines, but may still be

[19] UK Renewable Energy Roadmap Update (2012) DECC.

[20] Government response to the consultation on proposals for the levels of banded support under the Renewable Obligation for the period 2013-17 and the Renewables Obligation Order 2012 (December 2012) available from https://www.gov.uk/government/consultations/supporting-large-scale-renewable-electricity-generation

viable for landowners or self-supply of local buildings. Micro scale turbines have so far not developed or performed as expected due largely to siting constraints and poor access to adequate wind speeds.

6.11 **Planning constraints** - onshore wind projects have historically been subject to a number of difficulties in gaining planning consent, mainly through environmental concerns such as noise and visual impact. This has had the effect of reducing the proportion of applications gaining consent and lengthening planning determination times. Consenting rates vary across local authorities due to many factors but clearly those with core strategy policies/targets conducive to renewables and wind power which have been subject to public consultation are more likely to see increased consenting rates. A recent report on wind energy in the UK[21] notes that for the first time in five years, the UK is seeing a rise in the amount of UK wind capacity approved at a local level. In England capacity approvals at the local level increased by 60% compared to last year.

6.12 Currently Hinckley and Bosworth has no large scale wind deployed although two medium scale turbines have recently been installed on private land near Groby. **Table 6.1** indicates a small amount of micro scale wind is operational (micro scale wind within certain limits became Permitted Development in 2011). Although a planning application has not yet been submitted, it is understood that a small number of large scale turbines are currently being proposed by developers at a site near Desford. A potential constraint for large scale wind in the Borough concerns landscape sensitivity (see **Chapter 5**) which indicates that the landscape within Hinckley and Bosworth has moderate-high sensitivity to large scale wind turbines. This also suggests that the Borough may be susceptible to cumulative impacts of wind developments which may limit higher levels of deployment.

6.13 Increased opportunities for wind however may arise through proposals for community-owned projects where local communities can directly benefit from revenues. These are likely to be smaller developments which may be more acceptable to local communities and may be looked on more favourably in terms of gaining planning consent. Although no community wind proposals have yet been identified in the Borough, the number of community-owned energy projects is increasing nationally and may feature over the future time scales considered. It is worth noting that on a national basis over 50% of new planning submissions in 2012 were for projects below 5MW which typifies the scale of most community proposals.

Levels of deployment

6.14 **Business as Usual** based on previous activities, it is suggested that very few large or medium scale turbine proposals will gain consent during the periods considered under a Business as Usual approach. It is therefore assumed that no large scale turbines will be consented but that a small number of small and medium turbines will be deployed. Micro scale turbines are not expected to significantly increase over the period considered.

6.15 **15% renewables by 2020 –** Option A sees the 'high wind' mix deliver a total of 50MW deployed made up of approximately 12.4MW (5-6 large scale turbines), 14MW (15-16 medium turbines) and 24MW (47-48 small scale turbines) along with a small contribution of 0.13MW from micro-scale turbines. This represents 12%, 9%, 8% and 1% of the technical resource. Option B assumes no additional wind power is developed.

6.16 **Recommended Target Potential** – the recommendations for wind deployment assume a significant amount of wind is deployed, but that more emphasis is placed on small and medium scale turbines. It is assumed that large scale turbines are deployed but that these are at the smaller end of the 'large scale' size range considered (consistent with the findings of the landscape sensitivity analysis). This mix delivers a total of 17MW by 2020 made up of approximately 4MW (2 large scale turbines), 7.6MW (8-9 medium turbines) and 6MW (11-12 small scale turbines), this represents 3.5%, 5% and 2% of the technical resource. The 2026 target totals 24.8MW made up of approximately 7.2MW (4 large scale turbines), 11.3MW (12-13 medium turbines) and 6MW (12 small scale turbines) which represents 7%, 7.5% and 2% of the technical resource. A small contribution to both targets would also come from micro-scale

[21] Wind Energy in the UK – State of the Industry Report (2012) RenewableUK.

turbines. For comparison, a report by IT Power in 2008[22] suggested three sites that could potentially support 12-16MW of large scale wind.

Table 6.4: Wind deployment options

Technology	Business as Usual		15% Renewables (Option A)	15% Renewables (Option B)	Recommended Target Potential	
	2020 MW	2026 MW	2020 MW	2020 MW	2020 MW	2026 MW
Commercial /large wind	0	0	12.4	0	3.6	7.24
Medium wind (0.9MW)	2	2	13.6	0	7.6	11.3
Small wind (0.5MW)	3	3	23.8	0	6.0	6.0
Micro scale wind (<6kW)	0.13	0.13	0.13	0.13	0.13	0.25

Biomass

Managed woodland

6.17 **National trends and supply chains –** the UK's Renewable Energy Roadmap (2011) predicts that both biomass electricity and heat generation will experience major growth up to 2020 and sustainably-sourced woodfuel from managed woodlands will have a significant role to play within the biomass energy mix. Currently the majority of woodfuel sourced directly from woodland supplies smaller scale heat installations rather than large scale electricity plant, but on a national basis 58% of total heat from renewable sources comes from woodfuel and this contributed 8.1% towards the total UK renewable energy supply in 2011[23].

6.18 Additionally, in its Woodfuel Strategy for England (2007), the Forestry Commission proposed a target to bring an additional 2 million tonnes of woodfuel to market, annually, by 2020, representing 50% of the estimated unharvested available material in English woodlands. This will be supported by other sources such as arboricultural arisings and recovered wood. There are subsequent plans to significantly increase the area of woodland in active management, stimulated by increased demand for woodfuel through the Renewable Heat Incentive (RHI) scheme and through the use of energy markets to drive woodland creation in appropriate areas.

6.19 As demand grows, woodfuel supply chains are becoming more widespread with users now typically being offered a wider choice of suppliers. Although woodfuel demand in Hinckley and Bosworth is relatively low, discussions with local suppliers suggest that increases in demand can easily be met through existing supply chains although in the short term much of this is likely to be sourced from outside the Borough e.g. the National Forest. Wood pellets will also need to be sourced from further afield as no manufacturers have currently been identified in the local area.

6.20 **Technical deployment constraints -** There are now many woodfuel heat installations across the UK using mainly chip or pellet fuel in addition to the numerous installations overseas which indicates that this is a well-established and proven technology. Most of the problems experienced in the UK to date relate to woodfuel quality but the increasing adoption of woodfuel standards has improved this situation. Site-specific technical constraints mainly relate to space, access and flue issues but with good design and suitable choice of buildings these are not expected to present a barrier to wider adoption of woodfuel heating. Woodfuel use in CHP plant is not yet common and remains unproven at the smaller scale.

6.21 **Economic constraints -** Woodfuel heating plant has recently become increasingly viable due to the non-domestic RHI and domestic RHPP schemes and is expected to continue in this vein with the introduction of the domestic RHI scheme planned for later this year. Woodfuel use in Hinckley and Bosworth is likely to be almost exclusively dominated by heating installations as there are currently no plans for wood-fired electricity generation plant, which tend to be large scale. District heating for existing buildings may offer limited opportunities for woodfuel heating plant

[22] Renewable Energy Opportunities for Blaby, Harborough, Hinckley and Bosworth, Melton, North West Leicestershire, Oadby and Wigston and Rutland. (May 2008) IT Power.

[23] https://restats.decc.gov.uk/cms/renewable-energy-utilisation/

(see **Chapter 4**), but the Sustainable Urban Extensions planned for Earl Shilton and Barwell may provide a more viable opportunity for this technology.

Planning constraints - The key planning constraints with woodfuel supply and use tend to concern local impacts of fuel deliveries and heating plant emissions. Other than a very small area in Witherley there are no Smoke Control Areas or Air Quality Management Areas in the Borough[24]. Planning consent is therefore not expected to be a significant barrier to woodfuel development.

Levels of deployment

6.22 **Business as Usual** – the technical woodfuel resource of 1.4MW is relatively small in relation to the number of heat installations this could support, although if all woodland is considered i.e. not just managed woodland this will increase. For example the 1.5MW biomass woodchip boiler at the John Cleveland College currently at pre-planning stage is likely to require a large proportion, if not all, of the identified resource should the installation go ahead. Alongside other smaller woodfuel installations that are likely to occur during the period considered through the RHI scheme, this could result in a significant amount of woodfuel being sourced from outside the Borough, effectively meaning that over 100% of the technical resource is deployed. It is suggested that this is an acceptable basis on which to adopt targets as although some wood will be sourced from outside the Borough, the renewable heat generation plant will be located in the Borough and offsetting local emissions. Although there is likely to be competing demand for woodfuel from neighbouring Boroughs, the large potential resource in the wider area including the National Forest should help to avoid shortages.

6.23 Under Business as Usual, 50% of the technical resource is considered to be deployed by 2020 and 75% by 2026, which results in 0.9MW and 1.35MW respectively. No electricity generation from woodfuel is assumed due to scale issues.

6.24 **15% renewables by 2020 –** Option A sees 100% of the woodfuel heat technical resource utilised by 2020 to give 1.4MW, and Option B assumes 400% to give a total of 6MW. No electricity generation from woodfuel is assumed in either case.

6.25 **Recommended Target Potential** – it is suggested that a target of 3.5MW of heat production from woodfuel is adopted for 2020 and 7MW for 2026. As these targets represent 200% and 400% of the technical resource respectively, it is assumed that significant amounts of woodfuel will be sourced from outside the Borough.

Table 6.5: Woodfuel (managed woodland) deployment options

	Business as Usual		15% Renewables (Option A)	15% Renewables (Option B)	Recommended Target Potential	
Technology	**2020 MW**	**2026 MW**	**2020 MW**	**2020 MW**	**2020 MW**	**2026 MW**
Woodfuel (heat)	0.9	1.35	1.8	7.2	3.6	7.2
Woodfuel (electricity)	0	0	0	0	0	0

Energy Crops

6.26 **National trends and supply chains** – energy crop plantations remain at a low level the UK with only around 10,000-15,000 hectares currently in production. However, the UK Bioenergy Strategy (2012) recognises the important role that the various forms of biomass have in meeting both the national 2020 15% renewable energy target and the challenging carbon reduction goals for 2050. The Government's 2050 Pathways Analysis (2010) report sets several trajectories for bioenergy, with Trajectory A (current trends and drivers in agriculture and land use largely continue) predicting that 5% of UK land will be used for growing energy crops by 2050. This corresponds to around 0.9% in 2020 and 1.4% in 2026. Trajectory C however (securing lower emissions from the agriculture sector through significant investment in technology and knowledge transfer, as well as an increasing emphasis on bioenergy) would expect corresponding figures in

[24] http://www.hinckley-bosworth.gov.uk/info/200230/smoke_problem

2020 and 2026 to be 1.7% and 2.7% respectively. The UK has substantial amounts of land potentially available for energy crops, but deployment will depend on issues such as economic viability, end-use of energy crops, land ownership, existing farming activities, potential biodiversity impacts, protected landscapes and the presence of water-stressed areas.

6.27 **Technical deployment constraints –** the main technical constraints are generally focused on the production and use of energy crops in planting, harvesting and processing techniques to produce a fuel that is of a sufficient standard for use in common woodfuel plant. Woodfuel quality is less critical where energy crops are grown for co-firing in large scale electricity plant. These constraints are not expected to act as a significant barrier to energy crop development once appropriate technologies and methods (which already exist) are more widely disseminated. Electricity generation plant is also constrained by location of suitable grid connection points.

6.28 **Economic constraints –** the economic viability of energy crop production will be vital in engaging landowners and farmers to invest in energy crops. Difficulties lie in the logistics of securing woodfuel supply contracts with heat users considering the timescales needed to establish energy crops. Key issues include uncertain future fossil fuel prices and the value of energy crops compared to alternative land use including food production. Grant schemes such as the Energy Crops Scheme along with the RHI will be vital in the widespread establishment of energy crops. Additionally, with the Common Agricultural Policy (CAP) currently under revision for the period 2014-2020, there is a proposal[25] that will include a 3% ecological focus area on each farm holding. This aims to take several million hectares of arable land out of production. The European Biomass Association (AEBIOM) and the UK National Farmers Union are lobbying for perennial energy crops to be eligible for planting within this 3% area.

6.29 **Planning constraints –** although Environmental Impact Assessments can be required for planting above certain size thresholds, particularly in designated areas, there are not expected to be any significant planning constraints to the production of energy crops. Most planning concerns tend to relate to changes in land use and biodiversity but the end use of energy crops in heating plant however will have similar issues to those of woodfuel from woodlands as described above.

Levels of deployment

6.30 **Business as Usual** – this assumes a small amount of energy crop planting for heat end use, 0.5% of the technical resource (approximately 8 hectares), could be expected by 2020 due to national incentive schemes and this is assumed to double by 2026.

6.31 **15% renewables by 2020 –** Option A sees 20% of the technical energy crop heat and electricity resource (approx. 318 hectares) utilised by 2020 to give a total of 4.1MW and Option B increases this to 30% (approx. 477 hectares) to give a total of 6MW capacity.

6.32 **Recommended Target Potential** – this assumes the CAP ecological focus measure and other national incentives results in 50% of farmers in Hinckley and Bosworth choosing to grow miscanthus or SRC on 3.5% of their land (arable + bare/fallow), this would approximate to around 212 hectares (2.4MW heat or around 14% of the technical resource), with half being achieved by 2020 and the remainder by 2026.

Table 6.6: Energy crops deployment options

	Business as Usual		15% Renewables (Option A)	15% Renewables (Option B)	Recommended Target Potential	
Technology	**2020 MW**	**2026 MW**	**2020 MW**	**2020 MW**	**2020 MW**	**2026 MW**
Energy crops (heat)	0.1	0.2	3.5	5.3	1.2	2.4
Energy crops (electricity)	0	0	0.6	0.9	0	0

[25] Article 32: Ecological Focus Area. Based on the outcome of the latest vote of the Agriculture and Rural Development Committee at the European Parliament on 23/01/2013

Agricultural Arisings

6.33 **National trends and supply chains –** the UK produces more than 10 million tonnes per year of wheat and barley straw in addition to that from other crops such as oats, oilseed rape and rye. Since 1993 it has no longer been permitted to burn straw in the field so the vast majority is used for animal feed, bedding or is returned to the soil. The use of straw and similar crop residues as a fuel is currently limited to large scale electricity generation plant which can draw in a sufficiently large resource from the local area.

6.34 **Technical deployment constraints –** as with woodfuel, site-specific technical constraints mainly relate to the end-use of straw in terms of plant space, access and flue issues. Straw use in CHP plants is not yet common and remains unproven at the smaller scale. Location of suitable grid **connection** points can often be a constraint and largely depends on the generation capacity of the plant.

6.35 **Economic constraints -** the dispersed nature of straw arisings and its bulk hinders transport **logistics** so the resource from the wider area would also need to be assessed when considering the potential for large scale plant.

6.36 **Planning constraints –** any relevant constraints will mostly be related to the end-use of the fuel as described in the managed woodland resource section above.

Levels of deployment

6.37 **Business as Usual** – assumes no straw-fired plant is developed during the period considered.

6.38 **15% renewables by 2020** – Option A sees no straw-fired plant developed and Option B assumes 50% of the resource is used in small scale heat applications to give a total of 1.2MW. No electricity generation is assumed.

6.39 **Recommended Target Potential** – it is unlikely that a large scale straw-burning plant would be established in the Borough due to the relatively small resource once competing uses of animal feed and bedding are considered (accounted for in the technical resource) and the proportion likely to be returned to the soil. Over the time period considered it is more likely that several smaller scale straw-fired heat installations are established making a total of 0.2MW for 2020 and 0.5MW for 2026.

Table 6.7: Agricultural arisings deployment options

	Business as Usual		15% Renewables (Option A)	15% Renewables (Option B)	Recommended Target Potential	
Technology	**2020 MW**	**2026 MW**	**2020 MW**	**2020 MW**	**2020 MW**	**2026 MW**
Agricultural arisings (heat)	0	0	0	1.2	0.2	0.5
Agricultural arisings (electricity)	0	0	0	0	0	0

Poultry litter

6.40 The technical resource figure of 0.07MW electricity generation potential from poultry litter is considered too small to be developed as a viable resource and so is not considered further.

Wet Organic Waste

6.41 **National trends and supply chains –** use of wet organic waste in anaerobic digestion (AD) plant is widespread in the UK principally for the treatment of sewage but also for the processing of agricultural and food processing residues. As of late 2011, the UK had 214 AD facilities processing more than 5 million tonnes of feedstock and with a potential to generate over 170MW of electricity.[26] A very small number of plants now inject biogas directly into the gas grid but it is thought this practice will grow significantly in the future.

[26] Anaerobic digestion infrastructure in the UK (September 2011) WRAP & NNFCC.

6.42 **Technical deployment constraints –** AD technology is well-established but needs careful design regarding the feedstock mix. The Location of suitable grid connection points can often be a constraint and largely depends on the generation capacity of the plant.

6.43 **Economic constraints –** large scale plant requires a substantial amount of feedstock and the often dispersed nature of wet organic waste arisings mean that the economic capture radius for the feedstock needs careful assessment in terms of transport costs. Absence of 'gate' fees for delivered feedstocks and a lack of useful applications for surplus heat can both act as constraints to economic viability.

6.44 **Planning constraints –** the potential for odours, ground water contamination and disturbance to local residents from feedstock deliveries are the most common planning concerns. However, well-designed plants in suitable locations can easily avoid these constraints.

Levels of deployment

6.45 **Business as Usual** – no AD plants have been identified within Hinckley and Bosworth but there are a number of installations in neighbouring areas such as a 2MW plant at Huncote which processes 86,000 tonnes per year of pig slurry and food waste, and the 1.5MW Wanlip plant north of Leicester which uses 40,000 tonnes per year of food waste and sewage.[27] Planning consent has also been granted for a 1.5MW plant at Sapcote. It is therefore likely that a proportion of feedstocks arising within Hinckley and Bosworth will be supplying some or all of these installations.

6.46 No installations are assumed by 2020 but at least one small scale plant (300kW electricity) is expected by 2026, representing 7% of the technical resource.

6.47 **15% renewables by 2020** – Option A sees 20% of the resource developed and Option B assumes 50% of the resource is used, both in small scale AD plant.

6.48 **Recommended Target Potential** – one small-scale installation is assumed by 2020 with two more by 2026 making a total of 0.8MW of electricity generation and 1MW of heat, representing around 20% of the technical resource.

Table 6.8: Wet organic waste deployment options

	Business as Usual		15% Renewables (Option A)	15% Renewables (Option B)	Recommended Target Potential	
Technology	2020 MW	2026 MW	2020 MW	2020 MW	2020 MW	2026 MW
Wet organic waste (heat)	0	0.3	1	2.4	0.3	1
Wet organic waste (electricity)	0	0.3	0.8	2	0.3	0.8

Waste

Municipal Solid Waste and Commercial & Industrial Waste

6.49 Electricity and heat generation from 'Energy from waste' plant is well-established in the UK and **research** into advanced conversion technologies has resulted in more efficient processes and a greater proportion of the various waste streams being converted into energy classed as renewable. Although, no waste management facilities with energy recovery are currently planned within Hinckley and Bosworth, the local waste management authority at Leicestershire County Council are progressing an energy from waste plant at Shepshed which has gained planning consent and would generate up to 25MW of electricity and additional heat. This would accept up to 300,000 tonnes of material derived from both MSW and C&I waste streams from the wider area including Leicestershire and potentially further afield.

Levels of deployment

6.50 It is assumed that Hinckley and Bosworth's waste streams would be exported from the Borough and will not count towards the Borough's own renewable energy targets.

[27] http://biogas-info.co.uk/maps/index2.htm

Landfill Gas

6.51 **National trends and supply chains –** the technology used to generate electricity from landfill gas is considered to be mature and the supply chains are well developed, however a recent report from Ofgem indicates that there is little or no development in this sector at present and that the load factor is relatively low when compared to base load generation. This would indicate that the available resources are already close to peak production levels

6.52 The output of energy from landfill gas is expected to decline over the next couple of decades on a national scale due to declining resources. One of the main causes of this is the impact of the Landfill Directive, which sets demanding targets for the progressive reduction of biodegradable municipal waste being sent to landfill up to 2020. Not only does this mean that the total volume of waste will fall, but reducing the organic content of the waste will also alter the composition of the landfill gas and therefore potentially the level of energy that can be produced as a result of its combustion.

6.53 **Technical deployment constraints** – there are no existing active landfill sites within the Hinckley and Bosworth Borough boundary, with collected waste being transported to other sites within the county. This physically limits the potential for technology deployment in the short term, however in the longer term some level of development could be achieved should new waste management facilities be set up within the area.

6.54 The technical potential for deployment is difficult to predict as there are a large number of factors that could influence the capacity of any new installation. For example, leachate levels, organic waste infill rates, the efficiency of the gas collection system or changes in site management techniques could all affect productivity.

6.55 **Economic constraints –** it is not expected that the costs associated with generating energy from landfill gas will represent a major barrier to future deployment. Whilst the technology has fairly high capital and operating costs, these are well known and understood and significant economies of scale can be achieved at larger sites. Smaller sites are often less economically viable, particularly where the grid infrastructure requires reinforcement in order to accept the output, however this is normally a problem in more remote areas than Hinckley and Bosworth. Due to the maturity of the market, the costs associated with this type of generation are not expected to reduce significantly over time.

6.56 **Planning constraints –** generally UK planning guidance supports the development of power generation from landfill gas and there is usually very little public opposition to new such developments at existing landfill sites.

Levels of deployment

6.57 As Leicestershire County Council’s plans for future waste disposal sites do not currently include Hinckley and Bosworth (see above section on MSW & C&I waste), it is unlikely that new landfill gas facilities will feature in the timescales considered. The targets therefore assume that the only electricity generated from landfill will be from the existing Bradgate landfill gas scheme which is anticipated to generate 1.05MW by 2020 and 0.71 by 2026.

Hydro

6.58 **National trends and supply chains** – a recent study for DECC suggests that there are limited opportunities for further medium to large scale (>5 MW) developments of hydro power generation in the UK due to site availability. The study indicates that the majority of the economically attractive sites have already been exploited, and those that remain are often limited by environmental concerns associated with the creation of large dams. Existing capacity is estimated to be in excess of 1,458 MW, with the potential to achieve around a further 38 MW nationally. The authors suggest that higher levels of development are likely for smaller scale installations, with scope for approximately 650 MW of available unexploited resources across the UK, 250 MW of which are likely to be generated in England.

6.59 Existing hydropower supply chains are predominantly geared towards large and medium scale sites, however it is considered that the market for small scale hydropower will grow in line with demand and is unlikely to be a particular constraint to future development.

6.60 **Technical deployment constraints** – the topography of the land and the location and size of watercourses within the Borough do not make it naturally suitable for the development of medium or large-scale hydro power generation. There may be some scope for deployment of small or micro-scale installations, however it is unlikely that they will be able to make a significant contribution to the level of energy generated from renewable technologies within the Borough. Access to grid connection points is considered to be a constraint to further development at all scales.

6.61 **Economic constraints** – the costs of generating power using this technology reflect economies of **scale** and display high levels of variability at the smaller end of the scale, therefore as there is little potential within the Borough for larger plants, costs may be prohibitive for many locations. The Feed-in Tariff scheme however is likely to encourage development at the most viable sites.

6.62 **Planning constraints** – due to the potential impact on local ecosystems, the planning process can **represent** a significant constraint to the development of hydro schemes. Local authorities also have a statutory duty to consider the impact of hydropower schemes on river basin management in their area.

6.63 The complexity and timescales of planning consent and environmental licensing for small schemes could make this type of technology unattractive to developers for many sites. The introduction of the Feed-in Tariff has already had an impact on the time it takes to procure an environmental permit for hydro schemes due to the increase in the number of applications. The costs associated with mitigation measures arising from these processes (for example to improve fish passage) could also make some smaller schemes financially unviable.

Levels of deployment

6.64 **Business as Usual –** as the identified technical resource is very low, no sites are expected to be developed.

6.65 **15% renewables by 2020 –** both Options A and B see 25% of the technical resource developed, which corresponds to 30kW capacity. This would most probably consist of three or four small-scale sites that would only add a very small contribution to the Borough's renewable energy targets. For comparison, the IT Power study[22] identifies a site at Sheepy Magna Mill with a potential capacity of 10kW.

6.66 **Recommended Target Potential** – 25% of the technical resource is also assumed for the recommended target.

Table 6.9: Hydro deployment options

	Business as Usual		15% Renewables (Option A)	15% Renewables (Option B)	Recommended Target Potential	
Technology	2020 MW	2026 MW	2020 MW	2020 MW	2020 MW	2026 MW
Hydro	0	0	0.03	0.03	0.03	0.03

Solar Arrays

6.67 **National trends and supply chains** – larger installations (i.e. greater than 50kW) of photovoltaic panels had seen a relatively low rate of uptake and, until recently, there have been very few installations of greater than 5MW. However, over the last two to three years, there has been a significant increase in the number of planning consents given for large scale 'solar farms', most of which have been located in the South West of England. The initial peak was due to the favourable FiT rates that were first introduced, but a government fast-track review then cut the tariff for large scale installations which led to a drop-off in applications.

6.68 An increase in large solar installations is likely to further increase pressure on the photovoltaic supply chains in the short term, although this is likely to ease as greater production capacity is stimulated.

6.69 **Technical deployment constraints –** although the technical resource assessment applies a constraint in relation to proximity to 33kV substations, large scale solar arrays are still likely to present technical challenges in connecting to and balancing of the grid. There are few other technical constraints for the technology at this scale.

6.70 **Economic constraints** – large installations will benefit from economies of scale to some extent, although it is important to note that installations of over 5MW capacity do not currently qualify for financial assistance under the Feed-in Tariff. DECC's recent response to its consultation on proposals for the levels of banded support for solar PV under the Renewables Obligation up to 2017 saw ground-mounted solar PV given lower support than building-mounted systems. However, now that support levels are established, at least in the short term, an increased number of solar farm applications may result.

6.71 **Planning constraints** – non-domestic photovoltaic arrays greater than $9m^2$ are not included under the permitted development rights associated with small-scale installations, and will require a full planning application to be submitted. Local authorities are also likely to require the environmental impact to any site selected to be carefully considered before applications can be approved. Local objections to large scale solar arrays, mainly due to visual impact, have also been prominent on a number of developer proposals.

6.72 **Levels of deployment**

6.73 **Business as Usual –** although the technical resource is very large, it is assumed that very few large scale solar arrays are likely to be developed under BAU due to competing land uses and/or planning constraints.

6.74 **15% renewables by 2020 –** Option A sees 3% of the technical resource developed and Option B assumes 10% is implemented.

6.75 **Recommended Target Potential** – it is suggested that the Business as Usual target is adopted for 2020 but that this doubles by 2026.

Table 6.10: Large scale solar arrays deployment options

	Business as Usual		15% Renewables (Option A)	15% Renewables (Option B)	Recommended Target Potential	
Technology	2020 MW	2026 MW	2020 MW	2020 MW	2020 MW	2026 MW
Large scale solar arrays	3.18	3.18	4.77	15.89	3.18	6.36

Microgeneration

Solar Photovoltaics

6.76 **National trends and supply chains** – solar photovoltaics has now been included for the first time within the government's Renewable Energy Roadmap and is considered to be integral to the future technology mix. The UK currently has over 1.4GW of installed solar PV capacity (the majority of which is made up of installations generating less than 50kW), with an estimated potential for a further increase of between 7-20GW by 2020. The rapid increase in the deployment of photovoltaic technology in recent years has led to high demand for its components, which has placed some constraints on the supply chain and resulted in temporarily higher costs in some sections of the market.

6.77 **Technical deployment constraints** – the main technical constraints around deployment relate to the availability of suitably orientated unshaded roof or external wall space, both in terms of their area and their structural integrity. Dramatically increasing the level of decentralised solar electricity generation may also create new challenges in balancing the electricity grid, but it is expected that technical innovation and advancements in active network management will be able to lessen this impact over time.

6.78 **Economic constraints** – the costs of installing photovoltaic panels have fallen dramatically in recent years, particularly since the introduction of the Feed-in Tariff, with government figures indicating that costs decreased by 50% between summer 2011 and March 2012. Costs are expected to continue to fall over time as the market matures, which will allow further deployment of this technology. Conversely, volatility in the scale of financial incentives set by government has led to a reduction in investor confidence, which could impact on the ability of the market to provide the desired level of growth if it continues. Current eligibility requirements for the higher banded Feed-in Tariff rates e.g. for buildings to obtain an EPC rated D or above, will restrict a significant number of sites on viability grounds.

6.79 **Planning constraints** – the installation, replacement or alteration of photovoltaic panels on or within the curtilage of a dwelling or building is considered to be 'permitted development' and therefore does not normally require planning consent. There are however 27 separate conservation areas within the Borough of Hinckley and Bosworth, within which installations may be restricted if they are considered to have a negative impact on the area.

Levels of deployment

6.80 **Business as Usual –** although growth rates for solar PV have been extremely high since the introduction of the FiT scheme, recent and future changes to tariff levels make it difficult to predict the subsequent impact on take-up rates. However, considering the number of installations that have already occurred within Hinckley and Bosworth, and assuming that this annual installation rate will drop by an average of 80% over the periods considered, an estimate can be made of Business as Usual deployment. The figures then calculate to be 3.7MW by 2020 and 4.5MW by 2026, or 10% and 11.3% of the technical resource respectively.

6.81 **15% renewables by 2020 –** Option A sees 11% of the technical resource developed and Option B assumes 40% is implemented.

6.82 **Recommended Target Potential** – PV's permitted development status, FiT incentive and further potential for reduced capital cost is likely to result in continuing growth regardless of local planning requirements. Appropriate use of solar PV in conservation areas and in new developments can however be encouraged by local policies. New developments in particular are likely to incorporate significant amounts of solar PV to help meet Building Regulation emission targets or local sustainability requirements as the technology is simple to install and virtually maintenance free. Using the 'medium scenario' from DECC's Low Carbon Technology Uptake Scenarios for PV, and proportioning by population, the recommended target potential is therefore 4.1MW by 2020 and 7.5MW by 2026, or 11% and 19% of the technical resource respectively.

Table 6.11: Solar PV deployment options

	Business as Usual		15% Renewables (Option A)	15% Renewables (Option B)	Recommended Target Potential	
Technology	**2020 MW**	**2026 MW**	**2020 MW**	**2020 MW**	**2020 MW**	**2026 MW**
Solar PV	3.7	4.5	4.1	14.7	4.1	7.5

Solar Thermal

6.83 **National trends and supply chains** – nationally, as at the end of November 2012 there were 1,165 full applications for installations to be included under the Renewable Heat Incentive, 6% of which were for solar thermal collectors. Government statistics show that these installations had generated approximately 28MWh of heat by this date, and indicate a consistently upward trend in the **number** of applications for support for this technology type. It is therefore expected that the installed capacity of solar thermal will continue to increase as a result of this support mechanism, and as the market matures it is likely that costs will decrease as improvements to the supply chain become apparent. Solar thermal is a well-established technology and few problems are expected regarding the supply chain, which is likely to respond to market demand as take-up increases.

6.84 **Technical deployment constraints** – as in the case of solar photovoltaics, the main technical constraint to the deployment of solar thermal panels is likely to be the availability of suitably orientated and unshaded roof space. Solar thermal technology is a relatively simple technology and easy to install, although lack of space for a suitable hot water cylinder and incompatibility with existing boilers can sometimes act as constraints.

6.85 **Economic constraints** – as with all renewable heat technologies the economic viability of a solar thermal system is very dependent on the fuel it offsets and the economics are often marginal in areas with access to relatively cheap mains gas. However, solar thermal tends to be more expensive to install compared to other renewable heat technologies in relation to the amount of energy it produces. The recent introduction of the non-domestic Renewable Heat Incentive is expected to incentivise a rise in the deployment of this technology as financial viability is improved. However, there are some industry concerns that the level of support proposed in the late 2012 consultation on the forthcoming domestic RHI scheme will not sufficiently incentivise take-up.

6.86 Planning **constraints** – these are very similar to solar photovoltaics as described above.

Levels of deployment

6.87 **Business as Usual –** the short time elapsed since the introduction of the RHI and uncertainty over the level of support proposed for the domestic RHI make it difficult to establish deployment trends for this technology. Assuming solar thermal may not be as financially viable as solar PV, it is assumed that take-up rates could be around 50% of those for the solar PV at this level. The total capacity therefore calculates to be 0.54MW by 2020 and 0.95MW by 2026, or 1.8% and 2.9% of the technical resource respectively.

6.88 **15% renewables by 2020 –** Option A sees 10% of the technical resource developed and Option B assumes 50% is implemented.

6.89 **Recommended Target Potential** – as with solar PV, solar thermal's permitted development status, new financial incentive (RHI) and further potential for reduced capital cost is likely to result in a certain amount of continuing growth regardless of local planning requirements. Appropriate use in conservation areas and in new developments can however be encouraged by local policies and so it is therefore suggested the target assumes a 50% increase on the Business as Usual take-up rate. The total capacity therefore calculates to be 0.81MW by 2020 and 1.42MW by 2026, or 2.7% and 4.3% of the technical resource respectively.

Table 6.12: Solar thermal deployment options

	Business as Usual		15% Renewables (Option A)	15% Renewables (Option B)	Recommended Target Potential	
Technology	**2020 MW**	**2026 MW**	**2020 MW**	**2020 MW**	**2020 MW**	**2026 MW**
Solar thermal	0.54	0.95	2.95	14.75	0.81	1.42

Heat Pumps (ground and air)

6.90 **National trends and supply chains** – it is expected that the introduction of the Green Deal and smart metering policies will help to reduce the demand for heat, and that the Renewable Heat Incentive (RHI) will drive the uptake of heat pumps and the development of their supply chains over time. Government statistics indicate that the number of installations of air source heat pumps in particular has risen substantially in the short space of time that the RHI has been in place. In the long term, the widespread use of heat pumps will rely on the gradual decarbonisation of the electricity grid to move towards being a zero carbon technology.

6.91 **Technical deployment constraints** – the space requirements for ground source heat pumps can mean that they are often not suitable for retrofit projects in built up areas and their installation can be disruptive, therefore their deployment in the more urban areas of Hinckley and Bosworth could be restricted. The ground conditions and presence of groundwater can also impact on their performance in a given location.

6.92 Heat pumps require properties to be well insulated in order for them to operate efficiently. They are often therefore well-suited to new developments, but building insulation upgrades may need to be carried out on retrofit projects before heat pumps are considered a viable option.

6.93 **Economic constraints** – the costs of the installation of ground source heat pumps can vary widely depending on site conditions and type of ground loop (trenched or borehole), but in general costs are relatively high and so viability depends on the system working efficiently during its lifespan. This requires good design and a thorough understanding of the heat load profile being served. Successful roll out of this technology type therefore relies strongly on property owners having access to good quality designers and installers, so the availability of trusted MCS-accredited companies in the local area could impact on the number of installations ultimately achieved. Costs are expected fall as the market matures, making both ground and air source heat pump technologies more affordable and accessible.

6.94 **Planning constraints** – the installation of a ground source heat pump within the curtilage of a dwelling is considered to be permitted development and therefore many installations can take place without the need for a planning application (although again this may not be the case within designated conservation areas in the Borough). Air source heat pumps are also included under permitted development; however they are subject to a much longer list of conditions due to issues of visibility and potential noise pollution, particularly in areas where the built landscape is considered to be of historic value.

Levels of deployment

6.95 **Business as Usual –** this approach sees relatively low levels of heat pumps being deployed, with the majority of capacity coming from the off-gas household sector and new-build homes. To estimate Business as Usual deployment, DECC's Low Carbon Technology Uptake Scenarios were considered and the 'medium scenario' was taken for the number of installations of heat pumps in the residential sector and proportioned according to the number of customers in the East Midlands electricity distribution area. The percentage of off-gas customers in the East Midlands who would need to install a heat pump for the medium scenario targets to be met was then established and applied to the number of off-gas customers in Hinckley and Bosworth. The results showed that 15% of off-gas properties would need a heat pump in 2020, which corresponds to 1,231 properties or around 6MW. For the 2026 target under the medium scenario, 88% of off-gas properties would need a heat pump. This corresponds to 7,223 properties or 36MW. Under the Business as Usual approach it is then assumed that only 10% of these properties would install a heat pump.

6.96 The following assumptions have then been applied regarding the proportion of other building categories considered in the technical resource assessment that could be expected to install heat pumps under Business as Usual:

- 5% of new households by 2026
- 0.1% of the remaining building categories considered in the technical resource assessment by 2020 and 0.2% by 2026

6.97 This results in total capacity figures of 1.2MW for 2020 and 4.8MW for 2026.

6.98 **15% renewables by 2020 –** Option A sees 4% (8.5MW) of the technical resource developed and Option B assumes 13% (27.5MW) is implemented.

6.99 **Recommended Target Potential –** in recommending a deployment level for 2020, the same method as per Business as Usual above was applied to off-gas households, but with a final assumption that 50% of these properties would install a heat pump.

6.100 The following assumptions were then applied regarding the proportion of other building categories considered in the technical resource assessment that could be expected to install heat pumps:

- 10% of new households by 2026
- 1% of the remaining building categories considered in the technical resource assessment by 2020 and 2% by 2026

6.101 This results in total capacity figures of 5.7MW for 2020 and 23.2MW for 2026.

Table 6.13: Heat pump (ground and air) deployment options

	Business as Usual		15% Renewables (Option A)	15% Renewables (Option B)	Recommended Target Potential	
Technology	2020 MW	2026 MW	2020 MW	2020 MW	2020 MW	2026 MW
Heat pumps	1.2	4.8	8.5	27.5	5.7	23.2

Water Source Heat Pumps

6.102 **National trends and supply chains** – the national supply chain for water source heat pumps is not yet well developed and the availability of manufactured equipment has constrained development in the past (hence take up on a national scale has been relatively low), but is expected to mature as the number of installations is increased following the introduction of the Renewable Heat Incentive. As with other types of heat pump, availability of suitably qualified engineers and installers in the locality may impact significantly on the number of potential installations.

6.103 **Technical deployment constraints** – water source heat pumps must be sited near a suitable water source, for example a lake, pond, river, spring, well or borehole, therefore the form and availability of these sources and their proximity to potential points of use within the Borough may constrain development. The water must also be of sufficient quality as the level of impurities can have an effect on system performance and durability. It must also be able to meet the thermodynamic requirements of the heat pump.

6.104 **Economic constraints** – installing a water source heat pump eliminates the need for the kind of expensive groundworks associated with ground source heat pumps and financial support is also available through the Renewable Heat Incentive, therefore the economic constraints are not expected to be particularly significant in this case once suitable sites are identified.

6.105 **Planning constraints** – water source heat pumps are included under permitted development rights, therefore it is unlikely that the planning system would present a significant constraint. An extraction licence is however generally required from the Environmental Agency for any extraction above 20m^3/day for an open loop system, and a discharge consent is also likely to be required. The timescales and costs of obtaining these permissions may hinder the deployment of this technology to some extent.

Levels of deployment

6.106 **Business as Usual –** due to their relative scarcity and a general lack of awareness about this technology, it is unlikely that many, if any, projects would be implemented under this approach and so zero deployment is assumed.

6.107 **15% renewables by 2020 –** Option A sees 2.5% of the technical resource developed and Option B assumes 12.5% is implemented.

6.108 **Recommended Target Potential** – as with certain other renewable technologies such as wind and hydro, its deployable potential is difficult to estimate due to the site specific nature of what makes a viable installation. However, given the identified technical resource of 7.9MW, it could be expected that at least two installations (typically 0.2MW) will occur up to 2020 and that this triples by 2026 to 0.6MW. This represents 2.5% and 7.5% of the technical resource respectively.

Table 6.14: Water source heat pump deployment options

	Business as Usual		15% Renewables (Option A)	15% Renewables (Option B)	Recommended Target Potential	
Technology	2020 MW	2026 MW	2020 MW	2020 MW	2020 MW	2026 MW
Water source heat pumps	0	0	0.2	1.0	0.2	0.6

Key Conclusions

6.109 The process of setting out a future deployable potential for renewable energy is not straightforward as there are no standard methodologies and the extent to which targets are achievable within a certain timeframe will largely depend on future national policy incentives, site specific factors and the will of local organisations and their effectiveness in facilitating the local actions required. However, framing targets in the context of a Business as Usual approach and exploring technology mixes that would align with the national 15% renewables target by 2020 provides a useful setting from which to develop a Recommended Target Potential for the deployment of renewable energy within the Borough.

6.110 Technical, economic and planning opportunities and constraints vary considerably across technologies and different approaches are therefore necessary to estimate take-up rates for the scenarios considered. Where data is available, national trends and forecasts have been used along with Hinckley and Bosworth's own deployment rates to date.

6.111 A Business as Usual approach suggests that Hinckley and Bosworth would achieve a very low level of renewables deployment up to 2026 by providing only 2.3% of the Borough's non-transport annual energy demand by 2020 and 3.2% by 2026. This compares with a Recommended Target Potential of 7.1% by 2020 and 14% by 2026.

6.112 Wind power clearly has the potential to be a key technology in achieving a renewables target which significantly improves on the Business as Usual approach. The 15% by 2020 'Option B' (non-wind deployment) technology mix illustrates the heavy reliance on technologies such as solar, heat pumps and biomass heating should wind not be deployed, and indicates the challenges that would be encountered at this level of deployment. This particular mix, for example, would require 16MW of large scale solar arrays and an additional amount of building-integrated PV equivalent to 7,360 domestic sized systems. It is therefore recommended that wind at all scales contributes to deployment targets for the Borough, but with a focus on small/medium scale turbines and including the smaller end of the 'large scale' size range considered. This is in view of the findings of the landscape sensitivity analysis which indicate that the landscape within Hinckley and Bosworth has moderate-high sensitivity to large scale wind turbines.

6.113 The proposed targets are suggested as being achievable but will rely on Hinckley and Bosworth Council adopting suitably conducive policies to facilitate their achievement and a positive and proactive approach from developers, other public sector organisations and local communities. Success in meeting these targets will therefore depend on an effective consultation with these groups to set the proposals in the context of other Local Plan (2006 – 2026) policies and national targets, to raise awareness of the technology options available and to hear the community's concerns and preferences.

7 Recommendations

Introduction

7.1 This section summarises the key conclusions of the study and sets out a series of policy options for the Council to consider in the preparation of the Site Allocations and Development Management Policies Document and the Barwell and Earl Shilton Area Action Plan. The chapter concludes with guidance on the future monitoring of renewable energy developments within the Borough.

Context

7.2 This study has been prepared to form part of the evidence base for the preparation of the Council's Site Allocations and Development Management Policies Document and the Barwell and Earl Shilton Area Action Plan. These will form part of the Local Plan (2006- 2026)for the Borough, which will consist of five Development Plan Documents:

- Core Strategy.
- Site Allocations and Development Management Policies.
- Hinckley Town Centre Area Action Plan.
- Earl Shilton and Barwell Sustainable Urban Extension Area Action Plan.
- Gypsy and Traveller Allocations DPD

Policy Options

7.3 There are a number of policy options that could be considered in the preparation of Local Plan (2006- 2026). These include:

1. Setting a renewable energy vision and target
2. Establishing criteria for assessing renewable energy applications
3. Encouraging community renewables
4. Delivering the energy opportunities map
5. Allocating sites for standalone renewable and low carbon energy schemes
6. Setting targets for strategic sites
7. Identifying priority areas for delivery of district heating
8. Allowable Solutions

7.4 These are discussed in turn below:

Setting a renewable energy vision and target

7.5 The NPPF states that local authorities should have a positive strategy to promote energy from renewable and low carbon sources. Spatial Objective 12 of the adopted Hinckley and Bosworth Core Strategy relates to Climate Change and Resource Efficiency and seeks to minimise the impacts of climate change, minimise the use of resources and energy, increase the use of renewable energy technologies, and minimise greenhouse gas emissions. This forms part of the vision for renewable energy within the Borough.

7.6 To strengthen this vision, it is recommended that Hinckley and Bosworth should reflect in their policies that they will positively encourage the development of all forms of renewables within their Borough. This could include stating their commitment to delivering a renewable energy target for the Borough. A suggested target is outlined in **Chapter 6** of this report but there may be a desire to go beyond this and include a target to deliver 15% of their energy consumption from renewables by 2020.

7.7 The target 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.

7.8 It is important that targets are expressed as minimum targets, so that once it has been reached, further renewable energy development is not precluded. Monitoring of the targets will be essential in providing an important feedback loop on the effectiveness of the Local Plan (2006- 2026) and other mechanisms in facilitating the delivery of renewable and low carbon energy developments.

Establishing criteria for assessing renewable energy applications

7.9 The NPPF states that local authorities should design their policies to maximise renewable and low carbon energy development while ensuring that adverse impacts are addressed satisfactorily. No guidance is currently provided within the Core Strategy on the criteria that will be applied in assessing applications for renewable energy projects within the Borough. A policy of this nature should be included in the Site Allocations and Development Management Policies DPD.

7.10 Creating greater policy certainty for potential renewable energy developers is essential to realising the renewable and low carbon potential of the Borough. It is therefore important that the Local Plan (2006- 2026) 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, the development plan policy should list the issues that will be taken into account in considering specific applications. This should not be a long negative list of constraints. The policy should make it clear that the need for renewables does not need to be demonstrated in any planning application as this is clearly set out in national government policy and the core strategy.

7.11 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 landscape sensitivity, the Bosworth battlefield etc. It is important that the wider environmental and economic benefits of renewable energy proposals, whatever their scale, are appropriately recognised. Development proposals should also be required to show how any environmental and social impacts have been minimised through careful consideration of location, scale, design and other measures. It may be appropriate for more detailed issues to be left for a Supplementary Planning Document (SPD) on renewables.

Encouraging community renewables

7.12 The NPPF states that local authorities should support community-led initiatives for renewable and low carbon energy, including developments being taken forward through neighbourhood planning. Community-led renewable energy projects are increasingly being seen as an attractive option for local communities wishing to contribute to local/national climate change targets and as a way to generate local revenue to directly benefit the community. A small number of wind power projects have now been developed by community co-operatives within the UK and there are notable examples of community solar PV schemes.

7.13 A significant number of community-led projects are also known to be in the pipeline spanning other technologies such as biomass heating and hydro. Such groups face considerable challenges in the pre-planning stage and there are a number of opportunities for local authorities to provide advice and guidance throughout this stage, including provision of early advice on planning requirements and the lending of support to consultation activities within the community.

Delivering the energy opportunities map

7.14 The NPPF states that local authorities should consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure the development of such sources.

7.15 A key output from this study is the Energy Opportunities Map – See **Figure 7.1**. This map provides a spatial summary of the key opportunity areas for various forms of renewable energy within the Borough. This can be used to inform development decision and discussions and guide development towards the most suitable areas. A policy could for example be included requiring planning applications within the Borough to demonstrate how they contribute towards the delivery of the energy opportunities map (and or the Borough target).

7.16 It is important however that any locational policies are framed such that they do not preclude projects in other (constrained and currently considered suboptimal) areas; for example if better wind-speed data becomes available or if the factors determining optimal sites for wind turbines change. The energy opportunities map should not therefore be used to dismiss proposals where site specific evidence shows there is potential.

7.17 With the recent introduction of neighbourhood planning, the energy opportunities map could also provide a useful tool for communities and other stakeholder to identify the key opportunities for renewables within their area. It is important to note however that it is not possible to identify locations for all types of renewable energy as many technologies such as building integrated solar, heat pumps, farm-scale AD, and small-scale biomass can be located in nearly all areas.

Allocating sites for standalone renewable and low carbon energy schemes

7.18 If the Borough Council wants to give more strategic direction to the siting of renewables the DPD could allocate sites specifically for standalone renewables. There may be a 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.

7.19 As part of the preparation of this report and the Energy Opportunities Map, a number of broad areas of potential have been identified e.g. for wind and hydro but these are too numerous to be included as allocated sites. Further detailed work would also be required at the site level to ascertain if they are suitable for allocation in the DPD. In view of the number of sites available, this detailed work is beyond the scope of this study. It is also advisable that site allocation policies for standalone renewable and low carbon energy schemes should 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.

Setting targets for strategic sites

7.20 One policy option that can be used to promote the development of energy efficiency and renewable energy is the setting of sustainable building standards (that exceed the national requirement) or minimum carbon reduction targets for new strategic development sites. The Hinckley and Bosworth Core Strategy includes such a policy as follows:

> "Policy 24: Sustainable Design and Technology sets a requirement that all development in Hinckley, Burbage, Barwell and Earl Shilton, unless it makes the development unviable, meet:
>
> - Minimum of Code for Sustainable Homes Level 3 to 2013;
> - Minimum of Code Level 4 from 2013-2016.
> - Code level 6 from 2016 onwards;
>
> Residential developments in Key Rural Centres and Rural Villages will also be expected to meet the sustainability targets set out in Building a Greener Future. Schools, hospitals and office developments are required to meet BREEAM (or equivalent) assessment rating of 'very good.' From 2016 they will be required to meet, at a minimum, BREEAM (or equivalent) assessment rating of 'excellent."

7.21 In addition to the above policy, there may be scope to set or improve a target for carbon reduction for strategic sites such as the MIRA business development park. This site is used for research and development purposes by the automotive industry and it is proposed to expand and improve the park by incorporating new developments including a new public business centre, MIRA Engineering Centre and retail, leisure and hotel facilities. The MIRA Headquarters Development Sustainability Statement (April 2011) sets out an overall target of achieving an average carbon reduction from low or zero carbon technologies of at least 15% across the development. The Statement mentions that a previous feasibility study found that to reduce overall energy demand, and hence the size of infrastructure supplies, the following technologies may have 'good potential' for the site:

- Solar thermal hot water
- Photovoltaics
- Ground source heat pumps
- Air source heat pumps

7.22 And that the following have 'potential':

- Trigeneration combined heat, cooling and power (CHCP) (Gas or biomass fuel source)
- Medium sized wind turbine
- Water source heat pump (Utilisation of water feature adjacent to MIRA HQ to provide daily and annual energy storage)
- Kinetic road plate

7.23 Further discussions with MIRA would be needed to establish whether a strategic carbon reduction target could be set for the development park.

Identifying priority areas for delivery of district heating

7.24 The NPPF states that local authorities should identify opportunities where development can draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers. As part of this study a review of the opportunities for district heating has been undertaken as outlined in **Chapter 4.** The analysis identified two areas that may be suitable for district heating, particularly if they could be linked to a larger system in the development of the Sustainable Urban Extensions to the west of Barwell and the south of Earl Shilton.

7.25 Further detailed discussions with the council and assessments would however be required to determine the feasibility of these; such feasibility studies should consider a broad scope of options including biomass-fired plant and CHP potential. If these areas are identified as being feasible to proceed with, an appropriate policy should be included in the Development Management Policies stating that applications for development within these areas will be favourably considered where they support the delivery of district heating. The Council should also explicitly state its support of the delivery of district heating in these areas and commitment to work with the relevant parties to bring forward district heating proposals within these areas.

Allowable Solutions

7.26 In July 2010, the Coalition Government made very clear its commitment to ensuring that all new homes built from 2016 should be zero carbon. This is to be achieved by a combination of Carbon Compliance measures, which are undertaken on the individual building or the development; and 'Allowable Solutions', which secure carbon savings away from the site.

7.27 Allowable Solutions refers to any approved carbon-saving measures that would be available to developers from 2016 to allow for the carbon that they would not normally be required to mitigate on site through Carbon Compliance. The expectations that have become associated with Allowable Solutions are:

- That the developer would make a payment to secure emissions reductions through (largely) near-site or off-site, carbon-saving (Allowable Solutions) projects;
- That, independent of the developer, there would be an opportunity to aggregate a number of Allowable Solutions payments to deliver larger scale carbon-emission reduction projects;

- That Allowable Solutions would be affordable and (per unit of carbon) would cost, at least initially, less than Carbon Compliance;
- That wherever possible, Allowable Solutions would be linked with local projects that would bring local benefits.

7.28 The framework for Allowable Solutions is still under development but the Zero Carbon hub have produced guidance on how Allowable Solutions could operate[28].

7.29 Local authorities will have a key role to play in determining and delivering allowable solutions and a number of forward-thinking Local Planning Authorities are developing policies around Allowable Solutions, with some already progressing or even operating some form of Community Energy Funds, with Cambridgeshire-related Local Authorities, North Northamptonshire, the London Borough of Islington as well as Brighton highlighted as front runners. Further information on North Northamptonshire is provided in the box below.

7.30 There are two main types of policy that could be developed by the Borough to shape the development of Allowable Solutions:

- a policy requiring developers to contribute to a selected list of local project (i.e. which the local authorities considers to be most beneficial for the areas).
- a policy contributing towards a Community Energy Fund. This could be collected via the Community Infrastructure Levy (CIL).

7.31 Further research and analysis is currently underway at national level looking at how Allowable Solutions may operate and it is important that Hinckley and Bosworth keep abreast of this and consider how they may wish to implement Allowable Solutions within the Borough. This should also involve discussions with neighbouring authorities as a cross authority approach may be appropriate.

Case Study: North Northamptonshire – Community Energy Fund

North Northamptonshire's Joint Planning Unit is made-up of Northamptonshire County Council and the Borough Councils of East Northamptonshire, Kettering, Wellingborough and Corby. Working alongside the Woodland Trust and Rockingham Forest for Life Project, the Planning Unit has developed an innovative development management policy (Draft Policy 8) for a Joint Core Strategy Development Planning Document.

Draft Policy 8 outlines the Council's 'Allowable Solutions' for developments unable to achieve national and local carbon reduction and 'Zero carbon' requirements on-site. Developers contribute to the North Northamptonshire 'Community Energy Fund' (CEF) which invests in projects considered acceptable 'Allowable Solutions'. By using tree planting in Rockingham Forest as an 'Allowable Solution', North Northamptonshire Joint Planning Unit have sought to introduce a policy mechanism which enhances ecological networks, biodiversity, and reduces carbon.

Monitoring

7.32 It is essential that the Council effectively monitors the success of their development plans and other mechanisms/ initiatives in delivering renewable energy developments within the local authority area. Such monitoring could include tracking the number and generating capacity of renewable and low carbon energy proposals which have been approved/ refused planning permission and been commissioned within the area. There are a number of useful information sources which should be used to undertake this monitoring as follows:

- Renewable Energy Planning Database (REPD)(A national database ran by AEA Technology on behalf of DECC)[29];
- OFGEM Feed in Tariff Register; which provides information on all accredited microgeneration installations;[30]

[28] Allowable Solutions: Evaluating Opportunities and Priorities (September 2012) Zero Carbon Hub.
[29] www.restats.decc.gov.uk/cms/planning-database

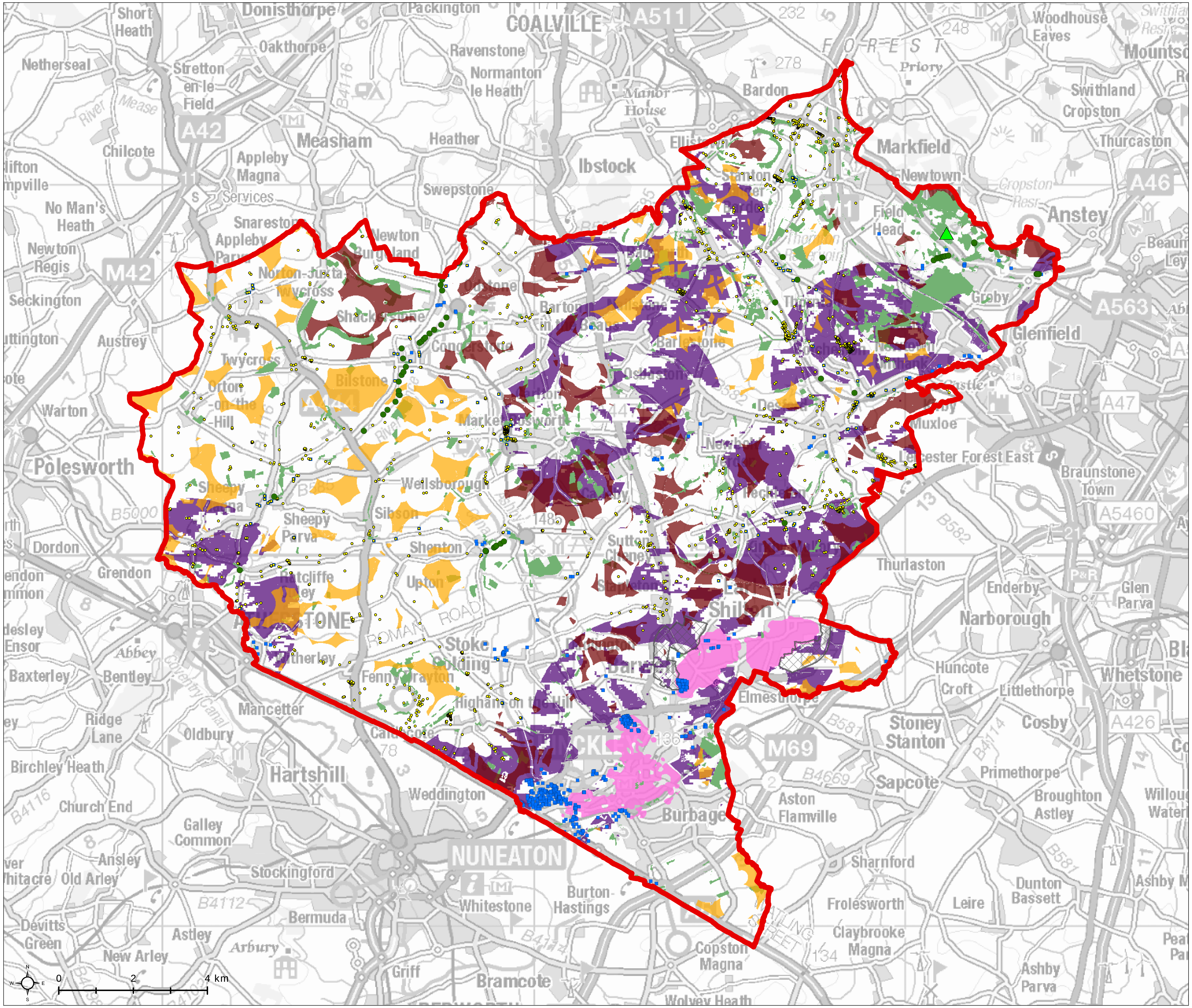
- OFGEM Renewables Obligation (RO) register, which provides information on all certified RO installations[31];
- Information on planning applications gathered by Hinckley and Bosworth Borough Council Planning Register;
- Renewables UK Wind Energy database[32].

7.33 These information sources should be used to compile the Authority Monitoring Report on the number and generating capacity of renewable energy projects which have been delivered in the area. Cross comparison could also be made to a Borough-wide renewable energy target (if the Council agrees to adopt such a target). It is important that any monitoring considers not just the installed and generating capacity of the projects but also the carbon dioxide reductions they deliver.

[30] https://www.renewablesandchp.ofgem.gov.uk/Public/ReportManager.aspx?ReportVisibility=1&ReportCategory=0

[31] https://www.renewablesandchp.ofgem.gov.uk/Public/ReportManager.aspx?ReportVisibility=1&ReportCategory=0

[32] http://www.renewableuk.com/en/renewable-energy/wind-energy/uk-wind-energy-database/index.cfm



Hinckley & Bosworth Renewable Energy Capacity Study

Figure 7.1

Renewable energy opportunities in Hinckley and Bosworth

- Hinckley and Bosworth boundary
- Sustainable Urban Extensions
- Potential for landfill gas (Bradgate)
- Potential for small-scale hydropower
- Property with potential for micro wind turbine
- Property with potential for water source heat pump
- Opportunities for wind energy within areas of higher landscape sensitivity
- Opportunities for wind energy within areas of lower landscape sensitivity
- Opportunities for woodland biomass
- Opportunities for solar arrays
- Opportunities for district heating

Please note: In terms of solar arrays, opportunity areas have been mapped, but only 10% of this is viable due to competing land uses such as food production. It was not possible to reduce the mapped area accordingly.

Map Scale @ A3:1:100,000

LUC

LUC LDN 5582-01_032_RE_Opportunities_RevC_UPDATED_DEC2014 01/12/2014

Source: OS, NLPG, Natural England, Environment Agency, H&B, CSE, Forestry Commission

Appendix 3.1: Assumptions for Assessment of Technical Potential in Hinckley & Bosworth

Opportunities / Constraints	Parameter	Assumption (Italics indicate that data was not available or there are no such sites/features in H&B)	Data source	Comments
Commercial / Large Scale Wind				
Opportunities	Wind Speed	-All areas with wind speed 5 m/s at 45m above ground level (agl)	NOABL Local developer consultation	The wind speed criterion of 5m/s was queried with local developers (working in Leicestershire and surrounds). Rather than commenting on a specific minimum wind speed criterion, one developer was keen that it was noted that macro scale wind data (such as NOABL) can be inaccurate at the site specific level and therefore sites should not be completely discounted if they fall outside this criterion. Additionally, wind speeds vary with height and therefore hub heights above and below the 45m level may vary greatly. A second developer confirmed that the size of the potential site will influence any decision on adequate wind speeds and they will consider development at any wind speed.
	Wind turbine size	Considered three turbine sizes: -large-scale turbines (dimensions: tip height 135m, rotor diameter 100m, up to 2.5MW) -medium-scale turbines (dimensions: tip height 80m, rotor diameter 55m, up to 0.9MW) -small-scale turbines (dimensions: tip height 40m, rotor diameter 27.5m, up to 0.5MW)	Local developer consultation Internet research into turbine manufacturers UKRenewables database	There are no standard categories for wind turbine sizes. Local developers advised that height assumptions should be checked against the dimensions of turbines being manufactured by the main manufacturers. This research showed an enormous range of sizes as well as the ability to generate custom sizes. A quick review of all onshore wind development applications recorded in the RenewableUK database (January to November 2012) showed a range of tip heights from less than 20m up to 150m with applications for all sizes in between. There was a clear dominance of applications being made for 125m turbines and up to 80m. The turbine sizes in the small and medium categories also serve to represent turbines that may be used for single turbine developments connected to a building or farm and community schemes.

Opportunities / Constraints	Parameter	Assumption (Italics indicate that data was not available or there are no such sites/features in H&B)	Data source	Comments
	Wind turbine Density	-Large: 4 turbines per km^2 -Medium: 10 turbines per km^2 -Small: 50 turbines per km^2	DECC methodology (5x rotor diameter spacing)	It must be noted that this is a maximum density calculation which does not take into account site shape and minimum site size. For the purposes of the calculation of technical potential, it has been assumed that where land is suitable for a range of turbine sizes, the largest turbine size will be used.
Constraints	Non accessible areas	-Roads -Railways -Rivers, canals -Lakes, reservoirs -*Airports* -*MOD training areas* -Major overhead transmission lines -Public Rights of Way -Small turbines should ideally be within 3km of a 33kV substation	Ordnance Survey Strategi, Meridian2 OS Mastermap CAA National Grid Western Power	A footprint was generated for roads using standard buffer sizes (based on carriage width). Motorway and railway data was taken from OS MasterMap. Rivers and other waterbodies were taken from MasterMap. Airports: point data from CAA did not reveal any CAA airfields or aerodromes in Hinckley and Bosworth. MOD training areas: this data was not made available for this study, but based on the East Midlands Councils Renewable Energy Capacity Study, there do not appear to be any training areas in Hinckley and Bosworth. Small turbines have had an additional constraint applied – that they should be located within 3km of an existing 33kV substation. This is a nominal buffer applied in order to take into consideration that a small turbine scheme will be more viable financially if it is located within proximity of an existing suitable grid connection.
	Exclusion areas	-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* -Buffer around rail and roads related to topple distance of small, medium and large turbines -Built-up areas (property buffers related to type of	Natural England, English Heritage, CAA Safeguarding Maps, NATS/NERL, Meridian2, NLPG (property buffers), MasterMap Hinckley and Bosworth	A revised boundary for Bosworth Battlefield was used (based on a map from the Conservation Management Plan currently out for consultation). A buffer around roads and railways was generated based on the tip height plus 10% (to account for toppling issues). Buffers around properties were based on NLPG point locations with the following distances for residential properties: Large turbines – 600m Medium turbines – 500m

Opportunities / Constraints	Parameter	Assumption (Italics indicate that data was not available or there are no such sites/features in H&B)	Data source	Comments
		property and size of turbine) -Conservation Areas -Local Wildlife Sites -Public Rights of Way -Slope		Small turbines – 400m And a 200m buffer for all commercial properties. These buffers were based on discussions with acoustic specialists and their informed opinion on what suitable buffer distance are likely to be required to take account of noise issues. Although Local Wildlife Sites are not an absolute constraint, Natural England recommended that they be excluded from areas of potential. The whole of Hinckley and Bosworth is within an area classified as 'Low' in terms of Bird Sensitivity based on RSPB data so this was not considered. Hinckley and Bosworth Council officers agreed that Charnwood and National Forests should not be excluded. Attempts were made to consult with NATS/NERL to identify any specific Civil Air Traffic Control constraints, but no response was received. Public Rights of Way were excluded with an additional buffer equal to that of tip height plus 10% to account for toppling issues. Developers were consulted regarding a maximum slope constraint and a maximum slope of 15 degrees was suggested and applied. Natural England was consulted regarding additional criteria and it was recommended that regard is paid to presence of protected species and BAP priority species (such as bats and birds). Unfortunately it has not been possible to obtain protected species records for the entire Borough with the resources available to this study. Natural England also recommended that landscape issues be addressed through a Sensitivity Study (which has been undertaken in parallel to this technical assessment).
	MOD constraints	*-Explosive Safeguarding Areas* *-MOD danger areas*	MOD	Specific guidance relating to MOD military constraints in Hinckley and Bosworth was sought, but a response was

Opportunities / Constraints	Parameter	Assumption (Italics indicate that data was not available or there are no such sites/features in H&B)	Data source	Comments
				not received. Regard was paid to the online MOD safeguarding maps.
Small scale wind (<6kw)				
Opportunities	Address Points	Identify all properties from NLPG with greatest potential for small scale wind, including: - Community and tourism properties, - Commercial and industrial properties - Isolated residential properties outside of settlement boundaries	NLPG OS Urban Areas (Meridian)	NLPG attribute data was used to classify the properties into types for this assessment. Residential properties within settlement boundaries were excluded.
	Wind Speed	-All areas with wind speed 4.5 m/s at 10m above ground level (agl)	NOABL	Checked the properties identified as being opportune against minimum wind speed requirements (4.5m/s at 10m agl)
	Wind turbine size	-6kW per address point	DECC	
Constraints	Mean wind speed scaling factor	-Wind scaling factor applied related to type of Lower Super Output Area (LSOA) the address falls within (rural, suburban, urban) -Exclude properties that are within cultural heritage designations (including Conservation Areas) -Exclude properties that are within areas with a high concentration of Listed Buildings	DEFRA Rural-Definition (Lower Super Output Area level)	Wind scaling factor of 56% for urban, 67% for suburban, 100% for rural Excluded properties that are within Conservation Areas and other cultural heritage designations. Only included properties within areas with 20 or less Listed Buildings per km2. Assigned wind speed and LSOA type to each suitable address point, and scaled wind speed according to LSOA classification. Included address points where scaled wind speed 4.5m/s at 10m above ground level. The scaling factor means that the bulk of the suitable address points will be in the rural wards as these require a lower starting wind speed.

Opportunities / Constraints	Parameter	Assumption (Italics indicate that data was not available or there are no such sites/features in H&B)	Data source	Comments
Energy Crops				
Opportunities	Existing resource	-*Existing energy crop schemes*	Natural England	There are no ECS (tranche 1 or 2) within Hinckley and Bosworth (based on Natural England GIS data).
	Available land	-Assume that energy crops are planted on land no longer needed for food production (i.e. all bare/fallow land) and on land covered by submitted applications to the ECS. -Include an additional 10% of land in food production.	DEFRA Agricultural and Horticultural Census (2010) Natural England	Spatial data to locate bare/fallow land and land in food production was not readily available for this study. Calculations are based on the 2010 DEFRA Agricultural and Horticultural Census. There were no active applications to the ECS (Natural England). The split between land available for Miscanthus:SRC is based on areas of crops existing under energy crop schemes under the old and new schemes for the East Midlands as set out in the East Midlands study (Miscanthus 75%: SRC 25%)
	Yield	*2010:* -10odt/ha SRC -15 odt/ha miscanthus *2020:* -11odt/ha SRC -16.5 odt/ha miscanthus *2026:* -11.7odt/ha SRC -17.5 odt/ha miscanthus	DECC methodology assumption of 10% increase in yield in a 10 year period	It was assumed there would be a 6% increase in yield between 2020 and 2026.
	Fuel requirement	*Electricity* -6000odt/year = 1MW *Heat* -Miscanthus: 17GJ/odt -SRC: 18GJ/odt -Plant conversion efficiency: 80% -Plant conversion factor: 45%	DECC methodology Natural England: Planting and Growing miscanthus Best Practice Guidelines July 2007 Energy Savings Trust	A standard value of 18GJ/odt was applied for SRC. 45% conversion factor value provided by the Carbon Trust as typical capacity factor for service applications in CT (2009), Biomass heating a practical guide for potential users, pg 43)
Constraints	Exclusion areas	-Common Land -SAC, SPA, Ramsar, SSSI, NNR, Ancient Woodland -Listed Buildings (with small buffer), Scheduled Monuments, Battlefields*, Public Rights of Way -BAP Habitats	Natural England English Heritage	In the absence of spatial data to compare opportunities (bare/fallow land and land in food production) to areas of constraint, data from the East Midlands study were used to estimate the amount of arable land and temporary grassland that was constrained by the factors listed alongside. The percentage of

Opportunities / Constraints	Parameter	Assumption (Italics indicate that data was not available or there are no such sites/features in H&B)	Data source	Comments
		-Permanent grassland: permanent pasture/grassland are already excluded from Rural Land Register data -Potentially only grades 3 and 4 ALC would be suitable/available for energy crops, therefore Grades 1 and 2 should be excluded		unconstrained arable land for Hinckley and Bosworth had previously been calculated as 76%. A percentage reduction was applied on this basis. * As this data was not recalculated for this study (it was taken from the East Midlands Study), the existing Bosworth Battlefield boundary was used. This % reduction approach was seen as the best way of accounting for these constraints in the absence of GIS data for this study.
	Environmental impacts	-A map showing the location of water stressed areas was provided by the Environment Agency for the East Midlands study.	Environment Agency Natural England	NE was consulted with regards to biodiversity impacts. It was requested that all UK BAP habitats be treated as constraints. This has been accounted for in the percentage reduction for constrained areas.
Woodland biomass				
Opportunities	Existing feedstock	-Use NFI data to estimate amount of woodland (by type and management) -Assumptions regarding yield classes per woodland type (4 – broadleaved, 12 – conifers, 6 – mixed woodland) -Assume 1 cubic metre = 1 green tonne and a loss of 50% when converting green tonnes to oven dried tonnes. - Unmanaged and private woodland, assume 100% is potentially available	National Forest Inventory and local community energy organisations (Green Fox Energy)	There is no FC managed woodland in Hinckley and Bosworth. The National Forest Inventory data has been released subsequent to the East Midlands Study. This data has been used instead of the NIWT data that was used in the East Midlands Study.
	Fuel requirement (electricity)	-6000odt/year = 1MW	DECC methodology	
	Fuel requirement (heat)	-18GJ/odt -Plant availability: 45% -Plant conversion efficiency: 80%	East Midlands study, Forestry Commission	
Constraints	Available feedstock	-Assumes 50% of woodfuel is uneconomic to harvest, or could go to alternative markets	Forestry Commission	The same assumptions as agreed with the Forestry Commission for the East Midlands study were used.

Opportunities / Constraints	Parameter	Assumption (Italics indicate that data was not available or there are no such sites/features in H&B)	Data source	Comments
Agricultural Arisings (Straw)				
Opportunities	Existing feedstock	-3 tonnes per ha of wheat and winter barley; -2 tonnes per ha of spring barley; -1.2 tonnes per ha of oil seed rape -Assumed area farmed for straw will remain constant to 2026	Defra (2007 and 2010) June Census of Agriculture and Horticulture – England	These assumptions deviate from the East Midlands study in order to better reflect the local situation. Where data was not available for Hinckley and Bosworth for 2010, it has been interpolated based on the 2007 June Census of Agriculture and Horticulture.
	Fuel requirement	Electricity: -Apply benchmark of 6,000 odt of baled straw per 1MW capacity Heat: -18GJ/odt -Plant availability: 60% -Plant conversion efficiency: 80%	DECC methodology Biomass Energy Centre	
Constraints	Available feedstock	Competing demands: -Animal bedding: 1.5 t of straw per annum per head of cattle (or 50% total straw – whichever is the lower figure) -Animal feed – 100% of spring barley used for animal feed	Defra (2007 and 2010) June Census of Agriculture and Horticulture – England	Spring barley introduced, but discounted due to competing use for animal feed. It is felt that it is useful to reflect the potential albeit it is discounted due to competing demands.
Poultry litter				
Opportunities	Existing feedstock	-Use data on poultry numbers and excreta factor per head of poultry -Assumed that per 1,000 broiler birds, 16.5 tonnes of litter is typically produced per annum -Only include broiler birds to calculate poultry numbers -Assume poultry numbers stay constant to 2026	Biomass Energy Centre Defra (2007 and 2010) June Census of Agriculture and Horticulture – England	2010 data for Hinckley and Bosworth was interpolated from 2007 agricultural census data.
	Feedstock requirement	-Apply benchmark of 11,000 tonnes of poultry litter required for 1MW capacity per annum	DECC methodology	
Constraints	Available feedstock	N/A	N/A	
Wet organic waste				

Opportunities / Constraints	Parameter	Assumption (Italics indicate that data was not available or there are no such sites/features in H&B)	Data source	Comments
Opportunities	Existing feedstock	-Used data on livestock numbers multiplied by manure factor: • Dairy cattle – 19.3t/animal/yr • Beef cattle – 10.6t/animal/yr • Cattle 1-2 yrs – 9t/animal/yr • Calves – 3.7t/animal/yr -Assumed will be housed for: • Dairy cattle – 6 months of the year • All others – 4 months of the year -Assumed only breeder and fattener pigs used to derive total slurry produced by pigs, both of which will be housed for 50% of the year. -Used data on pig numbers multiplied by manure factor: • Breeder pigs: 2.37t/pig/year • Fattener pigs: 1.1 t/pig/year -For food and drink waste: used data for food (the food, drink and tobacco and retail and wholesale sectors, animal and vegetable and non-metallic waste only). -Included grass and silage as potential feedstock. Estimated grass and silage potential based on the assumption that the available grassland can be managed to achieve a level of silage production that will feed every bovine in Hinckley and Bosworth very well - but if the cattle are fed not so well (but enough to remain as productive) the spare silage can be diverted into AD. -Used data from Agricultural and Horticultural Census with the following assumptions: • Dairy cattle: 264 (min)/348 (max) kg/animal;/housed month (housed 6 months) • Beef cattle: 168 (min)/240 (max) kg/animal;/housed month (housed 4	Biomass Energy Centre Defra (2007 and 2010) June Census of Agriculture and Horticulture – England Reiver Renewables provided the following sources: DEFRA Report AET/ENV/R/2104 Scottish Agricultural College "Best Practice" figures DEFRA Project WQ 0133 2009 (dry matter content accepted norm for Big Scale Silage) LUCs agricultural expert ADAS (2009) National Study into Commercial and Industrial Waste Arisings Advice from Leicestershire County Council Waste and Minerals Officer Defra Survey of Commercial and Industrial Waste Arisings Leicestershire County Council AMR 2010-2011 Biomass Energy Centre John Nix Farm Managers Pocketbook	2010 data for Hinckley and Bosworth was interpolated from 2007 agricultural census data. Reiver Renewables were consulted for a similar study in Cumbria and helped to develop the method for including grass and silage. The specific assumptions have been adjusted by LUCs agricultural expert to better suit the local conditions in Hinckley and Bosworth. For detailed method of calculating food and drink waste contributions for Hinckley and Bosworth, see Commercial & Industrial Waste assumptions and comments.

Opportunities / Constraints	Parameter	Assumption (Italics indicate that data was not available or there are no such sites/features in H&B)	Data source	Comments
		months) • Cattle 1-2yrs: 105 (min)/144 (max) kg/animal;/housed month (housed 4 months) • Calves: 57 (min)/78 (max) kg/animal;/housed month (housed 4 months) -35% Dry matter content.		
	Feedstock requirement	Electricity: Applied benchmark of 37,000 tonnes of wet organic waste required per 1MW capacity per year Heat: 1.2x electrical output	DECC methodology Consultation	
Constraints	Available feedstock and competing uses	-Assumed collectable portion of cattle and pig manure is reduced as they are housed for the following percentages of the year: • Dairy cattle: 60% • Beef cattle: 50% • Cattle 1-2yrs: 50% • Calves: 50% • Breeder pigs: 50% • Other pigs: 50% -For manure and slurry: assumed 100% of resource is available for energy -For food and drink: assumed 50% of total resources is available for energy	DECC methodology and LUCs agricultural expert	
Municipal solid waste				
Opportunities	Existing and potential new feedstock	-Use local authority municipal and household waste statistics from the waste management authority (County Council) -Increases in the use of the capacity to 2026 were based on changes in household numbers in Hinckley and Bosworth from CLG data. It was assumed that MSW per household would remain	Defra (2011/12) Local Authority Municipal Waste Statistics http://www.defra.gov.uk/statistics/environment/waste/wrfg23-wrmsannual/	The Leicestershire County Council Waste and Minerals officer confirmed that a biodegradable fraction of 68% of MSW was reasonable.

Field Cod

Opportunities / Constraints	Parameter	Assumption (Italics indicate that data was not available or there are no such sites/features in H&B)	Data source	Comments
		constant due to policies to reduce waste. -Used data from waste collection only, and then assumed biodegradable fraction is 68% of total MSW.	Consultation with Leicestershire County Council Waste and Minerals Officer	
	Feedstock requirement	-Electricity: Apply a benchmark of 10 kilo tonnes of MSW required for 1 MW capacity per annum. Heat: 2x electrical output	DECC and East Midlands Study CSE	
Constraints	N/A	-No significant constraint parameters identified	N/A	
Commercial and industrial waste				
Opportunities	Existing and potential new feedstock	-Include animal and vegetable waste and non-metallic waste only from the ADAS Study -Exclude sectors covered elsewhere (food, drink and tobacco; retail and wholesale) -Future C&I waste was based on future employee number projections as per the East Midlands Study (a UK benchmark of 0.05% per annum, according to UKCES)	ADAS (2009) National Study into Commercial and Industrial Waste Arisings Advice from Leicestershire County Council Waste and Minerals Officer Defra Survey of Commercial and Industrial Waste Arisings Leicestershire County Council AMR 2010-2011	C&I waste arisings data is not available at Local Authority level. DEFRA waste arisings data for the East Midlands (with distributed mixed wastes) was used to find the percentage of each waste type. These percentages were then applied to the overall C&I waste arisings figure for Leics/LCC/Rutland from the AMR. Similarly, the proportional breakdown by industry was taken from the East Midlands waste arisings and applied to the overall C&I waste arisings figure for Leics/LCC/Rutland from the AMR. MSW contributions per authority were then used to disaggregate this further to Hinckley and Bosworth. This method was agreed with the Leicestershire County Council Waste and Minerals Officer.
	Feedstock requirement	-Electricity: Apply a benchmark of 10 kilo tonnes required for 1 MW capacity per annum - Heat: 2x electrical output	DECC and East Midlands Study CSE	
Constraints	N/A	-No significant constraints identified	N/A	
Biogas - landfill				
Opportunities	Available resource	-All current landfill sites from the OFGEM RO register	OFGEM RO Register	There are no operational landfills in Hinckley and Bosworth. Bradgate is a non-operational landfill that currently produces landfill gas.
	Lifetime of resource	-Landfill gas production as modelled by GasSim.	Infinis Landfill Gas Manager	Data specific to Bradgate was supplied by Infinis. Figures were provided as a generating capacity (modeled in GasSim) and converted to MW by using a

Opportunities / Constraints	Parameter	Assumption (Italics indicate that data was not available or there are no such sites/features in H&B)	Data source	Comments
				capacity factor of 56.6% as taken from the East Midlands data from RESTATS/DECC (https://restats.decc.gov.uk/cms/historic-regional-statistics/). Bradgate is expected to continue to produce landfill gas until 2038.
Constraints	N/A	-No significant constraints identified	N/A	
Solar energy				
Opportunities	Existing roof space	Solar PV -25% of all domestic properties including flats; -40% of commercial properties; -80% of industrial buildings. Solar thermal -25% of all domestic properties including flats; -10% of the commercial properties suitable for Solar PV (4% of total commercial properties)	NLPG 2011 Census data	A figure for domestic properties was taken from the 2011 UK census. Data for commercial/industrial properties taken from NLPG data. Please note that the number of commercial/industrial properties in the Hinckley and Bosworth NLPG dataset is higher than that held in the OS Address Layer 2 dataset used for the East Midlands Study.
	Potential new roof space	-50% of all new domestic roofs	Hinckley and Bosworth Core Strategy	New domestic property data taken from the Hinckley and Bosworth Core Strategy.
	System capacity	For all suitable address points: -Domestic properties: 2kW -Commercial: 5kW -Industrial: 10kW	DECC methodology Research (industrial system capacity)	
Constraints	N/A	-No significant constraint parameters identified	N/A	
Solar energy (Large scale PV arrays)				
Opportunities	Available resource	-Solar irradiation threshold (>800kWh/kWpeak). -Suitable aspect (East through South to West facing slope) and slope (less than 15 degrees)	http://re.jrc.ec.europa.eu/pvgis OS Panorama data	All areas in Hinckley and Bosworth theoretically receive this amount of solar irradiation. South facing slopes are the most optimal locations.
	Proximity to National Grid	-Sites should be located within a maximum of 3km from a 33kV substation.	Western Power Distribution	Research has shown that preferred sites would be located within a maximum of 3km from a 33kV substation.
Constraints	Exclusion areas	-Unsuitable aspect (West through North to East facing slope)/ slope (exclude slope > 15 degrees) -Local, national and international nature conservation designations -BAP Habitats	OS Panorama Natural England English Heritage OS Meridian OS MasterMap	A revised boundary for Bosworth Battlefield was used (based on a map from the Conservation Management Plan currently out for consultation).

Field Cod

Opportunities / Constraints	Parameter	Assumption (Italics indicate that data was not available or there are no such sites/features in H&B)	Data source	Comments
		-Local, national and international heritage designations (using revised Bosworth Battlefield boundary) -Roads, railways and buildings, urban areas -Woodland (due to shading potential) -Agricultural Land Grades 1 and 2 (and 3a where data available) -Flood Risk Zones 2 and 3 -Minerals sites with a 250m buffer (due to shading caused by dust – research has shown that 98% of airborne dust settles within 250m of the emission source). -CROW Land	Forestry Commission (NFI) Agricultural Land Classification Environment Agency Flood Maps Hinckley and Bosworth	
	Competing land use	10% of suitable land as calculated above	N/A	A further reduction on suitable land was applied to take into consideration competing land uses such as food production.
Heat pump (air and ground source)				
Opportunities	Existing building stock	Domestic -75% of all off-grid properties -75% detached and semi-detached properties -50% of terraced properties -25% of flats Commercial -10% of commercial properties	NLPG Office of National Statistics Rural fuel poverty data from Centre for Sustainable Energy	Data for domestic properties was taken from the 2011 UK census. Data for commercial properties taken from NLPG data. Please note that the number of commercial properties in the Hinckley and Bosworth NLPG dataset is higher than that held in the OS Address Layer 2 dataset used for the East Midlands Study. Off-grid properties – Centre for Sustainable Energy (Identifying and Quantifying the Prevalence of Hard to Treat Homes, 2006). It was assumed that all off-grid properties were detached or semi-detached.
	Suitable new buildings	-50% of all new domestic properties	Hinckley and Bosworth Core Strategy	New domestic property data taken from the Hinckley and Bosworth Core Strategy.
	System capacity	-Domestic 5kW -Commercial 100kW	DECC methodology	
Constraints	N/A	-No significant constraints	N/A	
Heat pump (water source)				
Opportunities	Existing building stock	-Commercial, industrial and community properties that are within 250m of a lake, reservoir, canal or	NLPG OS Meridian 2	Excluding residential properties does not imply that the technology is not suited to residential / domestic use,

Opportunities / Constraints	**Parameter**	**Assumption (Italics indicate that data was not available or there are no such sites/features in H&B)**	**Data source**	**Comments**
		river. -Of these properties, assume 10% might be suitable. -Exclude residential properties	MasterMap Consultation with heat pump manufacturers and installers.	rather that consultation has shown that it is best suited (at the moment) to larger installations. Data showing the location of aquifers in relation to properties was not available.
	Suitable new buildings	*-New commercial and industrial property projections* *-Of 10% of new commercial and industrial properties, include a percentage equal to that existing % of properties within 250m of waterbodies.*	Hinckley and Bosworth site allocations	No figure for new commercial and industrial properties at 2020 and 2026 was available, so it was not possible to include this.
	System capacity	100kW per pump		Based on consultation with the Heat Pump Association and manufacturers.
Constraints	Exclusions	-Exclude properties within 250m of a waterbody that are additionally within 250m of an SAC/SPA/Ramsar site or SSSI.	Natural England Consultation with Hinckley and Bosworth Conservation Officer Consultation with heat pump manufacturers and installers.	Due to concerns about installing water source heat pumps in the vicinity of the Ashby Canal, a Case Officer at Hinckley and Bosworth BC was consulted. He confirmed that: '*as with all technologies the visual aspect was the key area of concern. They advise applicants to avoid proposals for heat pumps on street frontages or attached to side walls. Other than the physical impact on listed buildings, he knew of no reasons why inconspicuous heat pumps would not be approved in conservation areas*.' Discussions with installers/manufacturers confirmed this. It should be noted that WSHPs that involve extraction (not closed-loop systems) require an extraction licence from the EA.

Appendix 3.2: Capacity Factors

Technology	Capacity factor
Large Wind	25.9%
Medium Wind	25.9%
Small Wind	25.9%
Micro Wind	25.9%
Managed Woodland (heat)	45.0%
Managed Woodland (elec)	86.0%
Energy Crops (heat)	45.0%
Energy Crops (elec)	86.0%
Agricultural Arisings (heat)	45.0%
Agricultural Arisings (elec)	60.0%
Waste Wood (heat)	60.0%
Waste Wood (elec)	60.0%
Poultry Litter	60.0%
Wet Organic Waste (heat)	80.0%
Wet Organic Waste (elec)	60.0%
Municipal Solid Waste (MSW) (heat)	60.0%
Municipal Solid Waste (MSW) (elec)	60.0%
Commercial and Industrial (heat)	60.0%
Commercial and Industrial (elec)	60.0%
Landfill Gas	56.6%
Hydro	59.0%
Solar PV	9.0%
Solar Thermal	5.0%
Solar Arrays	10.0%
Heat Pumps	26.0%

Appendix 5.1: Results of the Sensitivity Analysis

LCA A: Charnwood Fringe Character Area

Summary of Landscape Character (taken from Landscape Character Assessment: Hinckley and Bosworth, 2006)

- *Prominent landform which includes the highest land in the Borough. Localised steep slopes around rocky outcrops and quarries.*
- *Diverse land uses which relate to the varied geology. Dominated by pasture and woodland with quarries, pools and outcrops*
- *Woodland cover of varying age from mature ancient to new National Forest plantations.*
- *Medium to small sized field pattern interspersed with large areas of woodland cover.*
- *Large clustered villages with strong suburban influences.*
- *Distinctive local assets such as Groby Pool and Billa Barra Hill*
- *Good network of public footpaths.*
- *Distant wide views to the urban edges of Leicester and surrounding Charnwood Forest.*
- *Diverse range of habitats due to variable land use types.*
- *Strong, long established aesthetic appeal.*

Landscape attributes and descriptions	**Landform and scale** – Undulating landform, steeply in places, with rocky outcrops and former quarry sites. Includes the highest land in the Borough. **Land cover pattern and presence of human scale features**– Diverse land use and varied landscape pattern. Land cover consists primarily of open pasture in an irregular field pattern, deciduous woodland, and frequent historic quarries. Medium to small sized field pattern interspersed with large areas of woodland cover. Fields are also bordered by hedgerows with numerous mature hedgerow trees. **Tracks/transport pattern** – A good road network with links to Leicester via the M1, A46 and A50 which pass through the area. A large number of smaller roads cross the landscape. **Skylines** – Prominent skylines due to this area forming the highest land in the Borough. However, these are no particularly distinctive in the wider context. **Perceptual qualities and man-made influence** – Working quarries, areas of restoration and substantial traffic movement through the area. Settlement comprises villages of Groby, Ratby and Markfield, which have a locally distinct and vernacular character; however they have also been subject to recent modern expansion. Close proximity and views to the urban edge of Leicester. Naturalistic and semi-naturalistic features include, Groby Pool (large natural expanse of open water), Billa Barra Hill (Local Nature reserve), ancient woodland, and areas of semi natural vegetation associated with disused quarries and rocky outcrops. **Inherent Capacity and Sensitivity for LCAs**[1] – "A strong distinctive character which is generally of high sensitivity and with limited capacity for change".
Discussion on landscape sensitivity	This area is of a relatively large scale in and is influenced by human activity including a busy road network which indicates lower sensitivity. However, the large areas of woodland and presence of human scale features increase sensitivity.
Key Landscape Sensitivities	• Historic character and small scale of the villages. • Localised steep slopes and rocky outcrops forming distinctive skylines. • Medium to small sized field pattern. • Mature ancient woodland, new National Forest plantations and hedgerows/ hedgerow trees. • The ecological, cultural and recreational interest of Groby Pool and Billa Barra Hill.

Sensitivity to different turbine heights	Small scale turbines (up to 40m)	Low-moderate
	Medium scale turbines (40m-80m)	Moderate
	Large scale turbines (80m -135m)	Moderate-high

Commentary on different cluster sizes Single turbine Small (<5 turbines) Medium (6-10) Large (11-25) Very large (>25)	The scale of the undulations and landcover means this landscape is likely to be particularly sensitive to 'large' or 'very large' clusters, as well as clusters at the upper end of the 'medium' scale.

[1] As set out in Landscape Character Assessment: Hinckley and Bosworth Borough, July 2006.

LCA B: Forest Hills Character Area

Summary of Landscape Character (taken from *Landscape Character Assessment: Hinckley and Bosworth* , 2006)

- *Gently undulating landform with small plateaus on higher ground. Highest point centred around Bagworth.*
- *Predominantly rural landscape with arable and rough set-aside, influenced by industrial / urban features such as masts, poles and pylons.*
- *Fields enclosed by hedgerows with scattered trees.*
- *Industrial heritage of quarrying and mining resulting in areas of restored land and new woodland within the National Forest.*
- *Generally large scale field pattern with groups of smaller fields surrounding settlements.*
- *Linear settlements of former mining villages with sparsely scattered farms on slopes in between.*
- *Good public access and footpath network throughout, especially within National Forest area.*
- *Visually open due to immature plantations. Wide ranging views from higher ground.*
- *Thornton reservoir is an attractive focal point.*

Landscape attributes and descriptions	**Landform and scale** – A gently undulating landform with plateaus on higher ground and some relatively steep valleys. Highest point around Bagworth. The rolling landform stretches from the Sence Uplands in the west where there are steeper slopes, rising steadily to the east where it meets the Charnwood Fringe. This is one of the larger character areas within the Borough. **Land cover pattern and presence of human scale features** – Comprises mainly farmland of arable and pasture use, set within irregular fields of both large scale and small scale. Hedgerows with hedgerow trees define fields, and mature tree belts and areas of new plantation form occasional features. Field sizes consist of both large and small sizes with larger fields on the flatter plateaux. **Tracks/transport pattern** – A good road network which links the settlements, consisting of rural, single lane roads. A railway line passes through the area. **Skylines** – locally prominent due to undulating landform (e.g. tops of river valleys), but not prominent in the wider context. Trees form most skylines, with some pylons visible and the stone spire of Nailstone a feature. **Perceptual qualities and man-made influence** – An evolving and changing landscape, with significant areas of new National Forest woodland, and strongly influenced by its industrial past. A strong sense of movement as a result of traffic levels which reflect the close proximity of large settlements around Leicester and the major transport routes, and audible impacts from overhead air traffic, which reduces tranquillity of the area. Bagworth Heath, Thornton Reservoir and the Tropical Bird Garden near Desford provide visitor attractions and ecological/semi-naturalistic character. Settlements comprise villages, on lower lying land or linearly spread along higher ridges, or scattered farm buildings. Urbanising feature such as pylon lines, masts and industrial buildings form occasional features. **Inherent Capacity and Sensitivity for LCAs[2]** – *"This is a changing landscape of lesser sensitivity due to the large areas of new woodland planting and extensive restoration schemes which will have yet to mature. An area which is more resilient to change due to the evolving nature of the landscape".*
Discussion on landscape sensitivity	The gently rolling landform, relatively large scale of the landscape and simple landscape pattern on the plateaux, and presence of urbanising features indicate a lower sensitivity to wind energy while the presence of human scale features and areas of steeper undulations around valleys increase sensitivity. The Borough LCA describes the area as a changing and evolving landscape, which is resilient to change.
Key Landscape Sensitivities	• Hedgerows with scattered trees, including mature trees in the form of tree belts within remnant mature hedgerows. • Areas of woodland. • Industrial heritage. • The visual and recreational interest of Thornton reservoir. • The small scale and rural character of the villages. • The stone spire of Nailstone church as a local landmark feature.

Sensitivity to different turbine heights	Small scale turbines (up to 40m)	Low
	Medium scale turbines (40m-80m)	Low-moderate
	Large scale turbines (80m -135m)	Moderate

Commentary on different cluster sizes Single turbine Small (<5 turbines) Medium (6-10) Large (11-25) Very large (>25)	The medium scale of the landscape means that this area is likely to be particularly sensitive to 'large' or 'very large' clusters, as well as clusters at the upper end of the 'medium' scale.

[2] As set out in Landscape Character Assessment: Hinckley and Bosworth Borough, July 2006.

LCA C: Market Bosworth Parkland Character Area

Summary of Landscape Character (taken from *Landscape Character Assessment: Hinckley and Bosworth* , 2006)

- *Rolling landform with gentle slopes which rise and fall reaching a high point around the town of Market Bosworth.*
- *Land use dominated by parkland, pasture and scattered trees.*
- *Increased tree cover associated with settlements.*
- *Field boundaries are predominantly hawthorn hedges with some post and rail or estate fencing.*
- *Scattered agricultural buildings are visible in wider views. Market Bosworth is mostly hidden by vegetation.*
- *Occasional narrow gated lanes with avenue trees.*
- *Open access within the parkland and country park supported by a good network of public footpaths.*
- *Area is semi-enclosed by trees and hedgerows which therefore limit views.*
- *Significant historic features typical of country estates including estate fencing, avenue trees, grazed pasture and lanes.*
- *Bosworth Battlefield has strong heritage associations.*
- *Market Bosworth provides an important focus within the area.*

Landscape attributes and descriptions	**Landform and scale** – A medium scale undulating landform with gentle slopes, which rise and fall reaching high points around the town of Market Bosworth. **Land cover pattern and presence of human scale features** – Changing field patterns and vegetation providing a range of scale and openness, with some large, open fields, and other enclosed, small scale areas, with irregular fields of pasture, mature trees and vegetation, in clumps or as avenues along roads. Also areas of estate parkland with mature scattered parkland trees and avenues if trees. Human scale features include hedgerow boundaries, hedgerow trees, estate fencing and farmsteads. **Tracks/transport pattern** – A number of small rural roads radiating from Market Bosworth, sometime lined with avenues of trees. **Skylines** – locally prominent due to the undulating nature of the landscape. Typically defined by trees. **Perceptual qualities and man-made influence** – This area is strongly associated with the town of Market Bosworth, and is strongly influenced by Bosworth Hall, and the surrounding estate parkland. It has tranquil, quiet and peaceful character. There is a strong built vernacular within Market Bosworth and the associated estate villages. Part of Bosworth Battlefield falls within the area. **Inherent Capacity and Sensitivity for LCAs** [3]– *"A strong, distinctive and diverse character area resulting in high sensitivity and restricted capacity to absorb change. A landscape with many important landscape features such as the historic parkland and ancient battlefield. The historic market town of Market Bosworth is a key landmark of regional importance".*
Discussion on landscape sensitivity	While the gently rolling landform and simple landscape patterns on the flatter farmland plateaux away from Market Bosworth indicate a lower sensitivity to wind energy, strong presence of human scale features, rural and tranquil character and historic character indicate a greater sensitivity to wind energy development, particularly around Market Bosworth and parkland. The Borough LCA also describes the area as having a high inherent sensitivity and little capacity for change.
Key Landscape Sensitivities	• Historic parkland and ancient battlefield. • Human scale features such as hedgerows, estate fencing and scattered agricultural buildings. • Narrow gated lanes with avenue trees. • Significant historic features typical of country estates including estate fencing, avenue trees, grazed pasture and lanes • The historic character of Market Bosworth and its historic landscape setting. • The strong vernacular of the surrounding estate villages. • Tranquil, peaceful and quiet character.

Sensitivity to different turbine heights	Small scale turbines (up to 40m)	Low-moderate
	Medium scale turbines (50m-80m)	Moderate
	Large scale turbines (80m -135m)	Moderate High

Commentary on different cluster sizes Single turbine Small (<5 turbines) Medium (6-10) Large (11-25) Very large (>25)	The scale of the undulations and landcover means this landscape is likely to be particularly sensitive to 'medium', 'large' and 'very large' clusters.

[3] As set out in Landscape Character Assessment: Hinckley and Bosworth Borough, July 2006.

LCA D: Desford Vales Character Area

Summary of Landscape Character (taken from *Landscape Character Assessment: Hinckley and Bosworth*, 2006)

- *Gently rolling landform.*
- *Although predominately arable, clustered areas of industrial and recreational facilities are locally prominent.*
- *Tree cover is limited with scattered trees and small linear woodland copses.*
- *Large to medium sized field pattern is defined by single species hawthorn hedgerows. Where hedgerows have been removed, open views across the landscape are possible.*
- *Clustered villages of varying size centre around crossroads. Desford is the largest settlement in the area.*
- *Good network of footpaths link settlements. Few major roads.*
- *Open views give an impression of a large scale landscape. Masts, poles, and pylons are often prominent.*

Landscape attributes and descriptions	**Landform and scale** – A moderate scale gently rolling landform rising to the north, flattening out in the south. **Land cover pattern and presence of human scale features** – Medium scale field pattern of arable land use, fields delineated by hedgerows with hedgerow trees. Rich mix of farmland and woodland, creating a rural patchwork. Human scale features include allotments, farms and scattered trees. **Tracks/transport pattern** – The A47 passes through to the south east forming part of the Borough boundary, whilst the A447 forms most of the western boundary. Between these, traffic uses a network of lanes and minor roads. A more major road network is located near Desford. Traffic tends to travel quickly along these routes and the area is periodically busy. There is a motorsport track at Mallory Park. **Skylines** – skylines are locally prominent due to the undulating nature of the landscape & characterised by trees. **Perceptual qualities and man-made influence** – A rural landscape occasionally influenced by modern, man-made development, such as isolated quarries, industrial areas comprising warehouses and factories, such as the Catapillar works at Desford, a number of masts, poles, and pylons, and several major, busy roads. **Inherent Capacity and Sensitivity for LCAs** [4]– "*A predominantly rural landscape occasionally influenced by development features, isolated quarries and industrial areas. This results in a landscape of varied sensitivity and capacity to accommodate change. A mixed character area with a variety of land uses. Sensitivity tends to increase towards the more rural west".*
Discussion on landscape sensitivity	Although the gently rolling nature of the landform and the presence of modern human influences and development indicate a lower sensitivity to wind energy development, the presence of human scale features and rural character indicate a higher sensitivity to wind energy development. The Borough LCA notes a varied inherent sensitivity and capacity for change across the area.
Key Landscape Sensitivities	• Human scale features, such as hedgerows, trees and allotments. • Rural character. • Areas of woodland, grassland and hay meadows. • Small scale and rural character of the villages.

Sensitivity to different turbine heights	Small scale turbines (up to 40m)	Low
	Medium scale turbines (40m-80m)	Moderate
	Large scale turbines (80m -135m)	Moderate-high

Commentary on different cluster sizes Single turbine Small (<5 turbines) Medium (6-10) Large (11-25) Very large (>25)	The scale of the undulations and landcover means this landscape is likely to be particularly sensitive to 'medium', 'large' and 'very large' clusters.

[4] As set out in Landscape Character Assessment: Hinckley and Bosworth Borough, July 2006.

LCA E: Stoke Golding Vales Character Area

Summary of Landscape Character (taken from *Landscape Character Assessment: Hinckley and Bosworth* , 2006)

- *Predominately flat with only gentle undulations.*
- *Mix of arable and pasture with frequent individual* trees.
- *Medium scale rectilinear field pattern bounded by mixed hedgerows with scattered hedgerow trees and small copses.*
- *Settlement usually associated with local high points.*
- *Area criss-crossed by network of small lanes and public footpaths. The Ashby Canal features numerous attractive canal bridges.*
- *Stoke Golding is an attractive settlement clustered around its prominent church, close to the Ashby Canal.*
- *Area is open and expansive with views occasionally limited by vegetation.*
- *This is generally a tranquil, rural character area despite the proximity of Hinckley and the A5.*

Landscape attributes and descriptions	**Landform and scale** – Predominately flat with only gentle undulations. The area is a medium scale resulting from the relatively flat topography and generally open aspect. **Land cover pattern and presence of human scale features** – Medium scale rectilinear field pattern bounded by hedgerows with scattered hedgerow trees and small copses. Simple land use, resulting in a consistent landscape pattern and simple character. Field patterns are mainly rectilinear and uninterrupted, creating a generally uniform pattern to the whole landscape. Human scale features include small woodland clumps, hedgerows and ditches which provide field boundaries, scattered trees, and small canal bridges across the Ashby canal. **Tracks/transport pattern** – A road network consists of mainly minor roads and lanes. The A447 crosses the area and the A5 forms the south western boundary. **Skylines** – some locally prominent skylines due to the undulating nature of the landscape, but not particularly prominent in the wider context. Trees and pylons form skylines features in this agricultural landscape. Also occasional church spires/ towers are distinctive features. **Perceptual qualities and man-made influence** – There are few settlements and few urbanising features. The A447 crosses the landscape and the A5 forms the south western boundary of the area. However, much of the area is free from significant traffic noise. Despite proximity to main urban centres and the A5, much of this area is distinctly rural and largely tranquil. Occasional urban influences from pylons, masts and poles. **Inherent Capacity and Sensitivity for LCAs** [5] *"It is of high sensitivity, with limited capacity for change. Much of which feels remote from the principal urban areas".*
Discussion on landscape sensitivity	The gently undulating landform and simple and uniform landscape pattern indicate a lower sensitivity to wind energy development. The rural/ tranquil character, human influences and church spires/towers increase sensitivity. The Borough LCA notes a high inherent sensitivity and limited capacity for change.
Key Landscape Sensitivities	• The hedgerows, scattered hedgerow trees and small copses • The network of small lanes. • The Ashby Canal and associated features such as canal bridges. • The small scale and rural character of the villages. • The rural setting of villages. • Human scale of the landscape. • Tranquil, rural character despite close proximity to urban centre sand A5, with few interrupting modern features and development.

Sensitivity to different turbine heights	Small scale turbines (25up to 40m)	Low-mod
	Medium scale turbines (40m-80m)	Moderate
	Large scale turbines (80m -135m)	Moderate-high

Commentary on different cluster sizes Single turbine Small (<5 turbines) Medium (6-10) Large (11-25) Very large (>25)	The scale of the landform and landcover means this landscape is likely to be particularly sensitive to 'large' or 'very large' clusters, as well as clusters at the upper end of the 'medium' scale.

[5] As set out in Landscape Character Assessment: Hinckley and Bosworth Borough, July 2006.

LCA F: Hinckley, Barwell and Burbage Fringe Character Area

Summary of Landscape Character (taken from *Landscape Character Assessment: Hinckley and Bosworth* , 2006)

- *Gently rolling landform with some areas of flat land such as Burbage Common*
- *Mix of arable and pasture with isolated areas of woodland. Increasing industrial use around urban areas.*
- *Medium sized rectilinear field pattern bounded by mixed hedgerows and few hedgerow trees. Agricultural land provides open areas of separating landscape between Barwell, Earl Shilton and Hinckley*
- *Landscape heavily influenced by established settlements, often situated on higher ground, with masts and poles prominent*
- *Significant transport infrastructure subdivides area.*
- *Distinctive landscape features such as Burbage Common and Wood have local and national importance as ecological and recreational resources.*
- *Localised containment provided by woodland, but urban areas frequently visible on ridgelines*

<table>
<tr><td rowspan="1">Landscape attributes and descriptions</td><td colspan="2">Landform and scale – Medium to large scale gently rolling landform. Some areas of flat land such as Burbage Common.
Land cover pattern and presence of human scale features – Fairly simple field pattern of repeating elements. Human scale features include occasional hedgerows trees and scattered farmsteads.
Tracks/transport pattern – Significant transport infrastructure passes through parts of the landscape, including the M69, A47 and the A5 along the south western extent.
Skylines – Not prominent. Urban areas are visible on the skyline, including church spires. Pylons are prominent features.
Perceptual qualities and man-made influence – Landscape heavily influenced by established settlements of Hinckley, Burbage, Earl Shilton and Barwell, which form the north western edge of the area. Industrial uses are also associated with urban fringe. The M69, A47 and A5 result in traffic and visual disturbance, especially at peak times. Distinctive landscape features such as Burbage Common and Wood have local and national importance as ecological and recreational resources, and help to retain a perception of tranquillity, in parts.
Inherent Capacity and Sensitivity for LCAs [6] "Sensitivity varies across the diverse urban fringe character area. Burbage Common is particularly distinctive and sensitive, with little capacity for change. Other areas are important due to their openness and consequent role in preventing urban coalescence. Strategically significant landscapes of high sensitivity are located close to principal urban areas".</td></tr>
<tr><td>Discussion on landscape sensitivity</td><td colspan="2">The gently rolling nature of the landscape, simple landscape pattern and influence of human activity and development indicate a lower sensitivity to wind energy development. However, the presence of human scale features and pockets of tranquillity (e.g at Burbage Common) indicate a higher sensitivity to wind energy development. The Borough LCA notes that inherent sensitivity and capacity varies across the landscape, with very little capacity for change at Burbage Common.</td></tr>
<tr><td>Key Landscape Sensitivities</td><td colspan="2">• Areas of woodland.
• Hedgerows and hedgerow trees.
• Ecological and recreational resources of Burbage Common and Wood (and the perception of tranquillity they provide).</td></tr>
<tr><td rowspan="3">Sensitivity to different turbine heights</td><td>Small scale turbines (up to 40m)</td><td>Low</td></tr>
<tr><td>Medium scale turbines (40m-80m)</td><td>Low-moderate</td></tr>
<tr><td>Large scale turbines (80m -135m)</td><td>Moderate</td></tr>
<tr><td>Commentary on different cluster sizes

Single turbine
Small (<5 turbines)
Medium (6-10)
Large (11-25)
Very large (>25)</td><td colspan="2">The scale of the undulations and landcover, plus the limited extent of this LCA, mean this landscape is likely to be particularly sensitive to 'medium', 'large' and 'very large' clusters.</td></tr>
</table>

[6] As set out in Landscape Character Assessment: Hinckley and Bosworth Borough, July 2006.

LCA G: Fen Lanes Character Area

Summary of Landscape Character (taken from *Landscape Character Assessment: Hinckley and Bosworth* , 2006)

- *Predominantly flat valley landscape with areas of gentle undulations.*
- *Predominantly arable with some occasional pasture.*
- *Small woodland clumps and willow trees associated with watercourses.*
- *Mixed field pattern of large to medium size with broken hedgerows. Hedgerow trees are either scattered or in clumps along roads and near watercourses.*
- *Small dispersed settlements clustered around cross-roads, with isolated farmsteads*
- *A444 forms main route through area with small lanes leading off and many public footpaths.*
- *Open aspect but views are occasionally curtailed by copses, hedgerow vegetation and limited vantage points.*
- *Frequent streams and ditches.*

<table>
<tr><td>Landscape attributes and descriptions</td><td colspan="2">Landform and scale – Gently undulating with some flat plateau areas between valleys. The landscape has an overall large scale.
Land cover pattern and presence of human scale features – A uniform land use consisting of flat, open arable fields with some pasture, and overall little diversity. Some areas of irregular field pattern. Human scale features include small woodland clumps, willow trees associated with watercourses, hedgerows and hedgerow trees, small settlements clustered around cross-roads and scattered farmsteads.
Tracks/transport pattern – The A444 passes north to south linking with the A5 which runs along the south west boundary, however, the majority of the area is served by minor roads and small lanes.
Skylines – Generally, not prominent due to flattish landform. However there are some locally prominent skylines, for example as seen from river valleys. Trees form the skyline & there are some church spires/ towers visible on the skyline e.g. at Sibson.
Perceptual qualities and man-made influence – The lack of significant settlement results in a strong rural sense of place away from urbanising elements such as the A5 corridor. Traffic noise affects tranquillity close to the A5 and A444, but generally the area is quiet and peaceful.
Inherent Capacity and Sensitivity for LCAs [7] "The open landscape and expansive views result in generally high sensitivity, although the large scale makes it resilient to change. A sensitive landscape due to its over-riding rural character and sparse distribution of small settlements".</td></tr>
<tr><td>Discussion on landscape sensitivity</td><td colspan="2">The gently undulating, large scale landform and simple and uniform landscape pattern indicate a lower sensitivity to wind energy development (particularly on flatter plateau areas). However, the presence of human scale features (including church towers on the skyline) and strong rural sense of place indicate a higher sensitivity to wind energy development. The Borough LCA notes that inherent sensitivity is generally high, although the large scale makes it resilient to change.</td></tr>
<tr><td>Key Landscape Sensitivities</td><td colspan="2">• Small woodland clumps, willow trees associated with watercourses, hedgerows and hedgerow trees as features of the landscape.
• Small scale and rural character of the settlements.
• Church towers/ spires as features of the skyline.
• Strong rural sense of place, quiet and peaceful character.</td></tr>
<tr><td rowspan="3">Sensitivity to different turbine heights</td><td>Small scale turbines (2up to 40m)</td><td>Low</td></tr>
<tr><td>Medium scale turbines (40m-80m)</td><td>Low-moderate</td></tr>
<tr><td>Large scale turbines (80m -135m)</td><td>Moderate</td></tr>
<tr><td>Commentary on different cluster sizes
Single turbine
Small (<5 turbines)
Medium (6-10)
Large (11-25)
Very large (>25)</td><td colspan="2">The scale of the undulations and landcover means this landscape is likely to be particularly sensitive to 'large' or 'very large' clusters, as well as clusters at the upper end of the 'medium' scale.</td></tr>
</table>

[7] As set out in Landscape Character Assessment: Hinckley and Bosworth Borough, July 2006.

LCA H: Upper Mease Character Area

Summary of Landscape Character (taken from *Landscape Character Assessment: Hinckley and Bosworth* , 2006)

- *Simple open landform of elevated rolling hills.*
- *Predominantly arable land use.*
- *Mature trees largely associated with small clustered villages.*
- *Large fields bordered by mixed species hedgerows with scattered hedgerow trees. Ditches define field boundaries where hedgerows have been lost.*
- *Dispersed farm buildings visible within wide panoramic views.*
- *A444 traverses an area of otherwise minor roads.*
- *Good network of public footpaths leading towards Twycross.*
- *Occasional woodland within surrounding landscape.*
- *Expansive and at times dramatic long ranging panoramic views are a notable characteristic feature, especially from the A444*
- *Twycross Zoo is an important visitor attraction of international importance.*

Landscape attributes and descriptions	**Landform and scale** –This area is located on a broad ridge with steep slopes to the west. **Land cover pattern and presence of human scale features** – Land cover is uniform with few subdividing features and limited diversity. At the local level, the pattern of the landscape is slightly more mixed as field sizes vary, particularly close to settlements. Land cover is mainly arable fields, some of which are very large. Human scale features include occasional small clumps of trees associated with settlements, some hedgerows, and scattered farmsteads. **Tracks/transport pattern** – The main transport route is the A444. Elsewhere, minor roads and lanes cross the landscape. **Skylines** – Generally not prominent due to flattish landform (particularly on the plateau areas). However there are some locally prominent skylines as seen from the west. Trees form the skyline & there are church towers at Twycross and Norton-Juxta-Twycross. **Perceptual qualities and man-made influence** – There is little settlement apart from Twycross, Norton-Juxta-Twycross and occasional dispersed farmsteads. Twycross Zoo forms a developed feature In the landscape. Traffic noise affects tranquillity close to the A444, but generally there is little traffic noise elsewhere and the area is largely quiet. There is often a sense of tranquillity. **Inherent Capacity and Sensitivity for LCAs** [8] *"A distinctive sensitive character derived from the elevated expansive landscape and panoramic views. An expansive rural landscape of generally high sensitivity".*	
Discussion on landscape sensitivity	The simple large scale landform and uniform land cover indicate a lower sensitivity to wind energy development. However, the presence of human scale features and the undeveloped rural and tranquil character indicate a higher sensitivity to wind energy development. The Borough LCA notes that inherent sensitivity is high.	
Key Landscape Sensitivities	• Human scale of the landscape resulting from features such as small clumps of trees and farmsteads. • The small scale and rural character of the villages. • Rural, quiet and tranquil character. • Church towers as local focal features on the skyline.	
Sensitivity to different turbine heights	Small scale turbines (up to 40m)	Low
	Medium scale turbines (50m-90m	Low -moderate
	Large scale turbines (90m -135m	Moderate
Commentary on different cluster sizes Single turbine Small (<5 turbines) Medium (6-10) Large (11-25) Very large (>25)	The scale of the undulations and landcover mean this landscape is likely to be particularly sensitive to 'medium', 'large' and 'very large' clusters.	

[8] As set out in Landscape Character Assessment: Hinckley and Bosworth Borough, July 2006.

LCA I: Gospall Parkland Character Area

Summary of Landscape Character (taken from *Landscape Character Assessment: Hinckley and Bosworth*, 2006)

-
- *Distinctive parkland landscape with many mature specimen trees.*
- *Historic associations with Handel the composer adds to the sense of place.*
- *Medium field pattern bordered by a mix of hedgerows, barbed wire fencing and small sections of estate fencing.*
- *Large farms relating to former estate buildings i.e. Gopsall Hall Farm and Gopsall House Farm.*
- *Tranquil and remote pasture..*
- *Good network of public footpaths leading towards Twycross.*
- *Some woodland within surrounding landscape.*
- *Generally expansive open aspect.*
- *Relic follies add interest.*

Landscape attributes and descriptions	**Landform and scale** – Located on a relatively large scale gently undulating plateau with local undulations formed by valleys. **Land cover pattern and presence of human scale features** – Land cover is quite diverse, consisting of large areas of open grassland parkland, with some arable farmland and areas of woodland. There are a large number of human scale features, often relating to the parkland landscape, including many mature specimen trees, woodland and avenues along roads, hedgerows and hedgerow trees, estate fencing, and large scattered farms relating to former estate buildings i.e. Gopsall Hall Farm and Gopsall House Farm. **Tracks/transport pattern** – Minor roads and lanes interconnect local villages. **Skylines** – not prominent on plateau; some locally prominent skylines as see from valleys; generally wooded with some church towers forming local features. **Perceptual qualities and man-made influence** – A rural, parkland character, with little modern development. The area is quiet and peaceful, and woodland provides a sense of enclosure. Minor roads and lanes pass through the landscape, and there is little traffic. Very little settlement, which relates primarily to the parkland landscape, consisting of former estate building such as Gopsall Hall which was demolished in 1952, estate villages at Shackerstone and Congerstone, large estate farms and smaller scattered farmsteads. **Inherent Capacity and Sensitivity for LCAs** [9] *"A remnant parkland landscape with declining historic features. Vulnerable to further deterioration and therefore highly sensitive. A fragile historic landscape which could easily be lost".*
Discussion on landscape sensitivity	Although the large scale and gently undulating landform indicates a lower sensitivity to wind energy development, the presence of human scale features and the strong historical and rural character indicate a higher sensitivity to wind energy development. The Borough LCA notes that inherent sensitivity is high due to the vulnerability of the remnant parkland features.
Key Landscape Sensitivities	• Remnant parkland features including mature specimen trees, woodland and avenues along roads, hedgerows and hedgerow trees, estate fencing, and large scattered farms relating to former estate buildings i.e. Gopsall Hall Farm and Gopsall House Farm. • The canal and historic canal structures. • Church towers forming local focal features. • Rural, quiet and tranquil character.

Sensitivity to different turbine heights	Small scale turbines (up to 40m)	Low-moderate
	Medium scale turbines (50m-90m	Moderate
	Large scale turbines (90m -135m	Moderate-high

Commentary on different cluster sizes Single turbine Small (<5 turbines) Medium (6-10) Large (11-25) Very large (>25)	The scale of the undulations and landcover mean this landscape is likely to be particularly sensitive to 'medium', 'large' and 'very large' clusters.

[9] As set out in Landscape Character Assessment: Hinckley and Bosworth Borough, July 2006.

LCA J: Upper Sence Character Area

Summary of Landscape Character (taken from *Landscape Character Assessment: Hinckley and Boswor*, 2006)

- *Gentle undulating landform which rises generally to the east.*
- *Mix of arable and pasture with small copses and scattered trees within mixed hedgerows.*
- *Well treed appearance despite lack of actual woodland.*
- *Regular pattern of medium sized fields become smaller around settlements.*
- *Settlements predominantly small villages*
- *Long distance footpaths pass through area.*
- *Some long distance views but mostly limited by trees.*

Landscape attributes and descriptions	**Landform and scale** – Gently undulating landform which rises generally to the east. The area has a medium scale. **Land cover pattern and presence of human scale features** – The land cover is simple, with a mix of arable with some pasture, set within regular pattern of fields of medium to small scale. Woodland and copses subdivide the field pattern creating a more interesting landscape framework. Additional human scale features include, mixed hedgerows along fields and roadsides, and scattered farm buildings. **Tracks/transport pattern -** The main traffic route is the A447, with minor roads and lanes passing through the area elsewhere. **Skylines** – Locally prominent due to undulating landscape. Treed skylines. **Perceptual qualities and man-made influence** – The lack of major roads and settlements results in overall tranquillity. **Inherent Capacity and Sensitivity for LCAs** [10] "*A low key but predominately tranquil rural character area which is sensitive to significant change. It has been subject to little significant change, and is quite resilient as a result. However, it's tranquil nature is highly sensitive".*	
Discussion on landscape sensitivity	The gently undulating landform, simple land cover pattern and presence of roads indicate a lower sensitivity to wind energy development. However, the presence of human scale features and tranquil rural character indicate a higher sensitivity to wind energy development. The Borough LCA notes a high inherent sensitivity to significant change.	
Key Landscape Sensitivities	• Areas of woodland, copses, mixed hedgerows and hedgerow trees. • Human scale of the landscape. • Small scale and rural character of the villages. • Rural, tranquil character.	
Sensitivity to different turbine heights	Small scale turbines (up to 40m)	Low-moderate
	Medium scale turbines (50m-90m	Moderate
	Large scale turbines (90m -135m	Moderate-high
Commentary on different cluster sizes Single turbine Small (<5 turbines) Medium (6-10) Large (11-25) Very large (>25)	The scale of the undulations and landcover mean this landscape is likely to be particularly sensitive to 'medium', 'large' and 'very large' clusters.	

[10] As set out in Landscape Character Assessment: Hinckley and Bosworth Borough, July 2006.

Appendix 5.2: Generic Guidance on the Siting Design of Wind Energy Developments

1.1 This Appendix is designed to provide generic guidance on the siting and design of wind energy development in Hinckley and Bosworth. It will help ensure that adverse landscape and visual impacts are addressed satisfactorily, including cumulative landscape and visual impacts, as required by paragraph 97 of the NPPF.

1.2 The guidance is intended for a range of audiences, including the development management teams, Council Members and developers involved in the preparation, presentation, review and consenting of wind energy development proposals in Hinckley and Bosworth.

Initial Scheme Planning and Siting

1.3 The initial focus in planning a wind energy scheme is on site selection and identifying the appropriate type and scale of wind energy development. Since wind turbines cannot be hidden, careful site selection as well as choice of turbine type and layout of turbines is the most effective way of minimising landscape and visual impacts. The layout and design of a wind energy development should be informed by landscape and visual impact assessment (LVIA).

1.4 For each possible development area or site, the relevant landscape character area (LCA) evaluation (see **Appendix 5.1**) should be consulted to understand the baseline landscape character and key sensitivities to wind energy development.

1.5 Since there are often local variations in landscape character and sensitivity within an LCT, a site-specific analysis should be undertaken to identify specific landscape and visual issues at any given site. It will be important to consider potential impact on;

- landscape characteristics
- special qualities
- views

1.6 This may be aided by generation of a zone of theoretical visibility[11] (ZTV). Guidance on producing ZTVs for wind energy development is contained in Scottish Natural Heritage Guidance on the Visual Representation of Windfarms[12].

1.7 The choice of site and development type should respect the specific sensitivity of the LCA concerned. It will also be important to consider other existing and proposed developments in the area – guidance in designing for multiple developments may also be relevant.

1.8 The following provides some generic guidance on siting wind energy development in Hinckley and Bosworth, focussing on minimising landscape and visual impacts. However, it is recognised that technologies need to be sited and designed to ensure a reasonable output and these two issues will need balancing.

- Consider the sensitivity assessment for the relevant landscape character area/s when choosing potential sites for wind energy development.
- Aim to site wind energy developments comprising more than one turbine on large-scale smooth gently sloping or flat landform rather than steep slopes so that wind turbines are seen to be at a relatively consistent height.

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[11] This represents the area over which a development can theoretically be seen, based on digital terrain data. This information is usually presented on a map base (also known as the Zone of Visual Influence, ZVI).

[12] Scottish Natural Heritage (2006) Visual Representation of Windfarms: Good Practice Guidance. [NB Scottish guidance has been quoted as there is no equivalent English guidance.]

- When siting medium or large-scale wind energy development (i.e. those with multiple turbines over 40m tip height), select sites in simple, regular landscapes with extensive areas of consistent ground cover over landscapes with more complex or irregular land cover patterns, smaller field sizes and landscapes with frequent human scale features (subject to satisfying other sensitivities).
- When siting multiple turbines, aim to locate turbines on the most level part of a site or following contours to avoid a confusing variation of turbine heights.
- When siting multiple turbines ensure turbines do not span across marked changes in character on the ground, such as changes in topography (this may be less of an issue where changes in character are less readable on the ground).
- It is generally less distracting to see whole turbines (or a substantial part of a turbine) rather than blade tips only – this may be a particular consideration for views from sensitive viewpoints or those frequented by a larger number of viewers.
- Siting of turbines should not prevent the understanding and appreciation of historic landmarks features such as church towers/spires.
- Consider locations in association with business parks and reclaimed, industrial and man-made landscapes where other landscape sensitivities are not compromised.
- Consider the landscape impacts of transmission infrastructure when siting development, aiming for sites that will minimise the need for above ground transmission infrastructure. Undergrounding cables may mitigate impacts in sensitive locations.
- Significant impacts on views from important viewpoints (including views which are integral to the character of conservation areas and iconic views), popular tourist and scenic routes, and settlements should be minimised.
- There may be some opportunity to site smaller single turbines in relation to farm buildings with larger scale single turbines sited in relation to larger businesses or community buildings - development should be commensurate with (or reflect) the scale of the associated buildings.
- Aim to avoid sites where turbines, tracks or other infrastructure would affect semi-natural habitats.
- When selecting sites consider potential impacts of transporting turbines to site, and the possible limitations presented by the road network, particularly narrow hedged, or historic sunken, lanes.
- Protect the character of conservation areas (including views integral to their character), and historic landscapes (including views to and from, particularly designed views).

Detailed Layout and Design

1.9 The next stage in planning a wind energy scheme is the detailed layout and design. Alternative options should be investigated to find the optimum layout and design of a wind energy development. The NPPF (para. 66) expects applicants to work closely with those directly affected by their proposals to evolve designs that take account of the views of the community. The landscape and visual impact assessment (LVIA) may aid this process. The following should be considered:

- Layout and number of turbines;
- Size, design and proportion of turbines;
- Requirement for, and location of, transformers;
- Site access and design of access tracks and onsite cables;
- Requirement for, and location of, borrow pits;
- Location and restoration of construction compounds;
- Location of monitoring masts;
- Design of lighting (if required);

- Location and design of substation building(s);
- Land management changes including opportunities for habitat creation/ enhancement appropriate for the character area, set out in a landscape management strategy.

1.10 The following provides some generic guidance for the detailed layout and design of wind energy developments in Hinckley and Bosworth:

Site Layout

- When developing multiple turbines, ensure that turbines read as a coherent group in all the main views – aim for a balanced composition.
- When developing multiple turbines, aim to avoid 'stacking' of turbines when seen from one direction as far as possible (such as is experienced when looking along a row).
- When developing multiple turbines, aim to avoid siting turbines which are remote from the rest of the group – maintain a clear balanced cluster.
- When developing multiple turbines, ensure cluster size is in proportion with, and does not overwhelm, the scale of the landform.
- The scale and numbers of turbines is particularly critical in the most sensitive areas.
- Aim to ensure wind turbines respect the hierarchy of elements in the landscape and do not compete with, or create clutter when seen together with, other man-made landscape elements such as pylons.
- In urban fringe or industrial contexts, developments should respond to the scale of the built form and sit comfortably alongside buildings or structures, providing a balanced composition.
- Information on landscape scale may provide an indication of suitable development sizes.
- Ensure the layout and design of the development responds to other wind energy developments in the same type of landscape to minimise cumulative impacts – this is more important the closer sites are together.

Turbine Design

- Ensure the height of turbines does not overwhelm the scale of the landform.
- Ensure that the proportion of rotor diameter to tower height is balanced - short blades on a tall tower or long blades on a short tower may look unbalanced. Aim for a ratio of approximately 1:1 for tower height: blade diameter.
- Three bladed turbines tend to look more balanced than two bladed turbines.
- Tubular steel towers tend to look simpler and less 'industrial' than lattice towers.
- Hubs are more aesthetically pleasing when oval shaped with flowing lines, rather than 'boxy' shapes.
- Simple, pale grey coloured turbines will be most suitable for most turbines over 25m to tip (to reduce contrast with the sky). However, in some cases darker colours may be suitable for very small turbines to help them blend into their setting.
- Speed of blade rotations should be kept as low as possible (particularly on smaller turbines) to reduce visual impact.
- Avoid use of coloured advertising banners on turbines, particularly in rural areas.

Ancillary Features

- Minimise damage to narrow lanes, stone walls, hedges, flower rich verges, trees, historic bridges and gateposts as a result of road widening – repair and replace any features lost.
- Minimise the length of new tracks introduced into the landscape, using existing routes wherever possible.
- Any new tracks should follow contours, avoiding steep slopes or wet ground where possible, and following field boundaries or woodland edges where possible – in some cases this may result in slightly longer lengths of track being required.
- Ensure the surface of tracks blend into the surrounding landscape and aim to re-vegetate tracks (in full or in part) and crane pads following construction.

- Where possible, house transformers within the turbine towers to reduce their visual impacts.
- Substation and control buildings should be carefully sited and should generally avoid high or exposed locations – use existing buildings where possible, or existing and locally occurring vegetation to screen new buildings.
- Ancillary features match the local vernacular where they are visible (e.g. using locally occurring materials on substations, control buildings, and transformer cabins if not housed within the turbines).
- Avoid use of urbanising elements in rural situations, such as kerbs, and minimise areas of hard surfacing, fencing and lighting.
- Ensure on-site cables are buried underground (without damage to key landscape features or archaeology) to minimise impacts on landscape character and visual amenity – grid connections should be underground wherever possible.
- If lighting is required on turbines for aviation purposes, use infra-red lighting to minimise visual impacts at night, particularly in rural areas.

Land Use/ Landscape Enhancement

- Aim for continuation of the existing land use underneath the turbines so that the landscape continues to flow underneath and around the turbines, or link land use to adjoining land uses especially if this can create more robust semi natural habitats and reduce habitat fragmentation.
- Consider providing enhanced management of landscape features, habitats and historic assets as part of a development, including contributing to wider landscape scale targets and projects in Hinckley and Bosworth Landscape Character Assessment.
- Developers should provide a design statement to set out how the design has evolved, how the design responds to landscape character, how visual issues have been addressed and how this guidance has been taken on board.

Designing for Multiple Developments

1.11 As larger numbers of wind energy developments are built, it is increasingly necessary to consider their cumulative effects. Without an agreed strategy or thresholds of acceptable change for a particular landscape or area it is difficult for developers and decision makers to determine acceptable limits to development. A landscape strategy may help indicate how much development might be accommodated in a landscape. However, in the absence of thresholds or landscape strategies the guidance below can assist in minimising cumulative effects.

- When designing a wind energy development it is important to consider how the scheme fits with other existing, consented and proposed schemes (including within neighbouring planning authority areas) to minimise cumulative impacts.
- If wind energy development already exists in a particular type of landscape, further wind energy development should continue this pattern of development (e.g. small clusters on hill tops, or single turbines associated with buildings), as long as the existing development is considered appropriate in the context of landscape character.
- Ensure multiple developments do not obscure distinctive landforms and are in scale with landform.
- If two or more wind energy developments are clearly visible in the same view and appear in the same type of landscape they should appear of similar scale and design (including the proportion of rotor diameter to tower height), unless the existing design is considered inappropriate – the closer they are to each other the more important this is.
- Ensure any wind energy scheme, or extension to an existing scheme, takes account of landscape sensitivity as well as any landscape strategies for wind energy development that may be available.
- As multiple wind energy developments are built they may 'compete' with the landscape's original foci – aim to maintain a hierarchy of focal points so that the original foci can still be appreciated in the landscape.

- Consider views from settlements when designing multiple wind energy developments – avoid 'surrounding' a settlement with wind turbines.
- Individual wind energy developments should generally appear visually separate from each other unless specifically designed to create the appearance of a single combined wind farm.
- When designing wind farm extensions it will be important that scale of turbines (including the proportion of rotor diameter to tower height) and rotation speeds are compatible.