Appendix 1.1

Descriptions of Renewable Energy Technologies and sources of further guidance

Wind Energy

Description of technology

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.

Wind power uses energy from the wind to turn a rotor connected to an electrical generator. The main visible components of a wind turbine consist of a tower, nacelle and rotor blade system. There are two main types of turbine – horizontal axis and vertical axis. The vast majority of machines are currently designed using a horizontal axis three-blade rotor system mounted on a steel mast. The rotor converts a portion of the power in wind into rotational motion, which is then converted into electricity by a generator located in the nacelle.

There are no rigid categories to describe the scale of individual wind turbines. Most large commercial onshore wind turbines are currently being produced in the 1-3MW range. Most such developments are connected to the national grid. 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.

Wind turbines operate between a range of wind speeds defined by the 'cut-in', 'rated' and 'cut-out' wind speeds, which are specific to the turbine model. Below a certain wind speed, (the cut-in speed) there is insufficient energy in the wind for the turbine to generate electricity. The amount of energy that turbines generate will depend primarily on wind speed but will be limited by the maximum output (kW) of the individual turbine. As the turbine will not operate below the cut-in wind speed or above the cut-out wind speed, the blades will be periodically stationary.

Swinford Wind Farm, Leicestershire (11x12.5MW turbines)

Further Guidance

Natural England's 'Making Space for Renewable Energy'. (2020). This guidance is to assist Natural England's staff to deliver a consistent and clear approach to the

discharge of its statutory responsibilities in relation to the deployment of on-shore wind energy development. It can be downloaded from: http://naturalengland.etraderstores.com/NaturalEnglandShop/NE254

Small Scale Non-commercial Wind

As defined in the DECC methodology, small scale wind is a sub-category of onshore wind which refers to turbines which have a capacity of less than 100 kW. Small scale wind energy developments have different characteristics to large scale developments which is reflected in the assessment parameters and the values set out in the DECC methodology. Small scale ground-based turbines, by their nature have lower hub/tip heights of about 15m agl and are viable at lower wind speeds (4.5 m/s at 10m agl). They are usually installed on-site and supply the on-site demand first before feeding the excess to the grid. The DECC methodology states that as they tend to be located in or next to built-up areas, their potential is a function of the number of buildings or sites available, rather than the density of turbines that could be installed (as in the case of the commercial scale wind energy assessment).

Proven 11 - 6kW turbine [Source: www.provenenergy.co.uk]

Biomass

Biomass can be generally defined as material of recent biological origin, derived from plant or animal matter. Biomass is widely used in many countries as a feedstock for modern heating systems. 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 plant or combined heat and power (CHP) plant due to the low carbon emissions associated with its use.

The DECC methodology considers four main types of biomass resource:

- managed woodland
- dedicated energy crops
- industrial woody waste
- agricultural arisings (straw)

There are three main conversion processes that are currently used to convert biomass into energy:

(1) direct combustion of solid biomass

(2) pyrolysis and gasification of solid biomass

(3) anaerobic digestion of solid or liquid biomass

For the purpose of the resource assessment, the DECC methodology considers that direct combustion is the most viable conversion process and therefore this is used as the basis for calculating the potential for installed capacity.

The energy output from biomass can be in the form of electricity or heat. Both options are therefore included in the assessments as appropriate.

NB: the DECC methodology does not take account of imported sources of biomass - ie from outside the East Midlands.

Biomass – Managed Woodland

The Forestry Commission England's woodfuel target aims to deliver 2 million fresh tonnes of wood fuel by 2020 (equivalent to approximately 1 million oven dry tonnes). Woodfuel from managed woodland is used to generate:

- heat only in biomass boilers;
- electricity only in dedicated biomass power stations, or combusted with other fuels in co-firing power stations; or
- both heat and electricity in combined heat and power systems.

Direct combustion, rather than pyrolysis or gasification, is currently the most viable conversion technology. This is the case at the region's current biomass combined heat and power plant at Slough (35 MWe / 20 MWth, photo below right).

Left: Heat-only biomass boiler at Chilterns Burial site. Right: Biomass combined heat and power station at Slough

Biomass from Energy Crops

Energy crops is the collective name for crops produced specifically for their fuel value. This includes short rotation coppice (SRC), miscanthus, straw, wheat, potatoes, sugar beet and biogenous fuels (biodiesel from oil seeds such as oilseed rape, methanol from cereals). The most common forms of energy crops used are short rotation coppice willow and poplar (SRC) which are coppiced every 2-4 years and miscanthus and other energy grasses (e.g. such as reed grass and switchgrass) which are cut annually.

Miscanthus field

Biomass from Waste Wood

Waste wood can arise from a variety of rural and urban industrial sources, such as offcuts from sawmills or construction & demolition sector waste.

Woodfuel from such waste sources can be used for energy in the same ways as woodfuel from managed woodland.

Biomass Agricultural Arisings

Agricultural arisings such as straw can form a further woody energy source. It is known that straw is currently fired on a small scale for on-site heat in an unquantifiable number of farm sites. However in line with the DECC methodology the assessment for this study assumes that at a commercial level, this fuel would be used for electricity.

Straw bale combustion boiler providing heat to local buildings

Biomass – Poultry Litter

The combustion of poultry bedding and manure for (usually) medium to large scale electricity-only generation has been established in East Anglia for about 15 years. Three plants already account between them for a high proportion of litter collected

from English poultry farms. However, smaller scale and more remote farms might become involved as the value of renewable electricity and heat rises. Future changes to farming practices such as moving away from battery cages to barn/free-range may decrease the availability and quantity of this fuel.

Architect's image of existing chicken litter power plant in Eye, north Suffolk.

Biogas – Wet Organic Waste

Wet organic waste refers to the digestion of livestock and food wastes under anaerobic conditions to produce biogas, a methane-rich energy source that may be fired in turbines to produce electricity. In most cases the co-generated heat is re-consumed by the biodigestor itself, to maintain the correct bacterial temperatures.

There are currently very few sites in the UK using farm manure or commercial/household food waste (as opposed to using feedstocks at sewage works or landfill sites) for this purpose, but their number is slowly increasing. Continental examples show that the coincidence of economic, geographical and institutional factors can be conducive to local success, while the mixing of both types of feedstock source can help to provide the necessary uniformity of composition required.

Biodigestor in Austria. Right: the attached power plant.

Further Guidance

Further guidance on how to comply with environmental legislation relating to biomass and energy from waste schemes is provided by netregs. This service is due to be transferred to the Business Link service from March 2011. See http://www.netregs.gov.uk/netregs/help/124894.aspx.

Some of the waste streams for biomass can be contaminated, and so a number of permits and licences can be required so developers are advised to consult with the Environment Agency early in the project development processs. Examples of permits/ plans that may be required include:

- Site Waste Management Plans: Any construction project in England costing over £300k needs a Site Waste Management Plan (SWMP). This covers and new build, maintenance and alteration or installation/removal of services. http://www.environment-agency.gov.uk/business/sectors/32729.aspx

- Biomass- Where any waste material is being used as fuel source, a permit is likely to be required under the Environmental Permitting Regulations. This will cover combustion processes, including the burning of biogas and operation of CHP plant. The type of permit usually depends on the size and output of the facility. Shredding and production of waste derived fuels can also be regulated, as is subsequent disposal of any residual materials such as by landspreading is also regulated. Teh Environment Agencies overview on biowastes is provided at the following link: http://www.environment-agency.gov.uk/business/topics/waste/105375.aspx

- The treatment of wet organic wastes, Municipal Solid Waste (MSW) and Commercial and Industrial (C&I) wastes, combustion of landfill and sewage gases and associated energy recovery are all likely to fall under the Environmental Permitting Regulations. Some wastes will be classified as hazardous and be subject to special controls over the movement and disposal. The main gateway to the waste regime is on the EA website at http://www.environment-agency.gov.uk/business/topics/waste/default.aspx

- Acting as a waste carrier or broker requires registration with us. International waste movements are also tightly regulated. There is information on the EA website

- Waste that it is often unsorted and can oftn be contaminated with other materials. For example waste wood can contain pesticides, nails or lead-based paint. The operator is responsible for ensuring that any wastes used to produce renewable energy are fit for this purpose and should specify and reject any material that is unsuitable. The Duty of Care applies to anyone who produces or holds waste. See http://www.environment-agency.gov.uk/business/topics/waste/40047.aspx

As these regimes are complicated, the Environment Agency advises that developers should seek appropriate specialist legal or technical advice. The Environmental Services Association (ESA) and Chartered Institution of Wastes Management (CIWM) are waste industry bodies who can also be contacted for advice.

Municipal Solid Waste

Municipal solid waste (MSW) is that which 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'.

Portsmouth Energy from Waste Plant

Commercial and Industrial 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 of commercial and industrial (C&I) waste 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

Methane-rich gas from landfill sites has been commercially exploited in the region since the early 1990s. These are almost all using 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.

This has been one of the East Midlands most significant renewable technology for the past twenty years. However, due to the average age and existing energy exploitation profile of landfill sites in this region, and the effects of landfill legislation, the resource is not thought to be a contributor in the medium to long term.

Trumps Farm landfill/energy site near Virginia Water

Sewage Gas

In a similar way to landfill gas, sewage gas is naturally created through anaerobic digestion where these conditions occur. It is often systematised by the waste water treatment companies to provide biogas for electricity to help power the sewage plant itself.

Small Farm sewage/energy site

Hydropower

Hydropower is the use of water flowing from a higher to a lower level to drive a turbine connected to an electrical generator, with the energy generated proportional to the volume of water and vertical drop or head.

Small scale hydropower plants in the UK generally refer to sites generating up to a few hundred kilowatts where electricity is fed directly to the National Grid. Plants at the smaller end of this scale (typically below 100 kW) are often referred to as micro-hydro and may include schemes providing power to a single home.

The majority of suitable locations in the East Midlands are likely to be for 'run of river' schemes, where a proportion of a river's flow is taken from behind a low weir and returned to the same watercourse downstream after passing through the turbine.

Osbaston 150kW hydropower scheme and fish pass on the River Monnow in Monmouthshire, opened 2009. [Source: www.aberdareonline.co.uk]

Further guidance

Environment Agency Hydropower Good Practice Guidelines - http://publications.environment-agency.gov.uk/pdf/GEHO0310BSCT-E-E.pdf

Environment Agency Community Hydropower Guide - http://publications.environment-agency.gov.uk/pdf/GEHO1010BTDN-E-E.pdf

Solar Energy

Solar energy generation involves the use of the sun's energy to provide hot water or electricity. **Solar Photovoltaic (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. PV is particularly suited to buildings that use electricity during the day such as offices, schools, and shops.

Solar photovoltaic (PV) cells can either be roof mounted or free-standing in modular form, 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. PV cells may also be attached directly to the appliances they power, such as lights or parking meters. The most common form of device comprises a number of semiconductor cells which are interconnected to form a solar panel or module. There is considerable variation in appearance, but all solar panels are dark in colour, and have low reflective properties.

Retrofit solar PV panels and Building-integrated solar PV tiles [Source: www.cse.org.uk]

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. The technology may also be referred to as solar thermal or solar water 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.

Solar thermal energy represents the most easily installed and potentially cheapest renewable energy application for domestic buildings. For non-domestic buildings, it is only appropriate if they have a high hot water demand, such as swimming pools, hotels and some industrial buildings. Solar thermal collectors work in conjunction with a hot water tank located within the building, which stores hot water and has an independent heating source such as a boiler or immersion heater to supplement the solar thermal system.

Solar thermal panel (evacuated tube system) [Source: www.cse.org.uk]

Appendix 2.1

Planning and Energy Policy Context

INTRODUCTION

Appendix 2.1 sets the context for the East Midlands renewable energy study by summarising the current and emerging planning and energy policy in England.

PLANNING POLICY

National planning policy

The Coalition Government has announced a programme of radical reforms to the planning system as part of its agenda for devolving greater powers to councils and neighbourhoods. The approach to reforming the planning system is set out in the ***Open Source Planning* Green Paper**[1], which sets out a wide range of proposals for a new 'open source' planning system. Central to these reforms is a 'simple and consolidated national planning framework, which will set out national and economic and environmental priorities, and how the planning system will deliver them'. The **Decentralisation and Localism Bill**[2,3], laid before Parliament in December 2010, begins to implement this new framework, confirming abolition of regional strategies, creating a duty to cooperate on local planning authorities, requiring local authorities to allocate a proportion of the Community Infrastructure Levy to the neighbourhood from which it was raised, establishing of neighbourhood development orders and plans, making pre-application consultation for larger developments compulsory, and transferring the responsibilities of the Infrastructure Planning Commission to the Secretary of State.

The implications of the new national planning framework on specific areas of planning policy, including renewable and low carbon energy, are currently unknown. In the meantime, current national policy and guidance set out in planning policy statements (PPS) and planning policy guidance (PPG) will continue to apply, and will be a material consideration when determining planning applications for renewable and low carbon energy developments.

Planning Policy Statement 22: Renewable Energy (PPS22) and its Companion Guide, both published in 2004 (ODPM), set out the Government's national policies and key principles for planning for renewable energy in England. It states that increased development of renewable energy resources is vital in facilitating the delivery of the Government's commitments on both climate change and renewable energy. The **Supplement to PPS1: Planning and Climate Change** (ODPM, 2007) also states that local planning authorities should provide a framework that promotes and encourages renewable and low carbon energy generation.

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[1] http://www.conservatives.com/~/media/Files/Green%20Papers/planning-green-paper.ashx

[2] Decentralisation and the Localism Bill: an essential guide, HM Government, December 2010, available from www.communities.gov.uk/decentralisationguide.

[3] Localism Bill Explanatory Notes, HM Government, December 2010, available from http://www.publications.parliament.uk/pa/cm201011/cmbills/126/en/2011126en.htm

In March 2010, the former Government commenced consultation on a revised **draft PPS: Planning for a Low Carbon Future in a Changing Climate**, which was intended to replace the PPS1 supplement and PPS22. The emphasis of this draft statement was that planning should actively support and help drive the delivery of renewables and low carbon energy, and placed particular importance on the role of regional strategies in setting ambitious targets for renewable energy and a clear strategy to support their delivery. It also stated that targets should be based on an assessment of the region's renewable energy resource, following guidance on assessing potential for renewables in the English regions published by the Department of Energy and Climate Change (DECC). In the light of the change in Government, the future of this revised PPS is still uncertain but is likely to be changed.

Between November 2009 and February 2010, the previous Government consulted on the six draft **Energy National Policy Statements** (NPSs). Having considered the responses to consultation and the Parliamentary scrutiny process the Government has made changes to the draft Energy NPSs and is re-consulting on the revised drafts until 24 January 2011. The Government intends to finalise and formally approve the energy National Policy Statements in Spring 2011. These National Policy Statements will then be used by ministers and the Major Infrastructure Planning Unit to be set up within the Planning Inspectorate when decisions are made on applications for development consent for nationally significant energy infrastructure.[4,5] The revised draft NPS on renewable energy infrastructure (EN-3)[6] covers any energy infrastructure for biomass and/or waste generating above 50 MW, any offshore wind farm generating above 100MW, and any onshore wind farm generating more than 50MW. This NPS does not cover other types of renewable energy generation, such as schemes that generate electricity from tidal or wave power.

Regional planning policy

In June 2010, the Coalition Government announced the **revocation of Regional Spatial Strategies** (RSS) with immediate effect. New ways for local planning authorities to address strategic planning and infrastructure are being introduced in the Decentralisation and Localism Bill (see above). It should be noted that in a letter to chief planning officers (dated 6th June 2010) the Secretary of State stated the following with regards to regional policies on renewable and low carbon energy:

'Through their local plans, authorities should contribute to the move to a low carbon economy, cut greenhouse gas emissions, help secure more renewable and low carbon energy to meet national targets, and to adapt to the impacts arising from climate change. In

[4] http://www.communities.gov.uk/documents/planningandbuilding/pdf/1803122.pdf
[5] http://www.decc.gov.uk/en/content/cms/news/en_statement/en_statement.aspx
[6] https://www.energynpsconsultation.decc.gov.uk/energy/renewable

doing so, planning authorities may find it useful to draw on data that was collected by the Regional Local Authority Leaders' Boards (which will be made available) and more recent work, including assessments of the potential for renewable and low carbon energy.'

The judgement of a recent court case brought by Cala Homes against the Secretary of State's decision to revoke RSS, quashed the revocation order. A subsequent The High Court ruling eventually ruled that the Government's intention to revoke RSS in the Localism Bill could be used as a material consideration - but this has been appealed by Cala with a further hearing set for early May 2011. Even if the appeal supports the Government's position, the weight that can be reasonably given to the intention to revoke may be limited without clear evidence to suggest a given RSS policy upon which a decision relies is no longer sound.

Policy 40 of the **East Midlands Regional Plan**[7] (Government Office for the East Midlands, March 2009) set out regional priorities for low carbon energy generation, including:

- A regional target of 1,120 MWe from CHP/district heating by 2020.
- Support for development of a distributed energy network using low carbon resources.
- Support for low carbon energy proposals in locations where environmental, economic and social impacts can be addressed satisfactorily.
- Lists of key considerations for Local Planning Authorities when establishing criteria for a) onshore wind energy, and b) other forms of renewable energy.

Despite the case brought by Cala Homes, it is still the government's intention to abolish RSS, and CLG's Chief Planning Officer wrote to local planning authorities setting out the clause in the draft Decentralisation and Localism Bill that covered the abolition of RSS[8]. The Bill itself confirms this intention but will not become law until the Bill receives Royal Assent.

With the intended abolition of RSS and the introduction of the 'localism' agenda by the new Government, it will fall to Local Planning Authorities, in cooperation with each other, to determine the contribution that they can make towards the challenging national targets.

Concluding comments on the planning policy environment

It is hard to judge the implications of the Government's proposed planning reforms until they begin to be reflected in local and neighbourhood plans. In the absence of regional policy setting out renewable energy capacity targets, greater emphasis is

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[7] http://webarchive.nationalarchives.gov.uk/20100528142817/http://www.gos.gov.uk/497296/docs/229865/East_Midlands_Regional_Plan2.pdf

[8] http://www.communities.gov.uk/publications/planningandbuilding/letterabolitionregional

likely to be placed on the need for local authorities to encourage the development of renewable and low carbon energy through local policies, supported by guidance in the proposed national planning framework (see above).

ENERGY POLICY

Policy on renewable and low carbon energy capacity is changing rapidly to take into account emerging technologies and targets at the national and global level. During the five-years from the end of 2004 through 2009, worldwide renewable energy capacity grew at annual rates of 10–60% for many technologies. For wind power and many other renewable technologies, growth accelerated in 2009 relative to the previous four years.[9] Currently, UK energy policy is in a state of flux until the new Government's position emerges fully. The recent **Comprehensive Spending Review**[10] (discussed in more detail below) confirmed the Coalition Government's commitment to investing in this area and to pressing ahead with the UK's competitive advantage in the green economy. DECC is the only department that will see its Capital Budget rise over the spend Review Period; a 59% increase is planned by 2014-2015.

National energy policy

The UK's current policy stance is to dramatically increase its use of renewable energy (including renewable electricity generation, renewable heat and renewable energy/fuels for transport). Underpinned by an EU-wide commitment to increase the use of renewable energy, the UK has committed to sourcing 15% of its energy from renewable sources by 2020.

The threat of dangerous climate change means there is an urgent need to reduce UK emissions of carbon dioxide and other greenhouse gases. The **Climate Change Act** [11](HM Government, November 2008) set a target for the UK to reduce its greenhouse gas emissions by 80% below 1990 levels by 2050 and 26% by 2020 and set up a system of five year carbon budgets. Renewables will help the UK to recover some of its energy self-sufficiency, while ensuring that more imported energy comes from reliable sources. Globally, there is an ongoing transition to a new, low-carbon future, and the UK can make the most of economic opportunities in this sector by getting ahead on the renewables agenda as quickly as possible.

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[9] REN21 Global Status Report
http://www.ren21.net/globalstatusreport/REN21_GSR_2010_full.pdf
[10] http://www.hm-treasury.gov.uk/spend_index.htm
[11] http://www.legislation.gov.uk/ukpga/2008/27/contents

Current Strategy

The current **UK Renewable Energy Strategy**[12] (HM Government, 2009) was put in place by the former Government to help tackle climate change, by reducing the UK's emission of carbon dioxide by over 750 million tonnes between now and 2030. It also promotes the security of the national energy supply by reducing overall fossil fuel demand by around 10% and gas imports by 20-30% against what they would have been in 2020. The strategy also has the aim of creating up to half a million more jobs in the UK renewable energy sector resulting from around £100 billion of new investment. Alongside energy saving, nuclear and carbon capture and storage, the strategy is a key element of an overall transition plan for the UK to achieve a low-carbon, sustainable future that helps address climate change.

New Government's Review of Priorities

The 2010 Spending Review revealed some the new Government's own plans on renewables and the low carbon agenda. Although the Renewable Energy Strategy is still in place, the Spending Review plus the Business Plan for DECC published in November 2010 set out the latest Government thinking and proposed action on the topic with reform priorities set out in Figure Error! **No text of specified style in document..1** below:

Figure **Error! No text of specified style in document.**.1: Compulsory Spending Review highlights

Structural Reform Priorities

- **Save energy with the Green Deal and support vulnerable consumers.**
  Reduce energy use by households, businesses and the public sector, and help to protect the fuel poor
- **Deliver secure energy on the way to a low carbon energy future.**
  Reform the energy market to ensure that the UK has a diverse, safe, secure and affordable energy system and incentivise low carbon investment and deployment
- **Drive ambitious action on climate change at home and abroad.**
  Work for international action to tackle climate change, and work with other government departments to ensure that we meet UK carbon budgets efficiently and effectively
- **Manage our energy legacy responsibly and cost-effectively**
  Ensure public safety and value for money in the way we manage our nuclear, coal and other energy liabilities

Source: DECC Business Plan 2011-2015

The new Government remains committed to obtaining 15% of energy from renewables by 2020, including by introduction of the Renewable Heat Incentive; allowing communities to keep additional business rates earned by hosting renewable energy projects (completed Nov 2010); and review of Feed in Tariffs and levels of

12 http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/res/res.aspx

support for different technologies under the Renewables Obligation. The aim is for a 34% reduction in greenhouse gas emissions by 2020 compared to 1990 levels.

As a result of the Spending Review, DECC will no longer fund technologies unless it is confident that they are the most critical to meeting long-term de-carbonisation and energy security objectives. Nor will it contribute to funding the establishment of the National Nuclear Centre of Excellence or provide the same scale of funding to deal with the overseas nuclear legacy once current commitments are met. The Government's key needs for technical advice and related support on nuclear non-proliferation issues will instead be met by new cross-government arrangements that were announced in the Strategic Defence and Security Review. There will be an end to voluntary contributions to international energy and climate organisations, instead contribution to international low carbon technology efforts will be channelled through the Official Development Assistance Budget. There will also no longer be funding for any of the economic development activities previously funded by the Regional Development Agencies.[13]

The Green Deal

The Green Deal is the Coalition Government's initiative to support the implementation of energy efficiency measures to households and businesses without needing to meet any upfront costs. The programme will be backed with a totally new finance mechanism designed around the needs of people and business. As noted above The Green Deal is a key priority of the Government's.

The Queen's Speech in May 2010 set out a provisional timetable to put in place the legal framework needed for Green Deal. The framework will be a key element of the Energy Bill due to be implemented in the first session of this parliament. It is anticipated that the Green Deal will be launched in Autumn 2012.

Renewable Heat Incentive

The Government announced the terms of the Renewable Heat Incentive (RHI) on 10 March 201114. This fulfils a commitment by the previous Administration made in February 2010 to support renewable heat generation.

The objective of the RHI is to encourage an increase in the uptake of renewable heat technologies from the current 1.5% of total heat demand to 12% by 2020. The RHI will operate in England, Scotland and Wales by stimulating uptake of renewable heat at the point of use through the payment of tariffs for every unit of useful heat that is

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[13] DECC Business Plan 2011-2015 http://www.decc.gov.uk/assets/decc/About%20us/decc-business-plan-2011-2015.pdf

[14] DECC (2011). The Renewable Heat Incentive. March 2011. www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/policy/incentive/incentive.aspx

generated. These tariffs are expected to be available in two phases. The first phase is open to non-domestic users in the autumn of 2011 and the second phase will start for domestic users a year later to coincide with the proposed 'Green Deal' scheme supporting energy efficiency in homes. In the meantime, domestic users will be eligible for a RHI Premium Payment (effectively a grant to households for the purchase of renewable heating systems) in July 2011.

The tariffs will be paid on the basis of the metred generation of useful heat in hot water or steam measured as kilowatt hours (kWh). DECC is considered the practicality of metering heat transmitted through air, potentially allowing tariffs to be paid on this in 2012. The tariffs will be paid for 20 years and will be degressive (i.e. falling as the costs relative to mainstream alternative technologies fall).

Funding of £860 million for the Initiative comes from Government spending (not electricity consumers as is the case for Feed In Tariffs or FITs). Like FITs and the Renewables Obligation, which are the Government's other principal programmes for supporting the renewable sector, the RHI will be administered by Ofgem's E-Serve division.

Summary of tariffs available through Phase 1 of the RHI

Eligible technology	**Tariff name**	**Eligible sizes**	Tariff rate (pence/kWh)	**Support calculation**
Solid biomass; Municipal Solid Waste (incl. CHP)	Small biomass	Less than 200 kWth	Tier 1: 7.6 Tier 2: 1.9	Metering. Tier 1 applies annually up to the Tier Break, Tier 2 above the Tier Break. The Tier Break is: installed capacity x 1,314 peak load hours, i.e.: kWth x 1,314
	Medium biomass	200 kWth and above; less than 1,000 kWth	Tier 1: 4.7 Tier 2: 1.9	
	Large biomass	1,000 kWth and above	2.6	Metering
Ground-source heat pumps; Water-source heat pumps; deep geothermal	Small ground source	Less than 100 kWth	4.3	Metering
	Large ground source	100 kWth and above	3	
Solar thermal	Solar thermal	Less than 200 kWth	8.5	Metering
Biomethane injection and biogas combustion, except from landfill gas	Biomethane	Biomethane all scales, biogas combustion less than 200 kWth	6.5	Metering

Feed-in Tariffs

Feed-in-Tariffs (FITs) are a financial incentive introduced in April 2010 for renewable generators with an installed capacity below 5 MW. They have been developed by to encourage individuals and businesses in the UK to generate renewable energy by guaranteeing generators a long term fixed price for the renewable energy they produce. This will help the UK reach its 2020 target of generating 15% of the UK's energy from renewable sources. They are particularly designed for 'first time' generators and consist of two tariffs: a Generation Tariff and an Export Tariff:

- **Generation Tariff** – a fixed rate that a generator will receive for every kilowatt of renewable energy generated regardless of where the energy is used. To measure the generation there must be an Ofgem approved total generation meter connected to the installation.

- **Export Tariff** – a fixed rate for the surplus amount of energy which is sent back to the electricity grid. This is measured by an export meter onsite and will initially be estimated for smaller installations. Generators receive the export tariff in addition to the generation tariff.

The Spending Review guaranteed improvement of efficiency of Feed-In Tariffs, rebalancing them in favour of more cost effective carbon abatement technologies. The DECC Business Plan revealed that the Department will undertake the first major review of Feed-in Tariffs for small-scale renewable energy, consult and implement changes over the Spending Review period (now until 2014/15) to save up to £40 million.

Offshore wind industry

The Spending Review also confirmed an investment of over £200 m for the development of technologies including offshore wind technology and manufacturing at port sites. The Prime Minister's recent speech to the Confederation of British Industry highlighted that the potential for Britain to lead in this industry is immense on the basis of having the natural asset (the wind) combined with first-class research capability and a wealth of experience across the aerospace, engineering and energy sectors. He promised to help secure private sector investment in this technology by providing up to £60 million to meet the needs of offshore wind infrastructure at UK ports. To help move things forward, the Crown Estate will also work with interested ports and manufacturers to realise the potential of their sites. This move will help to secure energy supplies, and could create up to 70,000 jobs (according to the Carbon Trust).

Green Investment Bank and Overseas

The Spending Review also included a commitment to £1 billion of funding to capitalise a UK wide Green Investment Bank. Subject to a final design, this will aim to provide financial interventions to unlock significant new private investment in low carbon infrastructure projects. Government ministers have said they want to 'create an enduring institution which can re-invest the proceeds from its investments' and expect the GIB to support risk that the market currently cannot afford. However, critics such as the Aldersgate Group have stated that the GIB would need up to £6 billion to realise its aspirations. It is the Government's intentions to complete its design and testing on the GIB proposals by Spring 2011.

Spending on overseas development assistance (ODA) was also protected, providing £2.9 billion of international climate finance to help developing countries.

Carbon Capture and Storage

On carbon capture and storage, the Spending Review revealed that there will be up to £1 billion of investment to create one of the world's first commercial scale carbon capture and storage (CCS) demonstration plants and there is an additional commitment to providing public funding for four CCS demonstration plants in coming years.

Carbon Reduction

The **CRC Energy Efficiency Scheme** (formerly known as the Carbon Reduction Commitment) will be maintained but reformed with the first allowance sales for 2011-12 emissions now taking place in 2012 rather than 2011. The CRC is a mandatory energy efficiency scheme aimed at improving energy efficiency and cutting emissions in large public and private sector organisations which together are responsible for around 10% of the UK's emissions. The scheme is designed to tackle CO_2 emissions not already covered by Climate Change Agreements (CCAs) and the EU Emissions Trading Scheme. Following the Spending Review, revenues from allowance sales in the scheme, totalling £1 billion a year by 2014-15 will be used to support the public finances, including spending on the environment, rather than recycled to participants.

Energy Legacy

The legacy of UK energy will be managed responsibly in a way that protects public safety. The Department will continue to manage capital funding for the Nuclear Decommissioning Authority (NDA) and spending on the highest hazards at sites such as Sellafield are protected.

Emerging legislation and policy

An **Energy Bill**[15] is currently passing through parliament and has been designed to provide for a step change in the provision of energy efficiency measures to homes and businesses (the Green Deal). It also seeks to enable investment in low carbon electricity generation including by implementation of the offshore electricity transmission regime beyond 2010 to ensure that wind farms can connect to the grid and giving investors in new nuclear increased certainty over their obligations., Further measures include those to improve energy security and to give companies improved access to upstream oil and gas infrastructure.

The Government is currently consulting on changes to measures to address fuel poverty to ensure that the help is better targeted at those in fuel poverty or most vulnerable to it.[16]

In addition, consultation on the reform of the climate change levy to provide support to the carbon price is planned for Spring 2011 with plans to publish on the consultation by November. The Government will decide whether to introduce a levy on electricity supplies for CCS or to fund future demonstrations from general public spending from this consultation.

There are also particular implications for local authorities and communities from the Coalition's commitment to maximising renewable energy generation. In August 2010 the ban on local authorities selling renewable energy generated from their own estates was overturned. According to a letter from Chris Huhne to all local authorities, they 'should assume their rightful place leading a local power revolution'[17]. This will open new sources of income including the full benefit of the feed in tariff and it is estimated could generate up to £100 m a year in income for local authorities across England and Wales.

More support is to be given to community ownership of renewable assets. The Coalition's Programme for Government[18] stated that it would '…encourage community-owned renewable energy schemes where local people benefit from the power produced. We will also allow communities that host renewable energy projects to keep the additional business rates they generate'. Further details of how this will operate in England are expected in the coming months.

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[15] http://services.parliament.uk/bills/2010-11/energyhl.html

[16] http://www.decc.gov.uk/en/content/cms/what_we_do/consumers/fuel_poverty/fuel_poverty.aspx

[17] http://www.decc.gov.uk/en/content/cms/news/pn10_89/pn10_89.aspx

[18] HM Government 2010 – The Coalition's Programme for Government.

Overall, there are still important national policy decisions being made in this area which will impact on local authorities' approaches to renewable energy. As far as possible this study takes account of emerging legislation.

Energy and carbon standards for new buildings

The previous Government stated an intention that all new homes would be zero carbon by 2016 and all non-domestic buildings by 2019, and the new Government has confirmed that national regulatory requirements will be progressively tightened to meet these requirements. They have confirmed that the national regulatory requirements will include a high level of energy efficiency, which has been incorporated into a revised Code for Sustainable Homes. The degree to which zero carbon can be achieved through on-site measures rather than offsite generation or carbon offsetting is currently under consideration with a decision expected later in 2011[19]. Building Regulations set out mandatory requirements for new buildings in England and Wales, including in relation to energy efficiency and carbon emissions. In its recent response to consultation on the future of Building Regulations[20] the Government has stated that it will take forward a programme looking at revisions to Part L (Conservation of fuel and power) delivering the next steps to zero carbon for homes and non-domestic buildings, and supporting wider policy for the retrofit of existing buildings.

Regional energy policy

Regional policy is in a similar state of flux as at the national level with the Government's move to scrap Regional Development Agencies and allocate Regional Growth Fund spending at Local Enterprise Partnership level; it is likely that there will be a greater emphasis on sub-regional developments.

The **East Midlands Regional Energy Strategy**[21] set out policies to support the overarching objectives of reducing the need for energy, using energy more efficiently, using energy from renewable sources, and making clean and efficient use of fossil fuels. Two subsequent studies published by EMRA in June 2006[22] presented a comprehensive assessment of the patterns of energy consumption and CO2 emissions across the East Midlands and highlighted the need for:

- Regional planning policies to reduce the need for energy.

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19 http://services.parliament.uk/hansard/Lords/ByDate/20101220/writtenministerialstatements/part011.html

20 Future changes to the Building Regulations – next steps, DCLG, December 2010.

21 http://www.gnpartnership.org.uk/wp-content/uploads/2009/04/east-midlands-regional-energy-strategy.pdf

22 'Determining Baseline Energy Consumption Data' and 'Regional Targets and Scenarios for Renewable Energy'

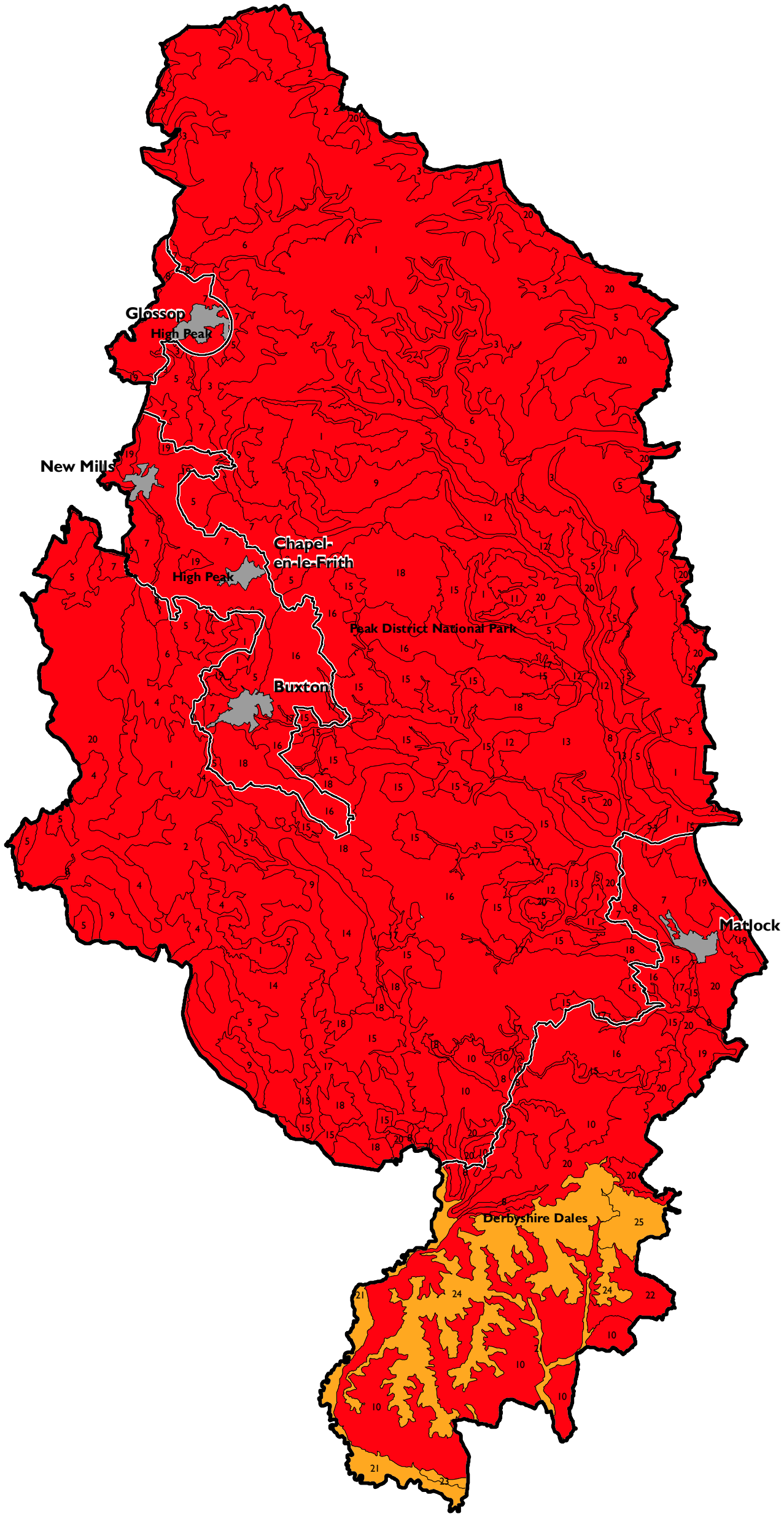
- A Significant increase in Combined Heat and Power capacity.
- Minimum regional targets for renewable energy generation, emphasising the role of micro-generation.
- Planning policies to enable a significant increase in renewable micro-generation, and to achieve the Government's ambitions for zero carbon development and regeneration.

Concluding comments on the energy policy environment

It is clear that the Coalition Government has carried forward previous commitments to support and increase renewable energy generation through both policy and fiscal measures. This is apparent from the fact that DECC was one of the few departments that escaped the recent funding cuts and received a substantial increase. As far as possible we have monitored policy developments at all spatial levels during the study to ensure that any key changes are taken into account in our analyses of renewable energy demand, capacity and viability.

Appendix 3.1

Peak Sub-regional Climate Change Study (2009) – Landscape Sensitivity Results



Peak Sub Region Climate Change Study

Figure 4.10: Landscape Sensitivity to Large Scale Wind Turbine Development

Source: LUC

Date: 05/02/2009
Revision: D

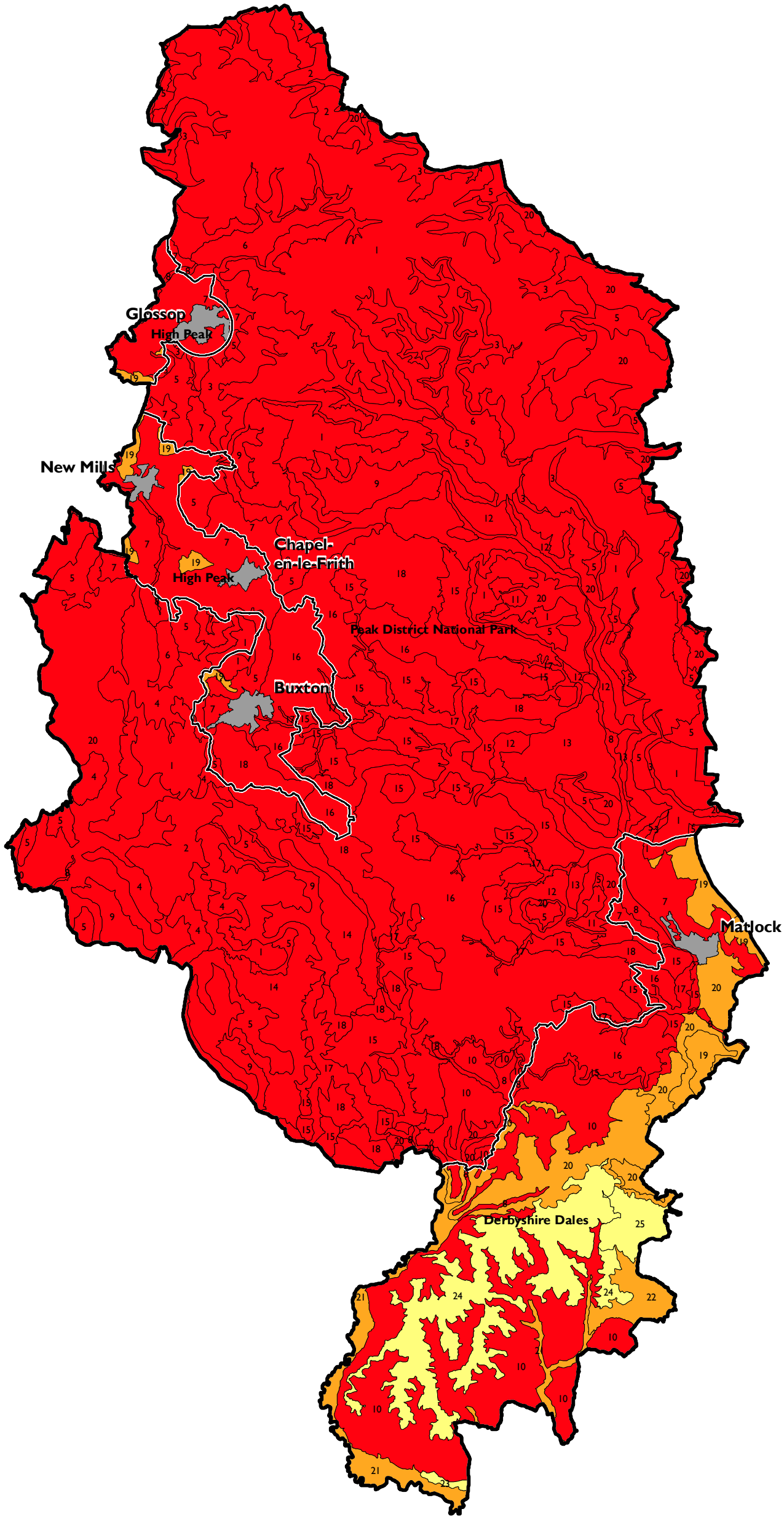
Key

- Peak Sub Region boundary
- Planning authority boundaries
- High
- Moderate-high
- Moderate
- Urban

0 5 10 Km

N W E S

File: S:\4400\4487_Peak_Sub_Region_Climate_Change_Study\GIS\Themes\ArcGIS9\4487-01_022_Large_Windturbine_Sens_9.2.mxd



Peak Sub Region Climate Change Study

Figure 4.12: Landscape Sensitivity to Medium Scale Wind Turbine Development

Source: LUC

Date: 03/04/2009
Revision: E

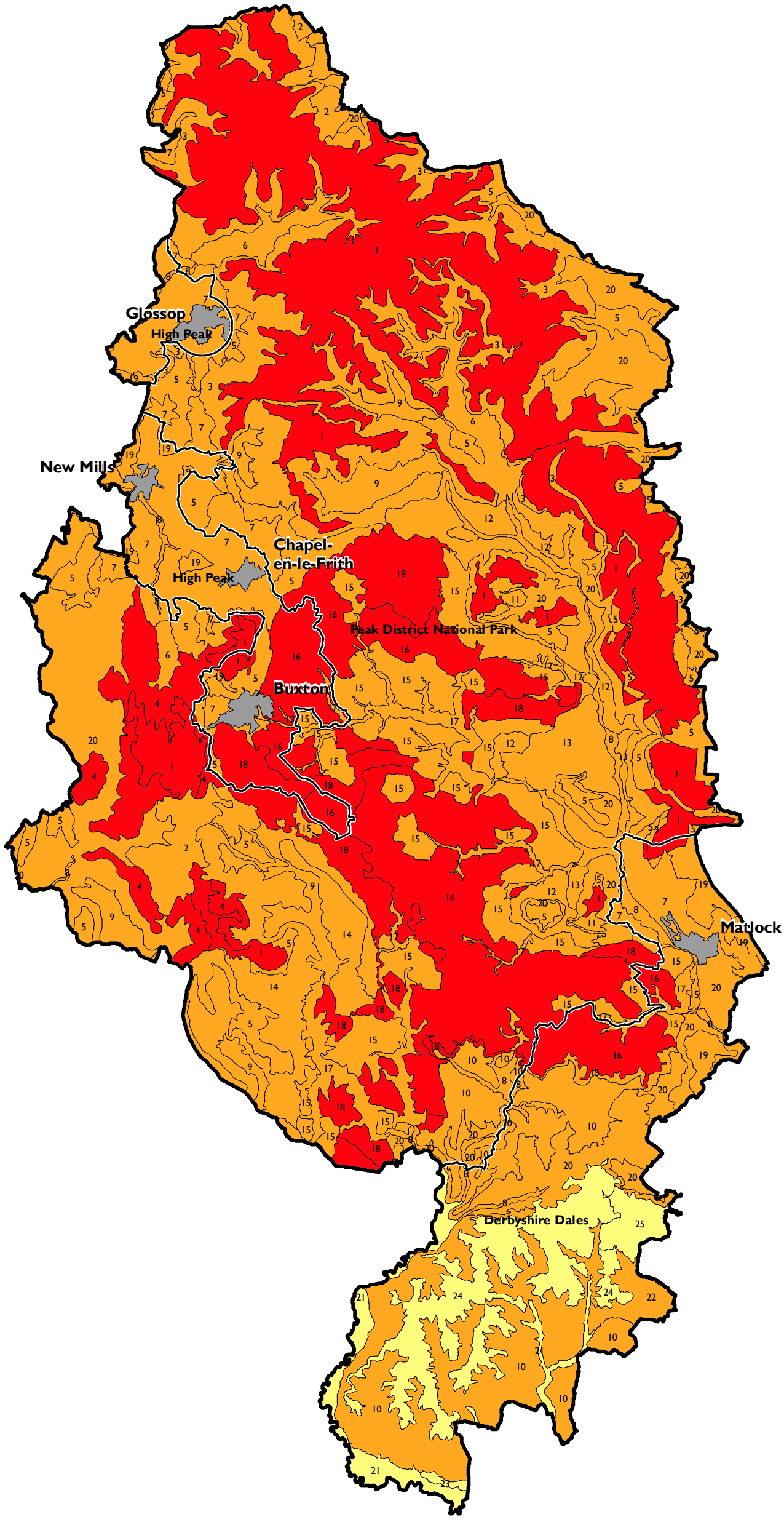
Key

- Peak Sub Region boundary
- Planning authority boundaries
- High
- Moderate-high
- Moderate
- Urban

0 5 10 Km

N W E S

File: S:\4400\4487_Peak_Sub_Region_Climate_Change_Study\GIS\Themes\ArcGIS9\4487-01_023_Medium_Windturbine_Sens_9.2.mxd



Peak Sub Region Climate Change Study

Figure 4.14: Landscape Sensitivity to Small Scale Wind Turbine Development

Source: LUC

Date: 05/02/2009
Revision: D

Key

- Peak Sub Region boundary
- Planning authority boundaries
- High
- Moderate-high
- Moderate
- Urban

0 5 10 Km

N W E S

File: S:\4400\4487_Peak_Sub_Region_Climate_Change_Study\GIS\Themes\ArcGIS9\4487-01_024_Small_Windturbine_Sens_9.2.mxd

Appendix 3.2

Assumptions used for Technical Renewable Energy Assessment

Table 1: Assumptions for commercial-scale wind

Parameters	DECC suggested data source	Data source EM Study	DECC suggested assumptions	East Midlands study assumptions	Justification for divergence from DECC
Wind Speed	NOABL	NOABL	Include area with wind speed 5 m/s at 45m above ground level (agl)	Include area with wind speed 5 m/s at 45m above ground level (agl)	No divergence
Wind turbine size	N/A	DECC suggested size for large-scale turbines Research into turbine dimensions for medium-scale Steering Group suggested height for small-scale turbine (in line with medium scale turbines for the Peak Sub-Region Study)	DECC methodology assumes a standard turbine size with specifications: 2.5MW, tip height 135m, rotor diameter 100m, hub height 85m	Considered three turbine sizes: • large- scale turbines (dimensions: tip height 135m, rotor diameter 100m, hub height 85m, 2.5MW) • medium-scale turbines (dimensions: tip height 90m, rotor diameter 60m, 1MW) • small-scale turbines (dimensions: tip height 65m, rotor diameter 43m, 0.5MW)	Steering Group agreed it would be useful to consider a range of turbine sizes as some smaller turbines may be appropriate within areas which are constrained for larger scale turbines.

Parameters	DECC suggested data source	Data source EM Study	DECC suggested assumptions	East Midlands study assumptions	Justification for divergence from DECC
Wind turbine Density	N/A	DECC methodology Discussions with Steering Group/Protected Landscape Officers RSPB/Natural England	Apply a distance between turbines of 5 rotor diameters or a benchmark of 9MW/km^2	*General assumption:* • Large: 4 turbines per km2 (500m between turbines) • Medium: 10 turbines per km2 (300m between turbines) • Small: 20 turbines per km2 (215m between turbines) *High Bird Sensitive Areas:* • 50% reduction of above *Medium Bird Sensitive Areas:* • 25% reduction of above *Protected Landscapes assumption:* • The findings of the Peak Sub-regional Climate Change Study (2009) have been used to identify the technical potential for commercial scale wind within the Peak District National Park (and for the Derbyshire Dales and High Peak districts as a whole). • In the absence of a more detailed sensitivity assessment for the Lincolnshire Wolds AONB it was assumed that there is zero capacity for wind within the AONB and within 2km of the AONB (i.e. zero turbines per km2). The same	Densities for small and medium turbines determined based on DECC suggested 5 rotor diameters between turbines. Protected Landscapes and sensitive areas approach agreed during discussions with Steering Group/Protected Landscape Officers. Natural England advised the use of RSPB/NE bird sensitivity mapping (Mapped and Written Guidance in Relation to Birds and Onshore Wind Energy Development in England, 2009 - http://www.rspb.org.uk/Images/EnglishSensitivityMap_tcm9-237359.pdf) to reduce the density of potential turbines within high and medium bird sensitive areas.

Parameters	DECC suggested data source	Data source EM Study	DECC suggested assumptions	East Midlands study assumptions	Justification for divergence from DECC
				assumption was applied to the area that falls within 2km of the Peak District National Park in North East Derbyshire.	
Non accessible areas	OS Strategi, MOD	OS Strategi for Roads, OS Meridian for railways and rivers/inland waters, CAA website and additional research for airports, MOD, MasterMap Address Layer 2 for settlements.	Exclude: Roads (A, B, motorways); Railways; Inland waters (rivers, canals, lakes, reservoirs); Airports; MOD training sites; Built up areas (settlement polygons).	- Roads (A, B, motorways) with an additional buffer based on carriage width to approximate the road footprint (used information from Highways Agency to convert road centrelines to polygons. Motorways 30m, wide, single carriageways 10m wide, double carriageways, 20m wide. Used own assumption to generate approximate polygons for railway widths (15m wide)) - Rivers, canals: with an additional buffer based on size of river to approximate footprint (used own assumption to generate approximate polygons for rivers (Large rivers 20m wide, medium rivers 15m wide, small rivers and canals 10m wide)) - Lakes, reservoirs: footprint from OS meridian data; - Airports: data from CAA and MOD; - MOD training areas; - Built up areas: see exclusion areas	The DECC methodology suggests OS linear datasets to be used for roads/rails/rivers/canals etc, but these have no footprint on the ground so cannot be excluded in their present form. We generated buffers relating to carriage width/river size to approximate the footprint of these features on the ground. Where possible, OS Meridian data was used instead of Strategi as it is mapped to 1:50 000 instead of 1:250 000. For built up areas, used the Address Layer 2 database to generate buffers around each property to enable a far more refined assessment to be undertaken – this is explained in the exclusion areas.

Parameters	DECC suggested data source	Data source EM Study	DECC suggested assumptions	East Midlands study assumptions	Justification for divergence from DECC
Exclusion areas	OS Strategi www.magic.gov.uk MOD	Natural England for Ancient woodland, English Heritage for historic interest sites, OS Strategi for Roads, OS Meridian for railways and rivers/inland waters, CAA, MasterMap Address Layer 2 for settlements. Consultation with NATS/NERL for Civil Air Traffic Control constraints. Consultation with MOD for training areas and safeguarded areas, National Grid	Exclude: - Ancient semi-natural woodland; - Sites of historic interest (with no buffer); - 150m buffer (tip height +10%) around roads and rail; - 600m buffer around OS Strategi settlement edges; - 5km buffer around airports; - Civil Air Traffic Control Constraints; - MOD training areas; - Explosive safeguarded areas, danger areas near ranges	- Exclude: - All ancient woodland (ancient semi-natural and PAWS) - National and international nature conservation designations - sites of historic interest - Scheduled Monuments, Registered Parks and Gardens, World Heritage Sites (plus buffers), Battlefields, Listed Buildings (including a small buffer around Listed Building point data to generate a footprint to be excluded) - 5km buffer around all airfields and airports (military and civilian) - Consulted with NATS/NERL to identify Civil Air Traffic Control constraints and it was reiterated that the safeguarding maps on their website are consultation zones, not 'show-stoppers' - Consult with MOD for guidance on MOD constraints and the following have been excluded: Explosive Safeguarding Areas and Danger Areas. - Buffer around rail and roads related to topple distance of small (75m), medium (100m) and large turbines (150m) - Buffers around settlement	Previous consultation with the Forestry Commission in the North West region indicated that the FC would object to any commercial-scale wind development within all types of ancient woodland – it was therefore suggested that this should be excluded. Natural England was consulted with regard to international and national nature conservation designations in the SE and NW regions. It was agreed that due to the size of these sites and the nature of their sensitivity, these sites should all be excluded from the potential resource. This was agreed for the East Midlands as well. Listed Buildings are mainly point data and therefore cannot be excluded in their current format. A buffer was applied based on the average size of listed buildings in the East Midlands to generate a footprint for exclusion. This buffer is not intended to approximate the setting of the listed building. This approach was developed with English Heritage for SE and NW studies.

Parameters	DECC suggested data source	Data source EM Study	DECC suggested assumptions	East Midlands study assumptions	Justification for divergence from DECC
				locations (based on a point location for each address) which varied according to type of address and turbine dimensions: Large and medium turbines - 600m for residential buildings, 200m for commercial/industrial buildings; - Small turbines – 500m for residential buildings and 200m for commercial/industrial properties - Buffer around National Grid overhead transmission lines equivalent to topple distances stated above. - Please note that the Steering Group considered issues arising from the potential for an area in Sherwood Forest to be designated a pSPA/SPA. On the advice of Natural England this area was not treated as an exclusion area in the assessment as it is not currently an pSPA or SPA and the study had to be based upon current mappable evidence. Natural England instead advised use of the published RSPB/NE Bird Sensitivity Mapping which covers some of the Sherwood Forest Area. This mapping data was used to reduce the density of potential turbines	It was requested that buffers for World Heritage Zones were also excluded. Topple distances were varied to match different turbine dimensions. OS Strategi urban area boundaries are generalized and it was felt that a better way of mapping this constraint was to generate buffers around address locations based on the type of address and the relative constraints related to noise for each address type and turbine size. The Steering Group requested that major overhead transmission lines (with a buffer) were excluded.

Parameters	DECC suggested data source	Data source EM Study	DECC suggested assumptions	East Midlands study assumptions	Justification for divergence from DECC
				within high and medium bird sensitive areas as set out under Turbine Density above.	
MOD constraints	Consultation with MOD	Consultation with MOD	Consult MOD to determine constraints associated with their sites/estates/Air Traffic Control/radar/safeguarded areas/danger areas and MOD bylaws	- Consultation with MOD: - GIS data were provided for training areas, explosive safeguarded areas, danger areas and these have been excluded. -	Data for Precision Approach Radar Zones were provided, but are not exclusion zones for wind, and were not excluded; Data for Byelaws were not available; Data for Low flying consultation zones and other radar considerations were available, but these are not fixed exclusion zones.

Table 2: Assumptions for small-scale wind (<6kW)

Parameters	DECC suggested data source	Data source proposed	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC
Address Points	OS Address Point	OS Mastemap Address Layer 2	Estimate total number of residential and non-residential buildings	Estimate the total number of residential properties as well as those which have potential for community schemes.	OS Address Point data is no longer the best available dataset and does not enable identification of properties suitable for community schemes. Note: The Steering Group discussed the exclusion of addresses within Conservation Areas, but comprehensive data were not available.
Wind Speed	NOABL	NOABL	Include area with wind speed 4.5 m/s at 10m above ground level (agl)	Include area with wind speed 4.5 m/s at 10m above ground level (agl)	No divergence
Wind turbine size	DECC methodology	DECC methodology	6kW per address point	6kW per address point	No divergence
Mean wind speed scaling factor	DEFRA Rural-Definition (ward level) Wind scaling factor: DECC methodology	DEFRA Rural-Definition (ward level) Wind scaling factor: DECC methodology	Include address points where scaled wind speed 4.5 m/s at 10m above ground level (agl). Assume scaling factor of 56% for urban, 67% for suburban, 100% for rural	Each suitable address point assigned a wind speed and a Lower Super Output Area type (LSOA) type, and wind speed scaled according to ward classification. Include address points where scaled wind speed 4.5 m/s at 10m above ground level (agl). Assume scaling factor of 56% for urban, 67% for suburban, 100% for rural.	- DECC method suggests use of DEFRA categories at ward level. Given the spatial scale of this study (District level), it was felt that LSOA would provide more detail. - DEFRA Rural-Definition dataset categorises LSOAs as: Urban >10k, Town and Fringe, and Village, hamlet and isolated dwellings.

Parameters	DECC suggested data source	Data source proposed	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC
					- To conform with the requirements of the DECC methodology, these were renamed: Urban, Semi-urban (this is felt to be a better description than suburban as listed in the DECC methodology), and Rural. - 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 (due to the scaling factor).

Table 3: Assumptions for plant biomass - managed woodland

Parameters	DECC suggested data source	Data source proposed	DECC suggested assumptions	Study Assumptions	Justification for divergence from DECC
Existing and potential feedstock	Option 1: FC Woodfuel Resource Tool	FC woodfuel resource tool and FC National Forest Inventory/National Inventory of Woodland and Trees (NIWT)	Use data from tool to estimate regional potential	Option1: Use regional data from FC woodfuel resource tool and disaggregate to Local Authority level based on the percentage split of woodland types as defined by the NIWT dataset. Subject to the same assumptions as the Forest Research tool.	The FC woodfuel resource tool gives figures at the regional level, not Local Authority. It is therefore necessary to refine the analysis for local level calculations. Option 1 is a top down assessment whereas Option 2 is a bottom up assessment.

Parameters	DECC suggested data source	Data source proposed	DECC suggested assumptions	Study Assumptions	Justification for divergence from DECC
	Option 2: Bring forward and increase the accuracy of National Forest Inventory woodfuel forecast	FC National Forest Inventory (NFI)/National Inventory of Woodland and Trees (NIWT)	Use NFI woodfuel forecast to estimate potential	NFI updates were not available. Use NIWT dataset to calculate the amount of woodland (by type and management) per Local Authority. 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 tones to oven dried tones. Different assumptions regarding woodland under different management (i.e. FC managed – assume constant production for woodfuel (8%), unmanaged and private woodland, assume 100% is potentially available.	
Fuel requirement – electricity odt/MW	DECC methodology	DECC methodology	6000odt/year = 1MW	6000odt/year = 1MW	No divergence
Fuel requirement – heat Odt/MW	Biomass Energy Centre	Biomass Energy Centre and consultation with FC	Low grade timber, and stemwood >14cm diameter and conifer stumps: 18 GJ/odt. Stemwood l<14cm	Option 1: Low grade timber, and stemwood >14cm diameter and conifer stumps: 18 GJ/odt. Stemwood l<14cm	Data were not available with information on stem size etc. for Option 2. An average needed to be applied. Discussions with the

Parameters	DECC suggested data source	Data source proposed	DECC suggested assumptions	Study Assumptions	Justification for divergence from DECC
			diameter, branches, tips and foliage: 12.5 GJ/odt. Plant conversion efficiency: 80%. Plant availability: 80%.	diameter, branches, tips and foliage: 12.5 GJ/odt. Option 2: 18GJ/odt. Plant conversion efficiency: 80%. Plant availability: 45%.	FC in the NW suggested 18GJ/odt would be a good approximation. Plant availability (capacity factor): 45% - Previous research has shown that the DECC methodology suggestion of 80% capacity factor is unrealistically high. (45% 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)
Exclusions of woodfuel potential	Forestry Commission statistics	Forestry Commission statistics and consultation with Forestry Commission	Apply exclusions based on: Woodfuel that is uneconomic to harvest Woodfuel that will or could go to alternative markets (such as paper, construction etc)	50% may be uneconomic to harvest (based mainly on accessibility issues). Breakdown between markets for wood will remain constant for FC managed woodland. Unmanaged woodland not subject to market competition.	No divergence, although the DECC methodology is not very specific in terms of constraints here and assumptions need to be applied. Note: It was initially proposed that the 50% reduction may need refinement, but further discussions with the FC have meant that this figure has been retained.

Table 4: Assumptions for plant biomass - energy crops

Parameters	DECC suggested data source	Data source proposed	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC (and who this needs to be agreed with)
Existing resource	National Non-Food crop centre; Natural England	Natural England Energy Crop Scheme GIS data	Use uptake data from Woodland Grant Scheme (SRC prior to 2005) and Energy Crop Schemes (SRC and miscanthus since 2001)	Use GIS data from Natural England energy crop schemes and consult NE re. other schemes that need to be considered.	Not a divergence, but Natural England has energy crop data mapped spatially up to 2008 (1st tranche schemes) and data thereafter is not publicly available, but an overall figure for the East Midlands was provided.
Available land (High scenario	Rural Payments Agency (PRA/IACS), DEFRA Energy Crop Opportunity Maps, Natural England	Rural Land Register (RPA), DEFRA Energy Crop Opportunity Maps, Natural England	Assume that all available arable land and pasture will be planted with energy crops. Exclude all constrained areas as defined in exclusion areas.	Assume that 'unavailable' land such as built up areas, transport infrastructure is already excluded from Rural Land Register. Use DEFRA Energy Crop Opportunity maps to determine the highest potential yield band for each land parcel. Where equal, miscanthus will be selected due to the higher yield assumption used in the DECC methodology. Exclude all constrained areas as defined in exclusion areas.	We feel that it is necessary to provide greater clarity on the interpretation of the term 'available land'. Natural England provided data from the RLR (all arable and temporary grassland with Public Rights of Way excluded) due to restricted access to the RLR data. Due to data limitations, it has not been possible to assess the potential for energy crops to be grown on ex-landfill and colliery sites, although there may be some potential for light rooting crops on older non contaminated sites.
Available land (Medium scenario	Rural Payments Agency (PRA/IACS)	DEFRA Agricultural and Horticultural Census	Assume that energy crops are planted only on land no longer needed for food production (i.e. all abandoned land and pasture)	Use GAEC12 land from the DEFRA Agricultural and Horticultural Census as a proxy for all abandoned land and pasture. A ratio of 75(%):25(%) Miscanthus: SRC has been used based on the existing split between crops.	A suitable spatial dataset has not been identified. Bare fallow/GAEC12 land includes all arable land not in production, including wild bird cover and game cover. As this data are not available in GIS format, it was necessary to estimate the

Parameters	DECC suggested data source	Data source proposed	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC (and who this needs to be agreed with)
					proportion of GAEC12 land within protected landscapes. This was done using the proportion of each Local Authority covered by protected landscapes. The split between Miscanthus:SRC is based on areas of crops existing under energy crop schemes under the old and new schemes (Miscanthus – 2066ha: SRC – 675ha)
Available land (Low scenario	Natural England	Natural England	Assume new crops will be planted to the extent of submitted applications to the ECS for 2010.	2010 total only available for East Midlands, not by Local Authority	A figure for the East Midlands as a whole has been provided by Natural England. The data are not available in GIS.
Yield	DECC methodology	DECC methodology	10odt/ha SRC 15 odt/ha miscanthus 10% increase for 2020 Further 10% increase for 2030	2020: - 11 odt/ha SRC - 16.5 odt/ha miscanthus 2030: - 12.1 odt/ha SRC - 18.15 odt/ha miscanthus	No divergence (but have extrapolated to 2030)
Fuel requirement (electricity)	DECC methodology	DECC methodology	6000odt/year = 1MW	6000odt/year = 1MW	No divergence

Parameters	DECC suggested data source	Data source proposed	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC (and who this needs to be agreed with)
Fuel requirement (heat)	DECC methodology	DECC methodology	12.5GJ/odt (woodchip); 17GJ/odt (wood pellets); 13GJ/odt (baled miscanthus). Boiler efficiency: 80% Plant conversion factor: 80%	Miscanthus: 17GJ/odt SRC: 18GJ/odt (Natural England: Planting and Growing miscanthus Best Practice Guidelines July 2007) Boiler efficiency: 80% Plant conversion factor: 45%	Have previously been advised that the values for miscanthus are incorrect in the DECC methodology. A standard value of 18GJ/odt was applied for SRC. The conversion factor at 80% is seen to be unrealistically high. (45% 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)
Exclusion areas	www.magic.gov.uk	www.magic.gov.uk (Common Land, nature conservation); Natural England (PROW); English Heritage; Field margin calculator (LUC) for generating assumptions for SPS cross-compliance buffers	Exclude: Permanent pasture/grassland; Public Rights of Way (with buffers – 3m for miscanthus, 5m for SRC); Common Land; SPS Cross compliance buffers alongside field boundaries; Nature conservation sites; Historic designations; Grades 1 and 2 ALC from high scenario available land	- Exclude Common Land, SAC, SPA, Ramsar, SSSI, NNR, Ancient Woodland, World Heritage Sites (and buffer), Listed Buildings (with small buffer for point data as per commercial scale wind constraints), Scheduled Monuments, Battlefields, Parks and Gardens. - Rural Land Register data - permanent pasture/grassland are excluded already. Potentially only grades 3 and 4 ALC would be suitable/available for energy crops, therefore Grades 1 and 2 should be excluded.	For high scenario, where mapped data are available, these mapped constraints were excluded. Natural England excluded PROW before providing the data to LUC It was not possible to take account of these mapped constraints under the medium scenario as the data are not spatial. It is not considered appropriate to exclude any areas from the Low scenario as these are actual crop locations.

Parameters	DECC suggested data source	Data source proposed	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC (and who this needs to be agreed with)
Environmental impacts	Consult EA re. Water stressed areas; Consult NE re. potential Biodiversity impacts (such as farmland bird species); Consult NE re. protected landscapes	Consult EA re. Water stressed areas; Consult NE re. potential Biodiversity impacts (such as farmland bird species); Consult NE re. protected landscapes	No blanket exclusion should be applied in protected landscapes however a maximum block limit may be applied.	- A map showing the location of water stressed areas was provided by the Environment Agency. Due to lack of spatial data for the medium scenario, this information has not been incorporated in the results; - NE was consulted with regards to protected landscapes and other biodiversity impacts. It was requested that all UK BAP habitats be removed from the high scenario as a constraint. It was not possible to exclude these areas from the medium scenario due to lack of spatial data. - Protected landscapes have been reported separately, but the same assumptions have been applied.	No divergence

Table 5: Assumptions for plant biomass - waste wood

Parameters	DECC suggested data source	Data source used	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC
Plant biomass - waste wood (DECC methodology Table 3-3)					

Parameters	DECC suggested data source	Data source used	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC
Opportunity Assessment					
Existing and potential new feedstock	Forestry Commission/WRAP	WRAP (2009) Wood Waste Market in the UK	For sawmill waste: regional level assessment of sawmill throughput For construction wood waste: use regional data and disaggregate on the basis of new housing allocations For future additional feedstock: increase existing feedstock by 1% per year	Regional data was disaggregated on the basis of employee numbers in each local area. All wood waste used except for MSW which is assessed separately Future additional feedstock as per DECC methodology	The Wrap report was used because it is considered to be more reliable than DECC data and the sawmill report is no longer published by the Forestry Commission DECC methodology details steps to arrive at a regional assessment. Refinement of the analysis was required for the local authority level assessment. Housing allocations were not used because data were for all types of C&I waste wood, not just construction.
Fuel requirement	Biomass Energy Centre	Biomass Energy Centre	For electricity: use benchmark of 6,000 odt/year per 1MW For heat: apply standard calorific values Plant availability – 60%; efficiency – 80%	For electricity: use benchmark of 6,000 odt/year per 1MW For heat, standard calorific values were applied and wood assumed to be of poorer quality It is also assumed that for heat generation, the plant is available 60% of the time and has an efficiency of 80%	Heat calorific values were sourced from the Biomass Energy Centre because these are not provided by the DECC methodology 80% availability thought to be unrealistically high – 60%, according to DECC's Digest of UK Energy Statistics, 2010, Table 7.4
Constraints Assessment					

Parameters	DECC suggested data source	Data source used	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC
Available feedstock	No data required	No data required	Assume 50% of resource is available	Assume 50% of resource is available	N/A
Summary of proposed methodology					
The proposed method identified the amount of regional C&I wood waste arisings. Sub-regional arisings data was disaggregated on the basis of employee numbers in East Midlands. An assumption that only 50% of this resource will be available for biomass due to competing demands was applied.					

Table 6: Assumptions for plant biomass – agricultural arisings (straw)

Parameters	DECC suggested data source	Data source used	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC
Plant Biomass - Agricultural Arisings (Straw) (DECC methodology Table 3-3)					
Opportunity Assessment					
Existing feedstock	Defra Agricultural and Horticultural Survey – England	Defra (2010) June Census of Agriculture and Horticulture – England	Use data of existing feedstock of all wheat and oil seed rape straw only	Used data of existing feedstock of all wheat and oil seed rape straw only Assumed 3.5 tonnes per ha of wheat and 1.5 tonnes per ha of oil seed rape Assumed area farmed for straw will remain constant to 2030	Assumptions relating to tonnage of wheat and oil seed rape are from the Biomass Energy Centre as DECC does not give guidance on these parameters
Fuel requirement	N/A	N/A	Apply benchmark of 6,000 odt of baled straw per 1MW capacity	Benchmark of 6,000 odt of baled straw per 1MW capacity applied	N/A

Parameters	DECC suggested data source	Data source used	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC
Constraints Assessment					
Available feedstock	Defra Agricultural and Horticultural Survey – England	Defra (2010) June Census of Agriculture and Horticulture – England	Apply 1.5 tonnes of straw per annum per head of cattle in the region	Applied 1.5 tonnes of straw per annum per head of cattle in the region – excluded this amount, or 50% depending on which is lower as per DECC methodology	N/A
Summary of proposed methodology					
The assessment methodology involved identifying the amount of wheat and oilseed rape straw available from the Agricultural and Horticultural Census. A reduction in the quantity of feedstock available was applied to take account of the demand for straw for cattle bedding.					

Table 7: Assumptions for animal biomass – wet organic waste

Parameters	DECC suggested data source	Data source used	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC
Animal Biomass-Wet Organic Waste (DECC methodology Table 3-4)					
Opportunity Assessment					
Existing feedstock	ADAS Manure Management Database, Defra Agricultural and Horticultural Survey – England and Food and Drink Federation	For livestock data: Defra (2010) June Census of Agriculture and Horticulture – England For manure factor: Biomass Energy Centre For food and drink waste: ADAS	For manure and slurry: use data on number of livestock multiplied by a manure factor For food and drink waste: use data from Defra and food and drink federation	For manure and slurry: used data on livestock numbers multiplied by a manure factor 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) from the ADAS study	For food and drink waste, the ADAS study was the most up to date and complete data source

Parameters	DECC suggested data source	Data source used	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC
		(2009) National Study into Commercial and Industrial Waste Arisings		Assumed that animal numbers stay constant to 2030	
Biogas yield	UK National Non-Food Crops Centre (NNFCC)	UK National Non-Food Crops Centre (NNFCC)	Assume biogas yields of 25m3/t for cattle, 26m3/t for pigs and 46m3/t for food and drink	Assumed biogas yields of 25m3/t for cattle, 26m3/t for pigs and 46m3/t for food and drink	N/A
Feedstock requirements	N/A	N/A	Apply benchmark of 37,000 tonnes of wet organic waste required per 1MW capacity per year	Applied benchmark of 37,000 tonnes of wet organic waste required per 1MW capacity per year	N/A
Constraints Assessment					
Limits to extraction	N/A	N/A	Assume 80% of the resources can be collected	Assumed 80% of the resources can be collected	N/A
Competing uses	N/A	N/A	For manure and slurry: assume 100% of total resource is available for energy For food and drink: assume 50% of total resources is available for energy	For manure and slurry: assumed 100% of total resource is available for energy For food and drink: assumed 50% of total resources is available for energy	N/A
Summary of proposed methodology					
The assessment methodology used data on the number of livestock multiplied by a manure facture (i.e. amount of manure per head per year). For food and drink waste the methodology used data from Defra and the Food and Drink Federation. The methodology involved the application of a benchmark of 37,000 tonnes of wet organic waste required per 1 MW capacity per year.					

Table 8: Assumptions for animal biomass – poultry

Parameters	DECC suggested data source	Data source used	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC
Animal biomass – poultry (DECC methodology Table 3-4)					
Opportunity Assessment					
Existing and potential new feedstock	Defra Agricultural and Horticultural Survey – England	Defra (2010) June Census of Agriculture and Horticulture – England	Use data on poultry numbers and excreta factor per head of poultry Only include broiler birds to calculate poultry numbers	Assumed that per 1,000 broiler birds, 16.5 tonnes of litter is typically produced per annum (Biomass Energy Centre) Assumed that animal numbers stay constant to 2030	N/A
Feedstock requirements	N/A	N/A	Apply benchmark of 11,000 tonnes of poultry litter required for 1MW capacity per annum	Applied benchmark of 11,000 tonnes of poultry litter required for 1MW capacity per annum	N/A
Constraints Assessment					
Available feedstock	N/A	N/A	Assume 100% of the resource is available for energy	Assumed 100% of the resource is available for energy	N/A
Summary of proposed methodology					
The assessment methodology used data on poultry numbers and an excreta factor for head of poultry (from Defra) to calculate the total resource produced per year. Assumptions on broiler litter were taken from Bio Energy Centre. The methodology applies a benchmark of 11,000 tonnes of poultry litter required for 1MW capacity per annum.					

Table 9: Assumptions for municipal solid waste

Parameters	DECC suggested data source	Data source used	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC
Municipal Solid Waste (DECC methodology Table 3-5)					
Opportunity Assessment					
Existing and potential new feedstock	Defra's quarterly MSW Statistics	Defra (2009) Local Authority Municipal Waste Statistics	Collate information from all local waste management plans	Used local authority municipal and household waste statistics 2008/09 data available from Defra Increases in the use of the capacity to 2030 were based on changes in household numbers in the East Midlands as a whole, from CLG data. It was assumed that MSW per household would remain constant due to policies to reduce waste.	N/A
Feedstock requirement	N/A	N/A	Apply a benchmark of 10 kilo tonnes of MSW required for 1 MW capacity per annum.	Applied a benchmark of 10 kilo tonnes of MSW required for 1 MW capacity per annum.	N/A
Constraints Assessment					
N/A	N/A	N/A	No significant constraint parameters identified	No significant constraint parameters were identified	N/A
Summary of proposed methodology					
The assessment methodology drew on data from Defra waste data flow which are supplied to Defra by each local authority. The methodology applied a benchmark of 10 kilo tonnes of MSW required for 1 MW capacity per annum.					

Table 10: Assumptions for commercial and industrial waste

Parameters	DECC suggested data source	Data source used	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC
Commercial and industrial waste (DECC methodology Table 3-5)					
Opportunity Assessment					
Existing and potential new feedstock	No specific source provided	ADAS (2009) National Study into Commercial and Industrial Waste Arisings	Collate information from all local waste management plans	Included animal and vegetable waste and non-metallic waste only Excluded sectors covered elsewhere (food, drink and tobacco; retail and wholesale) Future C&I waste was based on future employee number projections (a UK benchmark of 0.05% per annum, according to UKCES)	N/A
Feedstock requirement	No specific source provided	N/A	Apply a benchmark of 10 kilo tonnes of MSW required for 1 MW capacity per annum	Applied a benchmark of 10 kilo tonnes required for 1 MW capacity per annum	N/A
Constraints Assessment					
N/A	N/A	N/A	No significant constraint parameters identified	No significant constraint were parameters identified	N/A
Summary of proposed methodology					
The assessment methodology drew on data from the ADAS (2009) National Study into Commercial and Industrial Waste Arisings. The methodology applied a benchmark of 10 kilo tonnes required for 1 MW capacity per annum. No major constraints were identified.					

Table 11: Assumptions for Biogas - landfill gas

Parameters	DECC suggested data source	Data source used	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC
Biogas - landfill gas (DECC methodology Table 3-6)					
Opportunity Assessment					
Available resource	Environment Agency's Waste Management Licence Data and OFGEM RO Register	OFGEM RO Register	Use inventory of landfill sites and sizes and capacity	All current landfill sites in the East Midlands from the OFGEM RO register	N/A
Lifetime of resource	Environment Agency's Waste Management Licence Data and OFGEM RO Register	OFGEM RO Register	Refer to inventory of landfill sites and their age	Assumed that the present day capacity will continue flat for five years to 2015, then straight line reduction until the capacity in 2030 is 20% of today's capacity	Landfill gas resource forecasts were based on BERR landfill gas production forecast study.
Constraints Assessment					
N/A	N/A	N/A	No significant constraint parameters identified	No significant constraint were parameters identified	N/A
Summary of proposed methodology					
The assessment methodology referred to the inventory of landfill sites and their size and capacity to calculate total available biogas resource and relied on a UK-wide BERR landfill forecast study to inform the future resource assessment.					

Table 12: Assumptions for Biogas – sewage gas

Parameters	DECC suggested data source	Data source used	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC
Biogas – sewage gas (DECC methodology Table 3-6)					
Opportunity Assessment					
Available resource	Water Utilities	OFGEM RO Register	Refer to inventory of sewage treatment sites and their size and capacity	All current sewage gas sites in the East Midlands from the OFGEM RO register	N/A
Potential new resource	Water Utilities	ONS Population projections	Refer to water utility business plans and forecast	Assumed a 50% increase in capacity from 2010 to 2020 based on more efficient technology and smaller units becoming more economically viable, hence being able to be deployed at smaller treatment works. Population growth projections for the East Midlands were also used to determine the future available resource (7.5% increase from 2020 to 2030).	Assumption of an increase in capacity was based on more efficient technology and smaller units becoming more economically viable, hence being able to be deployed at smaller treatment works
Constraints Assessment					
N/A	N/A	N/A	No significant constraint parameters identified	No significant constraint were parameters identified	N/A
Summary of proposed methodology					
The assessment methodology drew on data from the inventory of sewage treatment sites, their size and capacity to calculate total available resource. An increase in capacity based on more efficient technology and smaller units was applied.					

Table 13: Assumptions for hydropower

Parameters	DECC suggested data source	Data source proposed	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC (and who this needs to be agreed with)
Hydropower opportunities	'Mapping Hydropower Opportunities in England and Wales' (2009)	Disaggregated hydropower opportunities as defined by the EA hydropower study by County and Local Authority	GIS data barriers from EA study 'Mapping Hydropower Opportunities in England and Wales' (2009)	Disaggregated hydropower opportunities as defined by the EA hydropower study by County and Local Authority. Barrier opportunities are presented as all barriers and those identified as 'win-wins' in the EA study.	The EA study data is intended for use at national and regional level and County and Local Authority level should be used with caution. Although all data for barriers was provided by the Environment Agency, the potential figures reflect the win-wins as these are seen as the proportion of the total resource that is accessible and viable for development. It has not been possible to get the data provided by the EA to tally up to the same totals as the EA study for East Midlands. We have been advised that certain parameters have changed such as the Heavily Modified Water bodies.
Constraints	N/A	N/A	No significant constraint parameters identified	No significant constraint parameters identified	N/A

Table 14: Assumptions for solar energy

Parameters	DECC suggested data source	Data source proposed	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC
Existing roof space	CLG statistics English Housing Survey ONS data	OS Mastemap Address Layer 2	Include: Domestic properties (including flats) 25% Commercial properties- 40% of all hereditaments; Industrial buildings – 80% of the stock	Included: 25% of all domestic properties including flats; 40% of commercial properties; 80% of industrial buildings. Use NLUD classification within address data to classify as residential, commercial and industrial. Others excluded. All efforts have been made to exclude addresses from Address Layer 2 that are not fixed properties/buildings. In relation to Solar Thermal all suitable domestic addresses included and an additional 4% of commercial properties.	DECC recommends the use of CLG statistics, the English Housing Survey and ONS data. None of these data sources provide the correct data for this assessment. Address Layer 2 data provided a good baseline dataset for this assessment. 40% of all commercial properties included (not just hereditaments due to data limitations). Include 4% of suitable commercial properties in the calculations for solar thermal potential.
Potential new roof space	RSS new housing provisions	New planned housing in the region disaggregated by Local Authority (from housing trajectory tables)	Include 50% of all new domestic roofs	Include 50% of all new domestic roofs	Housing projections are only available to 2026. An annual average was calculated in order to extrapolate the figures to 2030.

Parameters	DECC suggested data source	Data source proposed	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC
System capacity	DECC methodology	DECC methodology and advice from SQW regarding Industrial system capacity (as obtained during previous assessments in other regions).	Domestic 2kW; Commercial 5kW (electric only); Industrial – each region to use own assumption	For all suitable address points: Domestic properties: 2kW (thermal or electric); Commercial: 5kW (electric only); Industrial: 10kW	A regional figure for industrial system capacity was estimated at 10kW for the SE and NW regions based on advice from SQW.
Constraints	N/A	N/A	No significant constraint parameters identified	No significant constraint parameters identified	N/A

Table 15: Assumptions for heat pumps

Parameters	DECC suggested data source	Data source proposed	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC
Existing building stock	CLG statistics, English Housing Survey, ONS data	OS MasterMap Address Layer 2; ONS 2001 census statistics KS16 (Household Spaces and Accommodation Type) Off-gas grid data source: Centre for Sustainable Energy (Identifying and Quantifying the Prevalence of Hard to Treat Homes, 2006)	Include: Domestic – 100% of all off-grid properties, 75% detached and semi-detached properties, 50% of terraced properties, 25% of flats; Commercial – no assumption supplied.	Use NLUD classification within address data to classify as residential, commercial and industrial. Others excluded. All efforts have been made to exclude addresses from Address Layer 2 that are not fixed properties/buildings. For domestic properties, use breakdown between different property types from key statistics table KS016. Percentage of off-gas properties per Local Authority calculated using rural fuel poverty data from Centre for Sustainable Energy. Assumed that all off-gas properties will be detached or semi-detached. Assume 10% commercial properties will be suitable.	Only domestic and commercial properties considered. DECC recommends the use of CLG statistics, the English Housing Survey and ONS data. None of these data sources provide the correct data for this assessment. Address Layer 2 data provided a good baseline dataset for this assessment. Discussions with SQW on the SE and NW studies indicated that the omitted figure for commercial properties should be 10%.
Suitable new buildings	RSS New housing provisions	New planned housing in the region disaggregated by Local Authority	Include 50% of all new domestic roofs	Include 50% of all new domestic roofs	No divergence
System capacity	DECC methodology	DECC methodology	Domestic 5kW Commercial 100kW	Domestic 5kW Commercial 100kW	No divergence

Parameters	DECC suggested data source	Data source proposed	DECC suggested assumptions	Study assumptions	Justification for divergence from DECC
Constraints	N/A	N/A	No significant constraint parameters identified	No significant constraint parameters identified	N/A

Appendix 3.3

Address classification

Table 1: Address classification into residential, commercial, community, industrial, tourism and government offices

LU Order	LU Order Description	LU Group	LU Group Description	Classification
U010	AGRICULTURE AND FISHERIES	U011	Agriculture	Commercial
		U012	Fisheries	Commercial
U020	FORESTRY	U021	Managed forest	Other
		U022	Un-managed forest	Other
U030	MINERALS	U031	Mineral workings and quarries	Industrial
U040	RECREATION AND LEISURE	U041	Outdoor amenity and open spaces	Community
		U042	Amusement and show places	Commercial
		U043	Libraries, museums and galleries	Community
		U044	Sports facilities and grounds	Community
		U045	Holiday parks and camps	Tourism
		U046	Allotments and city farms	Community
U050	TRANSPORT	U051	Transport tracks and ways	Commercial
		U052	Transport terminals and interchanges	Tourism
		U053	Car parks	Commercial
		U054	Vehicle storage	Commercial
		U055	Goods and freight terminals	Industrial
		U056	Waterways	Tourism
U060	UTILITIES AND INFRASTRUCTURE	U061	Energy production and distribution	Industrial
		U062	Water storage and treatment	Industrial
		U063	Refuse disposal	Industrial
		U064	Cemeteries and crematoria	Community
		U065	Post and telecommunications	Commercial
U070	RESIDENTIAL	U071	Dwellings	Residential
		U072	Hotels, boarding and guest houses	Tourism
		U073	Residential institutions	Community
U080	COMMUNITY SERVICES	U081	Medical and health care services	Community
		U082	Places of worship	Community
		U083	Education	Community
		U084	Community services	Community
U090	RETAIL	U091	Shops	Commercial
		U092	Financial and professional services	Commercial
		U093	Restaurants and cafes	Commercial
		U094	Public houses and bars	Commercial
U100	INDUSTRY AND BUSINESS	U101	Manufacturing	Industrial

LU Order	LU Order Description	LU Group	LU Group Description	Classification
		U102	Offices	Commercial (government offices identified in their own category)
		U103	Storage	Commercial
		U104	Wholesale distribution	Commercial
U110	VACANT AND DERELICT	U111	Vacant	Other
		U112	Derelict	Other
U120	DEFENCE	U121	Defence	Industrial
U130	UNUSED LAND	U131	Unused land	Other

Table 2: Number of properties identified in each category

County or Protected Landscape reporting area	Local Authority	Residential	Industrial	Commercial	Community	Government Offices	Tourism	Total
Derbyshire	Amber Valley	54,619	104	1,919	447	55	57	57,201
	Bolsover	34,069	45	1,005	252	40	26	35,437
	Chesterfield	48,226	103	2,311	300	67	42	51,049
	Derby	107,024	126	4,105	758	77	61	112,151
	Erewash	50,061	120	1,888	341	41	27	52,478
	North East Derbyshire	43,762	60	1,308	318	22	41	45,511
	South Derbyshire	39,246	84	1,235	308	27	42	40,942
Leicestershire	Blaby	38,997	59	1,104	220	62	15	40,457
	Charnwood	70,442	123	2,289	458	69	53	73,434
	Harborough	35,888	66	1,504	378	42	28	37,906
	Hinckley and Bosworth	46,350	93	1,616	314	39	40	48,452
	Leicester	128,374	212	5,934	837	107	41	135,505
	Melton	22,021	45	847	255	27	21	23,216
	North West Leicestershire	40,145	91	1,932	357	43	49	42,617
	Oadby and Wigston	22,582	50	794	136	20	2	23,584
	Rutland	16,173	26	620	217	24	30	17,090
Lincolnshire	Boston	28,234	29	1,026	208	27	23	29,547
	East Lindsey	61,027	96	2,908	726	85	235	65,077
	Lincoln	43,297	54	1,876	277	46	24	45,574
	North Kesteven	47,079	54	1,404	407	56	32	49,032
	South Holland	38,104	49	1,336	313	36	33	39,871
	South Kesteven	59,149	79	2,142	536	66	30	62,002
	West Lindsey	39,125	53	1,269	420	54	46	40,967
Lincolnshire Wolds AONB	East Lindsey	3,053	4	119	86		9	3,271
	West Lindsey	1,209	4	50	18			1,281
Northamptonshire	Corby	26,240	62	931	165	30	6	27,434
	Daventry	32,678	70	1,261	360	39	20	34,428
	East Northamptonshire	37,130	47	1,220	350	48	20	38,815
	Kettering	41,240	59	1,371	299	42	17	43,028
	Northampton	92,164	146	3,872	517	68	26	96,793
	South Northamptonshire	35,915	76	1,362	391	48	26	37,818
	Wellingborough	33,480	85	1,308	251	40	13	35,177
Nottinghamshire	Ashfield	52,345	88	1,472	294	20	16	54,235
	Bassetlaw	49,582	83	1,917	430	50	65	52,127
	Broxtowe	49,036	66	1,545	326	41	29	51,043
	Gedling	50,720	52	1,285	286	50	14	52,407
	Mansfield	47,374	42	1,509	276	46	22	49,269
	Newark and Sherwood	50,979	75	1,875	437	63	39	53,468
	Nottingham	134,057	200	6,199	826	121	69	141,472
	Rushcliffe	47,015	47	1,339	403	65	40	48,909
Peak District Sub-Region Study Area	Barnsley	45		4	1			50
	Cheshire East	577	1	32	13		5	628
	Derbyshire Dales	32,823	67	1,735	455	53	98	35,231
	High Peak	40,768	75	1,827	366	55	92	43,183
	Kirklees	101		4	1		1	107
	North East Derbyshire	37			2		1	40
	Oldham	33		3	2			38
	Sheffield	381		10	6	1	1	399
	Staffordshire Moorlands	1,747	7	58	45	5	10	1,872
Total		1,974,723	3,177	74,680	15,389	2,017	1,637	2,071,623

Appendix 4.1

Results of Assessment of Renewable Energy Potential According to Housing Market Areas (HMAs)

CENTRAL LINCOLNSHIRE

	Lincoln				North Kesteven				West Lindsey (outside AONB)			
Technology	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	4.36	6.87	4.36	6.87	1,215.21	1,916.15	1,215.21	1,916.15	1,308.04	2,062.52	1,308.04	2,062.52
Medium Wind	0.44	0.69	0.44	0.69	25.29	39.88	25.29	39.88	25.60	40.36	25.60	40.36
Small Wind	5.73	9.04	5.73	9.04	603.38	951.41	603.38	951.41	723.78	1,141.26	723.78	1,141.26
Small Scale Wind <6kW	0.00	0.00	0.00	0.00	81.33	113.99	81.33	113.99	95.24	133.49	95.24	133.49
Managed Woodland (heat)	0.18	0.71	0.18	0.71	4.25	16.75	4.25	16.75	5.52	21.76	5.52	21.76
Managed Woodland (elec)	0.03	0.23	0.03	0.23	0.70	5.27	0.70	5.27	0.91	6.86	0.91	6.86
Energy Crops (heat) Medium	7.78	30.67	8.56	33.74	41.86	165.01	46.05	181.53	29.26	115.34	32.18	126.85
Energy Crops (elec) Medium	1.34	10.10	1.47	11.07	7.20	54.24	7.92	59.67	5.03	37.89	5.53	41.66
Agricultural Arisings	0.04	0.24	0.04	0.24	17.37	91.28	17.37	91.28	19.45	102.24	19.45	102.24
Waste Wood (heat)	0.67	3.54	0.74	3.91	0.40	2.12	0.45	2.34	0.30	1.57	0.33	1.73
Waste Wood (elec)	0.79	4.14	0.87	4.57	0.47	2.47	0.52	2.73	0.35	1.83	0.38	2.02
Poultry Litter	0.00	0.00	0.00	0.00	3.83	20.11	3.83	20.11	3.21	16.88	3.21	16.88
Wet Organic Waste	0.29	1.52	0.29	1.52	2.59	13.62	2.59	13.62	5.69	29.90	5.69	29.90
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	2.95	15.51	3.25	17.06	3.81	20.02	4.19	22.02	2.87	15.07	3.15	16.58
Commercial and Industrial	3.53	18.56	3.71	19.51	2.11	11.10	2.22	11.67	1.56	8.22	1.64	8.64
Landfill Gas	0.00	0.00	0.00	0.00	2.28	12.01	0.62	3.27	0.24	1.27	0.07	0.35
Sewage Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.66	0.16	0.71
Hydro	0.00	0.00	0.00	0.00	0.04	0.21	0.04	0.21	0.10	0.52	0.10	0.52
Solar PV	35.00	27.59	43.48	34.28	31.69	24.98	35.60	28.07	25.86	20.39	28.16	22.20
Solar Thermal	30.57	13.39	39.04	17.10	27.84	12.19	31.75	13.91	22.22	9.73	24.52	10.74
Heat Pumps	173.39	394.91	194.58	443.18	213.42	486.09	223.21	508.38	169.69	386.49	175.43	399.56
TOTAL (electricity)	265.73	527.39	63.67	105.08	1,997.30	3,276.75	2,000.81	3,279.35	2,218.08	3,619.35	2,221.12	3,626.17
Total (heat)	212.59	443.22	243.10	498.64	287.77	682.16	305.71	722.91	226.99	534.89	237.98	560.65

CENTRAL LINCOLNSHIRE (CONT)

	Lincolnshire Wolds AONB (West Lindsey)			
Technology	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	0.00	0.00	0.00	0.00
Medium Wind	0.00	0.00	0.00	0.00
Small Wind	0.00	0.00	0.00	0.00
Small Scale Wind <6kW	7.00	9.81	7.00	9.81
Managed Woodland (heat)	0.71	2.80	0.71	2.80
Managed Woodland (elec)	0.54	4.07	0.54	4.07
Energy Crops (heat) Medium	3.36	13.25	3.70	14.59
Energy Crops (elec) Medium	0.58	4.37	0.64	4.85
Agricultural Arisings	*	*	*	*
Waste Wood (heat)	*	*	*	*
Waste Wood (elec)	*	*	*	*
Poultry Litter	*	*	*	*
Wet Organic Waste	*	*	*	*
Biomass Co-firing	*	*	*	*
Municipal Solid Waste (MSW)	*	*	*	*
Commercial and Industrial	*	*	*	*
Landfill Gas	*	*	*	*
Sewage Gas	*	*	*	*
Hydro	0.00	0.00	0.00	0.00
Solar PV	1.04	0.82	1.30	1.03
Solar Thermal	0.88	0.39	1.15	0.50
Heat Pumps	5.85	13.33	6.52	14.84
TOTAL (electricity)	18.85	40.40	20.38	43.57
Total (heat)	35.45	75.98	38.23	81.46

COASTAL LINCOLNSHIRE

	Boston				East Lindsey (outside AONB)				Lincolnshire Wolds AONB (East Lindsey)			
Technology	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	215.69	340.10	215.69	340.10	1,325.11	2,089.43	1,325.11	2,089.43	0.00	0.00	0.00	0.00
Medium Wind	2.54	4.01	2.54	4.01	8.70	13.71	8.70	13.71	0.00	0.00	0.00	0.00
Small Wind	143.83	226.79	143.83	226.79	816.08	1,286.79	816.08	1,286.79	0.00	0.00	0.00	0.00
Small Scale Wind <6kW	41.37	57.98	41.37	57.98	131.20	183.89	131.20	183.89	19.25	26.99	19.25	26.99
Managed Woodland (heat)	0.07	0.28	0.07	0.28	4.32	17.03	4.32	17.03	3.08	12.14	3.08	12.14
Managed Woodland (elec)	0.01	0.08	0.01	0.08	0.71	5.35	0.71	5.35	1.93	14.54	1.93	14.54
Energy Crops (heat) Medium	7.78	30.67	8.56	33.74	47.77	188.31	52.55	207.15	13.38	52.74	14.72	58.03
Energy Crops (elec) Medium	1.34	10.10	1.47	11.07	8.21	61.85	9.04	68.10	2.30	17.33	2.53	19.06
Agricultural Arisings	4.43	23.31	4.43	23.31	28.19	148.15	28.19	148.15	*	*	*	*
Waste Wood (heat)	0.34	1.78	0.37	1.96	0.51	2.70	0.57	2.99	*	*	*	*
Waste Wood (elec)	0.39	2.08	0.44	2.29	0.60	3.16	0.66	3.49	*	*	*	*
Poultry Litter	0.31	1.61	0.31	1.61	4.34	22.82	4.34	22.82	*	*	*	*
Wet Organic Waste	1.21	6.37	1.21	6.37	10.48	55.06	10.48	55.06	*	*	*	*
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*	*	*	*
Municipal Solid Waste (MSW)	1.91	10.04	2.10	11.04	4.67	24.52	5.13	26.98	*	*	*	*
Commercial and Industrial	1.77	9.32	1.86	9.79	2.69	14.16	2.83	14.89	*	*	*	*
Landfill Gas	0.00	0.00	0.00	0.00	1.51	7.92	0.41	2.16	*	*	*	*
Sewage Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*	*	*	*
Hydro	0.00	0.00	0.00	0.00	0.01	0.05	0.01	0.05	0.00	0.00	0.00	0.00
Solar PV	18.12	14.29	19.33	15.24	41.06	32.37	42.93	33.85	2.51	1.98	3.03	2.39
Solar Thermal	15.58	6.82	16.79	7.35	33.17	14.53	35.04	15.35	2.09	0.92	2.62	1.15
Heat Pumps	117.91	268.55	120.92	275.41	274.14	624.38	278.82	635.04	14.95	34.05	16.26	37.04
TOTAL (electricity)	573.26	1,003.99	579.83	1,017.29	2,734.54	4,728.99	2,747.36	4,758.82	55.27	128.82	58.97	137.73
Total (heat)	141.68	308.10	146.71	318.75	359.91	846.95	371.30	877.56	101.39	236.77	107.67	251.03

DERBY

	Amber Valley				Derby				South Derbyshire			
Technology	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	49.39	77.88	49.39	77.88	9.95	15.69	9.95	15.69	113.13	178.38	113.13	178.38
Medium Wind	0.78	1.23	0.78	1.23	0.01	0.02	0.01	0.02	9.56	15.07	9.56	15.07
Small Wind	79.01	124.58	79.01	124.58	8.64	13.62	8.64	13.62	153.81	242.52	153.81	242.52
Small Scale Wind <6kW	41.44	58.08	41.44	58.08	0.00	0.00	0.00	0.00	40.88	57.30	40.88	57.30
Managed Woodland (heat)	2.02	7.96	2.02	7.96	0.12	0.47	0.12	0.47	2.54	10.01	2.54	10.01
Managed Woodland (elec)	0.33	2.49	0.33	2.49	0.02	0.15	0.02	0.15	0.42	3.16	0.42	3.16
Energy Crops (heat) Medium	1.77	6.98	1.95	7.69	0.45	1.77	0.49	1.93	4.79	18.88	5.27	20.77
Energy Crops (elec) Medium	0.30	2.26	0.34	2.56	0.08	0.60	0.08	0.60	0.82	6.18	0.91	6.86
Agricultural Arisings	0.36	1.92	0.36	1.92	0.04	0.19	0.04	0.19	1.62	8.54	1.62	8.54
Waste Wood (heat)	0.62	3.24	0.68	3.58	1.48	7.78	1.63	8.59	0.35	1.84	0.39	2.03
Waste Wood (elec)	0.72	3.78	0.80	4.18	1.73	9.08	1.91	10.03	0.41	2.14	0.45	2.37
Poultry Litter	0.08	0.41	0.08	0.41	0.00	0.00	0.00	0.00	0.34	1.81	0.34	1.81
Wet Organic Waste	5.18	27.24	5.18	27.24	0.11	0.57	0.11	0.57	5.11	26.86	5.11	26.86
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	3.50	18.40	3.85	20.24	9.70	50.98	10.67	56.08	3.12	16.40	3.43	18.04
Commercial and Industrial	3.20	16.79	3.36	17.65	6.49	34.11	6.82	35.85	1.81	9.52	1.90	10.01
Landfill Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.67	8.76	0.45	2.39
Sewage Gas	0.00	0.00	0.00	0.00	2.94	12.89	3.16	13.86	0.00	0.00	0.00	0.00
Hydro	1.39	7.18	1.39	7.18	1.20	6.20	1.20	6.20	0.68	3.51	0.68	3.51
Solar PV	34.96	27.56	36.81	29.02	68.87	54.30	73.23	57.73	26.20	20.66	28.88	22.77
Solar Thermal	29.66	12.99	31.52	13.81	58.86	25.78	63.22	27.69	22.63	9.91	25.31	11.09
Heat Pumps	230.36	524.67	235.01	535.26	438.31	998.29	449.19	1,023.08	171.07	389.63	177.77	404.89
TOTAL (electricity)	220.64	369.81	223.12	374.66	109.77	198.39	115.83	210.59	359.58	600.81	361.58	599.58
Total (heat)	264.43	555.84	271.18	568.30	499.22	1,034.10	514.65	1,061.76	201.38	430.27	211.28	448.79

LEICESTER & LEICESTERSHIRE

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

LEICESTER & LEICESTERSHIRE (CONT)

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

LEICESTER & LEICESTERSHIRE (CONT)

	North West Leicestershire				Oadby and Wigston			
Technology	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	64.27	101.35	64.27	101.35	4.12	6.49	4.12	6.49
Medium Wind	1.83	2.89	1.83	2.89	0.11	0.18	0.11	0.18
Small Wind	104.24	164.36	104.24	164.36	3.37	5.32	3.37	5.32
Small Scale Wind <6kW	39.86	55.87	39.86	55.87	0.00	0.00	0.00	0.00
Managed Woodland (heat)	2.48	9.78	2.48	9.78	0.02	0.08	0.02	0.08
Managed Woodland (elec)	0.41	3.09	0.41	3.09	0.00	0.00	0.00	0.00
Energy Crops (heat) Medium	7.35	28.97	8.09	31.89	1.20	4.73	1.32	5.20
Energy Crops (elec) Medium	1.26	9.49	1.39	10.47	0.21	1.58	0.23	1.73
Agricultural Arisings	1.41	7.43	1.41	7.43	0.03	0.13	0.03	0.13
Waste Wood (heat)	0.63	3.29	0.69	3.63	0.23	1.22	0.26	1.35
Waste Wood (elec)	0.73	3.84	0.81	4.24	0.27	1.42	0.30	1.57
Poultry Litter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wet Organic Waste	2.68	14.09	2.68	14.09	0.25	1.30	0.25	1.30
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	3.34	17.53	3.67	19.28	1.33	7.01	1.47	7.71
Commercial and Industrial	3.43	18.03	3.61	18.96	1.27	6.70	1.34	7.04
Landfill Gas	4.17	21.93	1.14	5.98	0.00	0.00	0.00	0.00
Sewage Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro	0.54	2.79	0.54	2.79	0.01	0.05	0.01	0.05
Solar PV	27.74	21.87	29.92	23.59	14.49	11.42	15.39	12.13
Solar Thermal	22.73	9.96	24.91	10.91	12.38	5.42	13.28	5.82
Heat Pumps	184.68	420.63	190.13	433.04	97.05	221.04	99.29	226.14
TOTAL (electricity)	255.91	444.56	255.78	434.38	25.47	41.61	26.61	43.67
Total (heat)	217.87	472.62	226.30	489.25	110.88	232.49	114.17	238.59

NORTH NORTHAMPTONSHIRE

	Corby				East Northamptonshire				Kettering			
Technology	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	135.27	213.29	135.27	213.29	1,010.78	1,593.80	1,010.78	1,593.80	412.68	650.71	412.68	650.71
Medium Wind	2.99	4.71	2.99	4.71	11.90	18.77	11.90	18.77	11.28	17.79	11.28	17.79
Small Wind	37.67	59.40	37.67	59.40	402.28	634.32	402.28	634.32	210.56	332.00	210.56	332.00
Small Scale Wind <6kW	9.78	13.71	9.78	13.71	41.35	57.96	41.35	57.96	21.04	29.49	21.04	29.49
Managed Woodland (heat)	1.53	6.03	1.53	6.03	3.85	15.18	3.85	15.18	1.89	7.45	1.89	7.45
Managed Woodland (elec)	0.25	1.88	0.25	1.88	0.63	4.75	0.63	4.75	0.31	2.34	0.31	2.34
Energy Crops (heat) Medium	0.83	3.27	0.91	3.59	15.17	59.80	16.69	65.79	11.68	46.04	12.85	50.65
Energy Crops (elec) Medium	0.14	1.05	0.16	1.21	2.61	19.66	2.87	21.62	2.01	15.14	2.21	16.65
Agricultural Arisings	0.89	4.66	0.89	4.66	7.33	38.51	7.33	38.51	2.08	10.95	2.08	10.95
Waste Wood (heat)	0.37	1.94	0.41	2.15	0.33	1.75	0.37	1.94	0.46	2.40	0.50	2.65
Waste Wood (elec)	0.43	2.27	0.48	2.50	0.39	2.04	0.43	2.26	0.53	2.80	0.59	3.10
Poultry Litter	0.00	0.00	0.00	0.00	0.37	1.96	0.37	1.96	0.00	0.00	0.00	0.00
Wet Organic Waste	0.25	1.30	0.25	1.30	2.16	11.35	2.16	11.35	1.52	8.01	1.52	8.01
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	1.97	10.34	2.16	11.37	2.37	12.47	2.61	13.72	3.03	15.92	3.33	17.51
Commercial and Industrial	2.43	12.75	2.55	13.41	2.19	11.50	2.30	12.09	3.00	15.77	3.15	16.58
Landfill Gas	3.66	19.21	1.00	5.24	1.13	5.92	0.31	1.61	0.61	3.22	0.17	0.88
Sewage Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro	0.06	0.31	0.06	0.31	2.26	11.68	2.26	11.68	0.00	0.00	0.00	0.00
Solar PV	28.66	22.60	41.44	32.67	27.20	21.44	32.18	25.37	33.99	26.80	43.42	34.23
Solar Thermal	26.13	11.44	38.91	17.04	23.88	10.46	28.86	12.64	30.40	13.32	39.84	17.45
Heat Pumps	125.20	285.16	157.15	357.92	161.21	367.17	173.66	395.53	179.81	409.54	203.40	463.26
TOTAL (electricity)	224.43	367.49	234.94	365.66	1,514.96	2,446.15	1,519.77	2,449.78	702.64	1,130.93	712.34	1,140.22
Total (heat)	154.06	307.85	198.91	386.73	204.44	454.36	223.43	491.07	224.24	478.75	258.48	541.47

NORTH NORTHAMPTONSHIRE (CONT)

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

NORTHERN

	Bassetlaw				Bolsover				Chesterfield			
Technology	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	805.00	1,269.32	805.00	1,269.32	71.96	113.47	71.96	113.47	4.95	7.80	4.95	7.80
Medium Wind	42.84	67.55	42.84	67.55	6.92	10.92	6.92	10.92	0.96	1.52	0.96	1.52
Small Wind	410.94	647.98	410.94	647.98	83.26	131.29	83.26	131.29	14.23	22.43	14.23	22.43
Small Scale Wind <6kW	70.41	98.69	70.41	98.69	15.59	21.85	15.59	21.85	0.65	0.91	0.65	0.91
Managed Woodland (heat)	7.08	27.91	7.08	27.91	1.13	4.45	1.13	4.45	0.34	1.34	0.34	1.34
Managed Woodland (elec)	1.16	8.74	1.16	8.74	0.18	1.36	0.18	1.36	0.06	0.45	0.06	0.45
Energy Crops (heat) Medium	25.22	99.42	27.74	109.35	1.93	7.61	2.12	8.36	0.45	1.77	0.49	1.93
Energy Crops (elec) Medium	4.34	32.70	4.77	35.94	0.33	2.49	0.36	2.71	0.08	0.60	0.08	0.60
Agricultural Arisings	6.38	33.55	6.38	33.55	0.87	4.59	0.87	4.59	0.34	1.80	0.34	1.80
Waste Wood (heat)	0.53	2.81	0.59	3.10	0.33	1.71	0.36	1.89	0.60	3.17	0.67	3.50
Waste Wood (elec)	0.62	3.28	0.69	3.62	0.38	2.00	0.42	2.21	0.70	3.70	0.78	4.09
Poultry Litter	0.73	3.86	0.73	3.86	0.16	0.82	0.16	0.82	0.00	0.00	0.00	0.00
Wet Organic Waste	3.05	16.01	3.05	16.01	1.19	6.26	1.19	6.26	0.27	1.41	0.27	1.41
Biomass Co-firing	406.00	3,200.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	3.53	18.56	3.88	20.42	2.74	14.42	3.02	15.86	3.46	18.18	3.80	19.99
Commercial and Industrial	2.63	13.84	2.77	14.55	1.69	8.87	1.77	9.33	3.12	16.42	3.28	17.26
Landfill Gas	2.51	13.22	0.69	3.60	0.46	2.41	0.13	0.66	5.30	27.84	1.44	7.59
Sewage Gas	0.00	0.00	0.00	0.00	1.29	5.65	1.39	6.07	0.00	0.00	0.00	0.00
Hydro	0.08	0.41	0.08	0.41	0.00	0.00	0.00	0.00	0.04	0.21	0.04	0.21
Solar PV	33.92	26.74	37.46	29.53	24.44	19.27	28.83	22.73	34.46	27.17	38.54	30.38
Solar Thermal	28.82	12.62	32.36	14.17	21.69	9.50	26.09	11.43	28.74	12.59	32.82	14.38
Heat Pumps	213.71	486.75	222.56	506.90	143.18	326.11	154.16	351.11	199.48	454.34	209.68	477.57
TOTAL (electricity)	1,794.16	5,455.34	1,390.85	2,253.76	211.47	345.66	216.05	350.12	68.62	130.44	69.43	116.45
Total (heat)	275.36	629.50	290.33	661.44	168.26	349.38	183.86	377.25	229.61	473.21	244.00	498.72

NORTHERN (CONT)

	North East Derbyshire (outside NP)			
Technology	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	25.80	40.68	25.80	40.68
Medium Wind	1.88	2.97	1.88	2.97
Small Wind	53.38	84.18	53.38	84.18
Small Scale Wind <6kW	35.87	50.27	35.87	50.27
Managed Woodland (heat)	2.83	11.16	2.83	11.16
Managed Woodland (elec)	0.46	3.47	0.46	3.47
Energy Crops (heat) Medium	3.72	14.66	4.09	16.12
Energy Crops (elec) Medium	0.64	4.82	0.70	5.27
Agricultural Arisings	0.62	3.27	0.62	3.27
Waste Wood (heat)	0.32	1.67	0.35	1.84
Waste Wood (elec)	0.37	1.95	0.41	2.15
Poultry Litter	0.16	0.82	0.16	0.82
Wet Organic Waste	4.06	21.32	4.06	21.32
Biomass Co-firing	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	3.32	17.45	3.65	19.19
Commercial and Industrial	1.64	8.64	1.73	9.08
Landfill Gas	0.00	0.00	0.00	0.00
Sewage Gas	0.00	0.00	0.00	0.00
Hydro	0.04	0.21	0.04	0.21
Solar PV	32.62	25.72	39.50	31.14
Solar Thermal	29.10	12.74	35.98	15.76
Heat Pumps	199.79	455.04	216.99	494.21
TOTAL (electricity)	160.86	265.74	168.25	274.01
Total (heat)	235.75	495.27	260.23	539.09

NOTTINGHAM CORE

	Broxtowe				Erewash				Gedling			
Technology	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	6.59	10.40	6.59	10.40	13.31	20.99	13.31	20.98	32.34	50.99	32.34	50.99
Medium Wind	0.95	1.49	0.95	1.49	0.09	0.14	0.09	0.14	1.23	1.94	1.23	1.94
Small Wind	12.33	19.44	12.33	19.44	26.76	42.19	26.76	42.19	40.13	63.28	40.13	63.28
Small Scale Wind <6kW	0.00	0.00	0.00	0.00	9.77	13.69	9.77	13.69	19.66	27.56	19.66	27.56
Managed Woodland (heat)	0.35	1.38	0.35	1.38	0.31	1.22	0.31	1.22	1.52	5.99	1.52	5.99
Managed Woodland (elec)	0.06	0.45	0.06	0.45	0.05	0.38	0.05	0.38	0.25	1.88	0.25	1.88
Energy Crops (heat) Medium	1.83	7.21	2.01	7.92	0.97	3.82	1.07	4.22	1.31	5.16	1.44	5.68
Energy Crops (elec) Medium	0.31	2.34	0.35	2.64	0.17	1.28	0.18	1.36	0.23	1.73	0.25	1.88
Agricultural Arisings	0.30	1.56	0.30	1.56	0.20	1.04	0.20	1.04	0.54	2.81	0.54	2.81
Waste Wood (heat)	0.46	2.43	0.51	2.68	0.47	2.45	0.52	2.71	0.41	2.13	0.45	2.36
Waste Wood (elec)	0.54	2.83	0.60	3.13	0.54	2.86	0.60	3.16	0.47	2.49	0.52	2.75
Poultry Litter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.22	0.04	0.22
Wet Organic Waste	0.48	2.51	0.48	2.51	1.11	5.82	1.11	5.82	0.64	3.38	0.64	3.38
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	3.24	17.02	3.56	18.72	3.63	19.10	4.00	21.01	3.48	18.31	3.83	20.14
Commercial and Industrial	2.28	11.97	2.39	12.58	2.42	12.71	2.54	13.36	2.00	10.51	2.10	11.05
Landfill Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.22	22.16	1.15	6.04
Sewage Gas	1.02	4.47	1.10	4.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro	1.46	7.55	1.46	7.55	0.64	3.31	0.64	3.31	0.75	3.88	0.75	3.88
Solar PV	32.47	25.60	36.01	28.39	34.94	27.55	39.29	30.98	31.84	25.10	34.64	27.31
Solar Thermal	28.45	12.46	31.99	14.01	29.84	13.07	34.20	14.98	28.49	12.48	31.28	13.70
Heat Pumps	194.84	443.77	203.69	463.92	210.62	479.71	221.51	504.51	197.36	449.51	204.36	465.45
TOTAL (electricity)	62.02	107.62	66.17	113.66	93.63	151.07	98.53	157.43	137.83	236.25	138.08	225.13
Total (heat)	225.93	467.25	238.55	489.92	242.21	500.28	257.61	527.64	229.09	475.27	239.05	493.18

NOTTINGHAM CORE (CONT)

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

NOTTINGHAM OUTER

	Ashfield				Mansfield				Newark and Sherwood			
Technology	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	15.34	24.18	15.34	24.18	34.50	54.40	34.50	54.40	675.02	1,064.37	675.02	1,064.37
Medium Wind	2.69	4.24	2.69	4.24	1.08	1.70	1.08	1.70	27.73	43.73	27.73	43.73
Small Wind	32.94	51.93	32.94	51.93	19.95	31.46	19.95	31.46	437.89	690.47	437.89	690.47
Small Scale Wind <6kW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	63.08	88.41	63.08	88.41
Managed Woodland (heat)	0.91	3.59	0.91	3.59	0.65	2.56	0.65	2.56	7.06	27.83	7.06	27.83
Managed Woodland (elec)	0.15	1.13	0.15	1.13	0.11	0.83	0.11	0.83	1.16	8.74	1.16	8.74
Energy Crops (heat) Medium	0.42	1.66	0.46	1.81	0.90	3.55	0.99	3.90	21.94	86.49	24.14	95.16
Energy Crops (elec) Medium	0.07	0.53	0.08	0.60	0.16	1.21	0.17	1.28	3.77	28.40	4.15	31.26
Agricultural Arisings	0.25	1.33	0.25	1.33	0.16	0.84	0.16	0.84	5.98	31.44	5.98	31.44
Waste Wood (heat)	0.58	3.05	0.64	3.37	0.48	2.53	0.53	2.80	0.53	2.78	0.58	3.07
Waste Wood (elec)	0.68	3.56	0.75	3.93	0.56	2.96	0.62	3.27	0.62	3.24	0.68	3.58
Poultry Litter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.32	12.21	2.32	12.21
Wet Organic Waste	0.58	3.06	0.58	3.06	0.30	1.59	0.30	1.59	4.49	23.62	4.49	23.62
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	3.53	18.54	3.88	20.39	3.63	19.06	3.99	20.96	3.65	19.17	4.01	21.09
Commercial and Industrial	2.86	15.04	3.01	15.81	2.38	12.49	2.50	13.12	2.60	13.68	2.74	14.38
Landfill Gas	2.21	11.63	0.60	3.17	0.00	0.00	0.00	0.00	1.42	7.48	0.39	2.04
Sewage Gas	0.00	0.00	0.00	0.00	0.60	2.63	0.65	2.83	0.00	0.00	0.00	0.00
Hydro	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.18	16.44	3.18	16.44
Solar PV	33.36	26.30	36.24	28.57	33.54	26.44	39.35	31.02	46.90	36.98	62.89	49.58
Solar Thermal	29.41	12.88	32.29	14.14	29.87	13.08	35.68	15.63	41.96	18.38	57.94	25.38
Heat Pumps	204.34	465.40	211.54	481.80	194.44	442.86	208.97	475.95	246.27	560.90	286.23	651.92
TOTAL (electricity)	94.66	161.48	96.51	158.36	96.96	155.59	103.37	163.29	1,279.83	2,088.38	1,295.72	2,101.37
Total (heat)	235.66	486.58	245.84	504.72	226.34	464.58	246.82	500.84	317.76	696.38	375.95	803.35

PEAK, DALES & PARK

	Derbyshire Dales				High Peak				Peak District NP			
Technology	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Medium Wind	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Small Wind	12.68	20.00	12.68	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Small Scale Wind <6kW	15.52	21.75	15.52	21.75	18.53	25.98	18.53	25.98	9.05	12.68	9.05	12.68
Managed Woodland (heat)	5.89	23.20	5.89	23.20	1.50	5.90	1.50	5.90	23.57	92.90	23.57	92.90
Managed Woodland (elec)	3.08	23.20	3.08	23.20	0.78	5.90	0.78	5.90	12.33	92.90	12.33	92.90
Energy Crops (heat) Medium	186.45	735.00	186.45	735.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy Crops (elec) Medium	97.56	735.00	97.56	735.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agricultural Arisings	0.56	2.95	0.56	2.95	0.06	0.31	0.06	0.31	*	*	*	*
Waste Wood (heat)	0.41	2.18	0.46	2.41	0.37	1.95	0.41	2.15	*	*	*	*
Waste Wood (elec)	0.48	2.54	0.53	2.81	0.43	2.27	0.48	2.51	*	*	*	*
Poultry Litter	1.18	6.18	1.18	6.18	0.09	0.49	0.09	0.49	*	*	*	*
Wet Organic Waste	17.73	93.16	17.73	93.16	4.28	22.47	4.28	22.47	*	*	*	*
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*	*	*	*
Municipal Solid Waste (MSW)	2.67	14.03	2.94	15.43	3.23	16.97	3.55	18.67	*	*	*	*
Commercial and Industrial	2.15	11.29	2.26	11.86	1.92	10.10	2.02	10.61	*	*	*	*
Landfill Gas	0.00	0.00	0.00	0.00	0.24	1.27	0.07	0.35	*	*	*	*
Sewage Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*	*	*	*
Hydro	0.74	3.80	0.74	3.80	0.66	3.40	0.66	3.40	1.16	6.00	1.16	6.00
Solar PV	8.83	6.96	8.83	6.96	3.60	2.84	3.60	2.84	11.42	9.00	11.42	9.00
Solar Thermal	111.87	49.00	111.87	49.00	6.85	3.00	6.85	3.00	212.33	93.00	212.33	93.00
Heat Pumps	68.05	155.00	68.05	155.00	293.73	669.00	293.73	669.00	2.63	6.00	2.63	6.00
TOTAL (electricity)	163.17	940.86	163.60	943.10	33.83	91.99	34.12	93.52	33.95	120.58	33.95	120.58
Total (heat)	372.68	964.38	372.72	964.61	302.45	679.85	302.49	680.05	238.53	191.90	238.53	191.90

PETERBOROUGH PARTIAL

	Rutland				South Holland				South Kesteven			
Technology	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	412.04	649.70	412.04	649.70	765.63	1,207.25	765.63	1,207.25	1,802.90	2,842.81	1,802.90	2,842.81
Medium Wind	10.26	16.18	10.26	16.18	11.45	18.05	11.45	18.05	41.16	64.90	41.16	64.90
Small Wind	162.41	256.09	162.41	256.09	432.13	681.38	432.13	681.38	833.80	1,314.73	833.80	1,314.73
Small Scale Wind <6kW	49.15	68.89	49.15	68.89	86.42	121.13	86.42	121.13	88.14	123.54	88.14	123.54
Managed Woodland (heat)	2.17	8.55	2.17	8.55	0.04	0.16	0.04	0.16	4.08	16.08	4.08	16.08
Managed Woodland (elec)	0.36	2.71	0.36	2.71	0.01	0.08	0.01	0.08	0.67	5.05	0.67	5.05
Energy Crops (heat) Medium	8.57	33.78	9.43	37.17	24.99	98.51	27.48	108.33	42.78	168.64	47.05	185.47
Energy Crops (elec) Medium	1.47	11.07	1.62	12.20	4.30	32.39	4.73	35.63	7.35	55.37	8.09	60.95
Agricultural Arisings	6.00	31.54	5.05	26.52	15.24	80.08	15.24	80.08	15.23	80.06	15.23	80.06
Waste Wood (heat)	0.18	0.93	0.20	1.03	0.39	2.04	0.43	2.25	0.64	3.39	0.71	3.74
Waste Wood (elec)	0.21	1.09	0.23	1.20	0.45	2.38	0.50	2.63	0.75	3.95	0.83	4.37
Poultry Litter	0.03	0.15	0.03	0.15	0.18	0.96	0.18	0.96	0.23	1.23	0.23	1.23
Wet Organic Waste	1.27	6.66	1.27	6.66	0.85	4.48	0.85	4.48	3.10	16.30	3.10	16.30
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	1.54	8.12	1.70	8.93	2.35	12.33	2.58	13.56	3.95	20.74	4.34	22.81
Commercial and Industrial	0.50	2.61	0.52	2.74	2.03	10.69	2.14	11.24	3.37	17.74	3.55	18.64
Landfill Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.25	11.84	0.61	3.23
Sewage Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro	0.06	0.31	0.06	0.31	0.00	0.00	0.00	0.00	0.49	2.53	0.49	2.53
Solar PV	11.68	9.21	13.28	10.47	26.49	20.88	30.10	23.73	43.70	34.45	51.65	40.72
Solar Thermal	9.87	4.32	11.47	5.02	23.00	10.07	26.61	11.66	38.08	16.68	46.02	20.16
Heat Pumps	71.85	163.65	75.85	172.76	177.89	405.16	186.91	425.71	262.19	597.16	282.05	642.40
TOTAL (electricity)	656.97	1,064.32	657.97	1,062.75	1,347.53	2,192.08	1,351.96	2,200.20	2,847.09	4,595.24	2,854.79	4,601.87
Total (heat)	92.64	211.24	99.12	224.54	226.31	515.95	241.47	548.10	347.77	801.95	379.91	867.85

WEST NORTHAMPTONSHIRE

	Daventry				Northampton				South Northamptonshire			
Technology	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)	2020 (MW)	2020 (GWh)	2030 (MW)	2030 (GWh)
Large Wind	1,110.62	1,751.23	1,110.62	1,751.23	16.12	25.42	16.12	25.42	912.95	1,439.53	912.95	1,439.53
Medium Wind	27.88	43.97	27.88	43.97	0.30	0.47	0.30	0.47	18.88	29.77	18.88	29.77
Small Wind	633.34	998.64	633.34	998.64	11.71	18.47	11.71	18.47	544.51	858.59	544.51	858.59
Small Scale Wind <6kW	67.91	95.18	67.91	95.18	6.34	8.89	6.34	8.89	82.51	115.65	82.51	115.65
Managed Woodland (heat)	3.02	11.90	3.02	11.90	0.12	0.47	0.12	0.47	2.76	10.88	2.76	10.88
Managed Woodland (elec)	0.50	3.77	0.50	3.77	0.02	0.15	0.02	0.15	0.45	3.39	0.45	3.39
Energy Crops (heat) Medium	19.83	78.17	21.81	85.98	0.83	3.27	0.91	3.59	13.30	52.43	14.63	57.67
Energy Crops (elec) Medium	3.41	25.69	3.75	28.25	0.14	1.05	0.16	1.21	2.29	17.25	2.52	18.98
Agricultural Arisings	5.07	26.67	5.07	26.67	0.16	0.84	0.16	0.84	5.69	29.90	5.69	29.90
Waste Wood (heat)	0.46	2.44	0.51	2.70	1.57	8.23	1.73	9.09	0.35	1.82	0.38	2.02
Waste Wood (elec)	0.54	2.85	0.60	3.15	1.83	9.60	2.02	10.61	0.41	2.13	0.45	2.35
Poultry Litter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.34	7.04	1.34	7.04
Wet Organic Waste	5.15	27.06	5.15	27.06	0.34	1.80	0.34	1.80	5.65	29.71	5.65	29.71
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	2.81	14.79	3.10	16.27	6.34	33.32	6.97	36.65	3.04	16.00	3.35	17.60
Commercial and Industrial	3.05	16.03	3.21	16.85	10.28	54.03	10.81	56.79	2.28	11.98	2.40	12.59
Landfill Gas	2.75	14.47	0.75	3.95	0.00	0.00	0.00	0.00	0.34	1.78	0.09	0.49
Sewage Gas	0.00	0.00	0.00	0.00	6.25	27.36	6.71	29.41	0.00	0.00	0.00	0.00
Hydro	0.01	0.05	0.01	0.05	0.18	0.93	0.18	0.93	0.14	0.72	0.14	0.72
Solar PV	26.89	21.20	33.53	26.44	67.59	53.29	78.96	62.25	29.40	23.18	36.58	28.84
Solar Thermal	23.31	10.21	29.95	13.12	58.35	25.56	69.72	30.54	25.50	11.17	32.68	14.31
Heat Pumps	157.92	359.68	174.50	397.44	364.03	829.11	392.46	893.87	174.92	398.40	192.87	439.28
TOTAL (electricity)	1,889.94	3,041.61	1,895.42	3,041.47	127.60	235.63	140.81	253.89	1,609.88	2,586.63	1,617.51	2,595.16
Total (heat)	204.54	462.40	229.79	511.14	424.90	866.65	464.94	937.56	216.83	474.70	243.32	524.16

Appendix 4.2

Additional results for energy crops, managed woodland and hydropower

Table 1: Energy crops (high scenario) results

Local Authority (or protected Landscape reporting boundary)	Electricity 2020 (MW)	Electricity 2030 (MW)	Heat MW 2020	Heat MW 2030
Amber Valley	7.30	8.03	42.43	46.67
Bolsover	6.72	7.39	38.66	42.52
Chesterfield	3.23	3.55	18.59	20.45
Derby	0.87	0.95	5.00	5.50
Derbyshire Dales	included in Peak Sub-Region Study Area	included in Peak Sub-Region Study Area	included in Peak Sub-Region Study Area	included in Peak Sub-Region Study Area
Erewash	6.37	7.00	36.63	40.30
High Peak	included in Peak Sub-Region Study Area	included in Peak Sub-Region Study Area	included in Peak Sub-Region Study Area	included in Peak Sub-Region Study Area
North East Derbyshire	16.36	17.99	94.12	103.53
South Derbyshire	20.58	22.64	118.48	130.33
Blaby	11.57	12.72	66.71	73.38
Charnwood	15.14	16.65	88.12	96.93
Harborough	49.26	54.19	292.39	321.63
Hinckley and Bosworth	24.88	27.37	144.13	158.55
Leicester	0.43	0.47	2.45	2.69
Melton	38.75	42.63	232.21	255.43
North West Leicestershire	18.13	19.95	105.37	115.91
Oadby and Wigston	1.11	1.22	6.36	7.00
Rutland	35.69	39.26	212.72	233.99
Boston	0.41	0.45	2.35	2.59
East Lindsey	137.03	150.73	788.54	867.39
Lincoln	0.54	0.59	3.19	3.51
North Kesteven	80.46	88.51	465.97	512.57
South Holland	0.55	0.60	3.14	3.45
South Kesteven	93.79	103.16	548.31	603.14
West Lindsey	139.29	153.22	802.03	882.23
Corby	4.52	4.97	26.65	29.32
Daventry	56.06	61.66	336.55	370.20
East Northamptonshire	57.88	63.66	336.23	369.85
Kettering	17.72	19.49	106.83	117.51
Northampton	0.91	1.00	5.23	5.76
South Northamptonshire	62.41	68.65	364.03	400.43
Wellingborough	14.57	16.02	84.09	92.50
Ashfield	4.58	5.04	26.45	29.10
Bassetlaw	58.09	63.90	339.45	373.39
Broxtowe	3.33	3.67	19.18	21.10
Gedling	7.68	8.45	44.40	48.84
Mansfield	3.81	4.19	21.92	24.11
Newark and Sherwood	69.82	76.81	404.06	444.47
Nottingham	0.19	0.21	1.08	1.19
Rushcliffe	34.68	38.15	200.04	220.04
Peak District Sub-Region Study Area	19.08	20.99	110.01	121.02
Lincolnshire Wolds AONB	45.57	50.13	262.24	288.46
Total	1,169.34	1,286.27	6,806.33	7,486.97

Table 2: Energy Crops (low scenario) results

	Electricity 2020 (MW)	Electricity 2030 (MW)	Heat MW 2020	Heat MW 2030
East Midlands	0.73	0.80	4.22	4.64

Table 3: Results of hydropower assessment using all barriers from the Environment Agency Study

County	Local Authority	MW
Derbyshire	Amber Valley	3.20
	Bolsover	0.05
	Chesterfield	0.34
	Derby	2.64
	Erewash	2.91
	North East Derbyshire	0.32
	South Derbyshire	2.78
Leicestershire	Blaby	0.13
	Charnwood	1.58
	Harborough	0.17
	Hinckley and Bosworth	0.12
	Leicester	0.21
	Melton	0.25
	North West Leicestershire	1.25
	Oadby and Wigston	0.06
	Rutland	0.17
Lincolnshire	Boston	0.08
	East Lindsey	0.20
	Lincoln	0.07
	North Kesteven	0.10
	South Holland	0.11
	South Kesteven	1.24
	West Lindsey	0.15
Lincolnshire Wolds AONB	East Lindsey	0.04
	West Lindsey	0.00
Northamptonshire	Corby	0.07
	Daventry	0.10
	East Northamptonshire	5.07
	Kettering	0.06
	Northampton	0.45
	South Northamptonshire	0.54
	Wellingborough	0.91
Nottinghamshire	Ashfield	0.03
	Bassetlaw	0.55
	Broxtowe	2.73
	Gedling	1.74
	Mansfield	0.03
	Newark and Sherwood	4.19
	Nottingham	2.24
	Rushcliffe	5.90
Total		**42.78**

*Please note that the Local Authorities covered by the Peak Sub-Region Study Area have not been assessed

Table 4: Results of managed woodland Option 1 assessment (2017-2021)

County	Local Authority	Area of woodland (ha)	% of East Midlands woodland	Electricity (MW)	Heat (MW)
Derbyshire	Amber Valley	1,733.1	2.25%	0.29	1.61
	Bolsover	1,115.0	1.45%	0.18	1.03
	Chesterfield	279.0	0.36%	0.05	0.26
	Derby	103.0	0.13%	0.02	0.10
	Erewash	264.9	0.34%	0.04	0.25
	North East Derbyshire	2,205.0	2.86%	0.36	2.04
	South Derbyshire	1,996.9	2.59%	0.33	1.85
Leicestershire	Blaby	175.0	0.23%	0.03	0.16
	Charnwood	1,611.5	2.09%	0.27	1.49
	Harborough	1,518.2	1.97%	0.25	1.41
	Hinckley and Bosworth	1,104.8	1.43%	0.18	1.02
	Leicester	33.8	0.04%	0.01	0.03
	Melton	1,628.1	2.11%	0.27	1.51
	North West Leicestershire	1,788.6	2.32%	0.29	1.66
	Oadby and Wigston	9.6	0.01%	0.00	0.01
	Rutland	1,942.4	2.52%	0.32	1.80
Lincolnshire	Boston	42.7	0.06%	0.01	0.04
	East Lindsey	3,520.0	4.57%	0.58	3.26
	Lincoln	143.3	0.19%	0.02	0.13
	North Kesteven	3,083.6	4.00%	0.51	2.86
	South Holland	28.6	0.04%	0.00	0.03
	South Kesteven	4,311.3	5.59%	0.71	3.99
	West Lindsey	5,810.8	7.54%	0.96	5.38
Lincolnshire Wolds AONB	East Lindsey	1,974.1	2.56%	0.33	1.83
	West Lindsey	450.4	0.58%	0.07	0.42
Northamptonshire	Corby	913.0	1.18%	0.15	0.85
	Daventry	2,032.9	2.64%	0.33	1.88
	East Northamptonshire	4,325.2	5.61%	0.71	4.01
	Kettering	1,535.0	1.99%	0.25	1.42
	Northampton	104.1	0.14%	0.02	0.10
	South Northamptonshire	3,416.7	4.43%	0.56	3.16
	Wellingborough	584.2	0.76%	0.10	0.54
Nottinghamshire	Ashfield	1,221.1	1.58%	0.20	1.13
	Bassetlaw	5,518.7	7.16%	0.91	5.11
	Broxtowe	355.6	0.46%	0.06	0.33
	Gedling	1,415.1	1.84%	0.23	1.31
	Mansfield	835.2	1.08%	0.14	0.77
	Newark and Sherwood	5,961.3	7.73%	0.98	5.52
	Nottingham	173.5	0.23%	0.03	0.16
	Rushcliffe	1,422.3	1.85%	0.23	1.32
Peak District Study Area **(within East Midlands only)**	Derbyshire Dales	6,391.3	8.29%	1.05	5.92
	High Peak	3,668.3	4.76%	0.60	3.40
	North East Derbyshire	340.3	0.44%	0.06	0.32
Total		**77,087.4**	**100.00%**	**12.69**	**71.40**

* Please note that only those parts of the Peak District National Park that are within the East Midlands have been included (to match the Woodfuel Resource Tool data)

Table 5: Assumptions used in the assessment of Option 1 managed woodland calculations

	Stemwood 7-14cm	Stemwood 14-16cm	Stemwood 16-18cm	Stemwood 18+cm	Poor quality	Tips	Branches	Foliage	Total East Midlands)
Oven Dried Tonnes (odt)	10,863	6,955	8,331	87,242	11,433	897	23,838	2,774	152,333
Conversion to electricity	6000odt/MW								
Electricity (MW)	**1.8**	**1.2**	**1.4**	**14.5**	**1.9**	**0.1**	**4.0**	**0.5**	**25.4**
Conversion factor (GJ/odt)	12.5	18.0	18.0	18.0	18.0	12.5	12.5	12.5	
Total GJ	135,788	125,190	149,958	1,570,356	205,794	11,213	297,975	34,675	2,530,948
Conversion to heat (kWh)	80% conversion efficiency								
Total kWh (heat)	30,199,140.0	27,842,256.0	33,350,659.2	349,247,174.4	45,768,585.6	2,493,660.0	66,269,640.0	7,711,720.0	562,882,835.2
Conversion to heat (MW)	45% capacity factor								
Heat (MW)	**7.7**	**7.1**	**8.5**	**88.6**	**11.6**	**0.6**	**16.8**	**2.0**	**142.8**
Uneconomic to harvest	50%								
Alternative markets	Not considered in this option as ownership/level of management is not known								
Total electricity (MW)	**0.9**	**0.6**	**0.7**	**7.3**	**1.0**	**0.1**	**2.0**	**0.2**	**12.7**
Total heat (MW)	**3.8**	**3.5**	**4.2**	**44.3**	**5.8**	**0.3**	**8.4**	**1.0**	**71.4**

Data on oven dried tonnes (odt) extracted from Forest Research Woodfuel Resource Tool for 2017-2021

Appendix 4.3

Results of Assessment of Renewable Energy Potential in CO2 Savings

LINCOLNSHIRE

	Boston		East Lindsey*		Lincoln		North Kesteven		South Holland		South Kesteven		West Lindsey*	
Technology	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)
Large Wind	-133.96	-85.33	-823.03	-524.24	-2.71	-1.72	-754.77	-480.76	-475.54	-302.90	-1,119.78	-713.26	-812.42	-517.49
Medium Wind	-1.58	-1.01	-5.40	-3.44	-0.27	-0.17	-15.71	-10.00	-7.11	-4.53	-25.56	-16.28	-15.90	-10.13
Small Wind	-89.33	-56.90	-506.87	-322.86	-3.56	-2.27	-374.76	-238.71	-268.39	-170.96	-517.87	-329.87	-449.54	-286.34
Small Scale Wind <6kW	-22.84	-14.55	-72.43	-46.14	0.00	0.00	-44.90	-28.60	-47.71	-30.39	-48.66	-31.00	-52.58	-33.49
Managed Woodland (heat)	-0.07	-0.07	-4.12	-4.12	-0.17	-0.17	-4.05	-4.05	-0.04	-0.04	-3.89	-3.89	-5.27	-5.27
Managed Woodland (elec)	-0.03	-0.02	-2.11	-1.34	-0.09	-0.06	-2.08	-1.32	-0.03	-0.02	-1.99	-1.27	-2.70	-1.72
Energy Crops (heat) Medium	-4.75	-5.23	-29.19	-32.11	-4.75	-5.23	-25.58	-28.14	-15.27	-16.79	-26.14	-28.75	-17.88	-19.66
Energy Crops (elec) Medium	-3.98	-2.78	-24.36	-17.09	-3.98	-2.78	-21.37	-14.97	-12.76	-8.94	-21.81	-15.29	-14.93	-10.45
Agricultural Arisings	-9.18	-5.85	-58.36	-37.17	-0.09	-0.06	-35.96	-22.90	-31.55	-20.09	-31.54	-20.09	-40.27	-25.65
Waste Wood (heat)	-0.43	-0.48	-0.65	-0.72	-0.86	-0.95	-0.51	-0.57	-0.49	-0.55	-0.82	-0.91	-0.38	-0.42
Waste Wood (elec)	-0.82	-0.58	-1.24	-0.87	-1.63	-1.15	-0.97	-0.69	-0.94	-0.66	-1.56	-1.10	-0.72	-0.51
Poultry Litter	-0.64	-0.40	-8.99	-5.73	0.00	0.00	-7.92	-5.05	-0.38	-0.24	-0.48	-0.31	-6.65	-4.24
Wet Organic Waste	-2.51	-1.60	-21.69	-13.81	-0.60	-0.38	-5.36	-3.42	-1.76	-1.12	-6.42	-4.09	-11.78	-7.50
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	-3.95	-2.77	-9.66	-6.77	-6.11	-4.28	-7.89	-5.53	-4.86	-3.40	-8.17	-5.72	-5.94	-4.16
Commercial and Industrial	-3.67	-2.46	-5.58	-3.73	-7.31	-4.90	-4.37	-2.93	-4.21	-2.82	-6.99	-4.68	-3.24	-2.17
Landfill Gas	0.00	0.00	-3.12	-0.54	0.00	0.00	-4.73	-0.82	0.00	0.00	-4.66	-0.81	-0.50	-0.09
Sewage Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.26	-0.18
Hydro	0.00	0.00	-0.02	-0.01	0.00	0.00	-0.08	-0.05	0.00	0.00	-1.00	-0.64	-0.20	-0.13
Solar PV	-5.63	-3.82	-12.75	-8.49	-10.87	-8.60	-9.84	-7.04	-8.23	-5.95	-13.57	-10.22	-8.03	-5.57
Solar Thermal	-1.65	-1.78	-3.52	-3.71	-3.24	-4.14	-2.95	-3.37	-2.44	-2.82	-4.04	-4.88	-2.36	-2.60
Heat Pumps	-32.44	-45.39	-75.43	-104.65	-47.71	-73.04	-58.72	-83.78	-48.94	-70.16	-72.14	-105.87	-46.69	-65.85
Total (electricity)	-278.12	-178.06	-1,555.61	-992.24	-37.22	-26.37	-1,290.71	-822.79	-863.46	-552.03	-1,810.06	-1,154.61	-1,425.66	-909.81
Total (heat)	-39.34	-52.94	-112.90	-145.32	-56.73	-83.52	-91.81	-119.90	-67.18	-90.35	-107.02	-144.29	-72.57	-93.79

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

NOTTINGHAM AND NOTTINGHAMSHIRE

	Ashfield		Bassetlaw		Broxtowe		Gedling		Mansfield		Newark and Sherwood		Nottingham		Rushcliffe	
Technology	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)
Large Wind	-9.52	-6.07	-499.99	-318.47	-4.09	-2.61	-20.09	-12.79	-21.43	-13.65	-419.26	-267.05	-1.87	-1.19	-258.09	-164.40
Medium Wind	-1.67	-1.06	-26.61	-16.95	-0.59	-0.37	-0.76	-0.49	-0.67	-0.43	-17.22	-10.97	-0.03	-0.02	-6.39	-4.07
Small Wind	-20.46	-13.03	-255.24	-162.58	-7.66	-4.88	-24.93	-15.88	-12.39	-7.89	-271.98	-173.24	-1.56	-0.99	-172.43	-109.83
Small Scale Wind <6kW	0.00	0.00	-38.87	-24.76	0.00	0.00	-10.85	-6.91	0.00	0.00	-34.83	-22.18	0.00	0.00	-25.33	-16.13
Managed Woodland (heat)	-0.87	-0.87	-6.75	-6.75	-0.33	-0.33	-1.45	-1.45	-0.62	-0.62	-6.73	-6.73	-0.19	-0.19	-1.88	-1.88
Managed Woodland (elec)	-0.45	-0.28	-3.44	-2.19	-0.18	-0.11	-0.74	-0.47	-0.33	-0.21	-3.44	-2.19	-0.09	-0.06	-0.95	-0.60
Energy Crops (heat) Medium	-0.26	-0.28	-15.41	-16.95	-1.12	-1.23	-0.80	-0.88	-0.55	-0.60	-13.41	-14.75	0.00	0.00	-5.81	-6.40
Energy Crops (elec) Medium	-0.21	-0.15	-12.88	-9.02	-0.92	-0.66	-0.68	-0.47	-0.47	-0.32	-11.19	-7.84	0.00	0.00	-4.87	-3.40
Agricultural Arisings	-0.52	-0.33	-13.21	-8.42	-0.62	-0.39	-1.11	-0.71	-0.33	-0.21	-12.38	-7.89	-0.06	-0.04	-8.47	-5.40
Waste Wood (heat)	-0.74	-0.82	-0.68	-0.75	-0.59	-0.65	-0.52	-0.57	-0.61	-0.68	-0.67	-0.74	-2.88	-3.18	-0.63	-0.69
Waste Wood (elec)	-1.40	-0.99	-1.29	-0.91	-1.12	-0.79	-0.98	-0.69	-1.16	-0.82	-1.28	-0.90	-5.47	-3.85	-1.19	-0.84
Poultry Litter	0.00	0.00	-1.52	-0.97	0.00	0.00	-0.09	-0.06	0.00	0.00	-4.81	-3.06	0.00	0.00	-0.54	-0.34
Wet Organic Waste	-1.21	-0.77	-6.31	-4.02	-0.99	-0.63	-1.33	-0.85	-0.63	-0.40	-9.30	-5.93	-0.62	-0.40	-6.51	-4.15
Biomass Co-firing	0.00	0.00	-1,260.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-631.66	0.00
Municipal Solid Waste (MSW)	-7.30	-5.12	-7.31	-5.12	-6.70	-4.70	-7.21	-5.05	-7.51	-5.26	-7.55	-5.29	-25.36	-17.77	-7.58	-5.31
Commercial and Industrial	-5.92	-3.97	-5.45	-3.65	-4.71	-3.16	-4.14	-2.77	-4.92	-3.29	-5.39	-3.61	-23.37	-15.64	-5.03	-3.37
Landfill Gas	-4.58	-0.80	-5.21	-0.90	0.00	0.00	-8.73	-1.52	0.00	0.00	-2.95	-0.51	0.00	0.00	0.00	0.00
Sewage Gas	0.00	0.00	0.00	0.00	-1.76	-1.20	0.00	0.00	-1.04	-0.71	0.00	0.00	0.00	0.00	0.00	0.00
Hydro	0.00	0.00	-0.16	-0.10	-2.97	-1.89	-1.53	-0.97	0.00	0.00	-6.47	-4.12	-1.28	-0.82	-2.63	-1.67
Solar PV	-10.36	-7.17	-10.53	-7.41	-10.08	-7.12	-9.89	-6.85	-10.42	-7.78	-14.56	-12.44	-28.79	-20.25	-11.05	-8.62
Solar Thermal	-3.12	-3.42	-3.05	-3.43	-3.02	-3.39	-3.02	-3.32	-3.17	-3.78	-4.45	-6.14	-8.28	-9.31	-3.38	-4.23
Heat Pumps	-56.22	-79.40	-58.80	-83.54	-53.61	-76.45	-54.30	-76.71	-53.50	-78.44	-67.76	-107.44	-134.99	-193.22	-55.87	-83.72
Total (electricity)	-63.61	-39.73	-2,148.86	-565.47	-42.39	-28.52	-93.06	-56.48	-61.29	-40.97	-822.61	-527.23	-88.51	-61.03	-1,142.71	-328.13
Total (heat)	-61.20	-84.79	-84.70	-111.42	-58.66	-82.06	-60.09	-82.92	-58.45	-84.12	-93.02	-135.80	-146.34	-205.90	-67.56	-96.91

DERBY AND DERBYSHIRE

	Amber Valley		Bolsover		Chesterfield		Derby		Derbyshire Dales*		Erewash		High Peak*		North East Derbyshire**		South Derbyshire	
Technology	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)
Large Wind	-30.68	-19.54	-44.70	-28.47	-3.07	-1.96	-6.18	-3.94	0.00	0.00	-8.27	-5.26	0.00	0.00	-16.02	-10.21	-70.26	-44.76
Medium Wind	-0.49	-0.31	-4.30	-2.74	-0.60	-0.38	-0.01	0.00	0.00	0.00	-0.05	-0.03	0.00	0.00	-1.17	-0.74	-5.94	-3.78
Small Wind	-49.07	-31.26	-51.71	-32.94	-8.84	-5.63	-5.36	-3.42	-7.88	-5.02	-16.62	-10.58	0.00	0.00	-33.16	-21.12	-95.53	-60.85
Small Scale Wind <6kW	-22.88	-14.57	-8.61	-5.48	-0.36	-0.23	0.00	0.00	-8.57	-5.46	-5.39	-3.44	-10.23	-6.52	-19.80	-12.61	-22.57	-14.38
Managed Woodland (heat)	-1.93	-1.93	-1.08	-1.08	-0.32	-0.32	-0.11	-0.11	-5.61	-5.61	-0.30	-0.30	-1.43	-1.43	-2.70	-2.70	-2.42	-2.42
Managed Woodland (elec)	-0.98	-0.62	-0.53	-0.34	-0.18	-0.11	-0.06	-0.04	-9.14	-5.82	-0.15	-0.09	-2.32	-1.48	-1.37	-0.87	-1.25	-0.79
Energy Crops (heat) Medium	-1.08	-1.19	-1.18	-1.30	-0.27	-0.30	-0.27	-0.30	-113.93	-113.93	-0.59	-0.65	0.00	0.00	-2.27	-2.50	-2.93	-3.22
Energy Crops (elec) Medium	-0.89	-0.64	-0.98	-0.68	-0.24	-0.15	-0.24	-0.15	-289.52	-184.41	-0.50	-0.34	0.00	0.00	-1.90	-1.32	-2.43	-1.72
Agricultural Arisings	-0.75	-0.48	-1.81	-1.15	-0.71	-0.45	-0.07	-0.05	-1.16	-0.74	-0.41	-0.26	-0.12	-0.08	-1.29	-0.82	-3.36	-2.14
Waste Wood (heat)	-0.78	-0.87	-0.41	-0.46	-0.77	-0.85	-1.88	-2.08	-0.53	-0.58	-0.59	-0.66	-0.47	-0.52	-0.40	-0.45	-0.44	-0.49
Waste Wood (elec)	-1.49	-1.05	-0.79	-0.55	-1.46	-1.03	-3.58	-2.52	-1.00	-0.70	-1.13	-0.79	-0.90	-0.63	-0.77	-0.54	-0.84	-0.59
Poultry Litter	-0.16	-0.10	-0.32	-0.21	0.00	0.00	0.00	0.00	-2.43	-1.55	0.00	0.00	-0.19	-0.12	-0.32	-0.21	-0.71	-0.45
Wet Organic Waste	-10.73	-6.83	-2.47	-1.57	-0.55	-0.35	-0.22	-0.14	-36.70	-23.37	-2.29	-1.46	-8.85	-5.64	-8.40	-5.35	-10.58	-6.74
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	-7.25	-5.08	-5.68	-3.98	-7.16	-5.02	-20.08	-14.07	-5.53	-3.87	-7.53	-5.27	-6.68	-4.68	-6.87	-4.82	-6.46	-4.53
Commercial and Industrial	-6.62	-4.43	-3.50	-2.34	-6.47	-4.33	-13.43	-8.99	-4.45	-2.98	-5.01	-3.35	-3.98	-2.66	-3.40	-2.28	-3.75	-2.51
Landfill Gas	0.00	0.00	-0.95	-0.16	-10.97	-1.91	0.00	0.00	0.00	0.00	0.00	0.00	-0.50	-0.09	0.00	0.00	-3.45	-0.60
Sewage Gas	0.00	0.00	-2.23	-1.52	0.00	0.00	-5.08	-3.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro	-2.83	-1.80	0.00	0.00	-0.08	-0.05	-2.44	-1.56	-1.50	-0.95	-1.30	-0.83	-1.34	-0.85	-0.08	-0.05	-1.38	-0.88
Solar PV	-10.86	-7.28	-7.59	-5.70	-10.70	-7.62	-21.39	-14.49	-2.74	-1.75	-10.85	-7.77	-1.12	-0.71	-10.13	-7.81	-8.14	-5.71
Solar Thermal	-3.14	-3.34	-2.30	-2.77	-3.05	-3.48	-6.24	-6.70	-11.86	-11.86	-3.16	-3.63	-0.73	-0.73	-3.08	-3.81	-2.40	-2.68
Heat Pumps	-63.38	-88.21	-39.39	-57.86	-54.88	-78.70	-120.59	-168.60	-18.72	-25.54	-57.95	-83.14	-80.82	-110.25	-54.97	-81.45	-47.07	-66.73
Total (electricity)	-145.67	-94.00	-136.16	-87.85	-51.38	-29.22	-78.15	-52.84	-370.60	-236.62	-59.51	-39.50	-36.24	-23.46	-104.68	-68.75	-236.66	-150.43
Total (heat)	-70.32	-95.54	-44.36	-63.46	-59.30	-83.65	-129.10	-177.80	-150.65	-157.52	-62.59	-88.37	-83.44	-112.93	-63.43	-90.90	-55.26	-75.54

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

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

NORTHAMPTONSHIRE

	Corby		Daventry		East Northamptonshire		Kettering		Northampton		South Northamptonshire		Wellingborough	
Technology	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)
Large Wind	-84.02	-53.51	-689.81	-439.38	-627.80	-399.88	-256.31	-163.26	-10.01	-6.38	-567.03	-361.18	-84.37	-53.74
Medium Wind	-1.86	-1.18	-17.32	-11.03	-7.39	-4.71	-7.01	-4.46	-0.19	-0.12	-11.73	-7.47	-4.26	-2.71
Small Wind	-23.40	-14.90	-393.37	-250.56	-249.86	-159.15	-130.78	-83.30	-7.28	-4.63	-338.20	-215.42	-49.73	-31.67
Small Scale Wind <6kW	-5.40	-3.44	-37.49	-23.88	-22.83	-14.54	-11.62	-7.40	-3.50	-2.23	-45.55	-29.02	-6.25	-3.98
Managed Woodland (heat)	-1.46	-1.46	-2.88	-2.88	-3.67	-3.67	-1.80	-1.80	-0.11	-0.11	-2.63	-2.63	-0.52	-0.52
Managed Woodland (elec)	-0.74	-0.47	-1.48	-0.95	-1.87	-1.19	-0.92	-0.59	-0.06	-0.04	-1.34	-0.85	-0.27	-0.17
Energy Crops (heat) Medium	-0.51	-0.56	-12.12	-13.33	-9.27	-10.20	-7.14	-7.85	-0.51	-0.56	-8.13	-8.94	-2.28	-2.51
Energy Crops (elec) Medium	-0.42	-0.30	-10.12	-7.09	-7.75	-5.42	-5.96	-4.18	-0.42	-0.30	-6.80	-4.76	-1.90	-1.34
Agricultural Arisings	-1.83	-1.17	-10.51	-6.69	-15.17	-9.66	-4.31	-2.75	-0.33	-0.21	-11.78	-7.50	-6.10	-3.89
Waste Wood (heat)	-0.47	-0.52	-0.59	-0.65	-0.42	-0.47	-0.58	-0.64	-1.99	-2.20	-0.44	-0.49	-0.51	-0.43
Waste Wood (elec)	-0.89	-0.63	-1.12	-0.79	-0.81	-0.57	-1.10	-0.78	-3.78	-2.66	-0.84	-0.59	-0.96	-0.68
Poultry Litter	0.00	0.00	0.00	0.00	-0.77	-0.49	0.00	0.00	0.00	0.00	-2.77	-1.77	-0.24	-0.16
Wet Organic Waste	-0.51	-0.33	-10.66	-6.79	-4.47	-2.85	-3.15	-2.01	-0.71	-0.45	-11.70	-7.45	-1.09	-0.70
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	-4.07	-2.85	-5.83	-4.08	-4.91	-3.44	-6.27	-4.39	-13.12	-9.20	-6.30	-4.42	-4.64	-3.25
Commercial and Industrial	-5.02	-3.36	-6.31	-4.23	-4.53	-3.03	-6.21	-4.16	-21.28	-14.25	-4.72	-3.16	-5.40	-3.61
Landfill Gas	-7.57	-1.31	-5.70	-0.99	-2.33	-0.41	-1.27	-0.22	0.00	0.00	-0.70	-0.12	-3.14	-0.54
Sewage Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-10.78	-7.38	0.00	0.00	0.00	0.00
Hydro	-0.12	-0.08	-0.02	-0.01	-4.60	-2.93	0.00	0.00	-0.37	-0.23	-0.29	-0.18	-0.81	-0.52
Solar PV	-8.90	-8.20	-8.35	-6.63	-8.45	-6.37	-10.56	-8.59	-20.99	-15.62	-9.13	-7.24	-9.02	-7.40
Solar Thermal	-2.77	-4.12	-2.47	-3.17	-2.53	-3.06	-3.22	-4.22	-6.18	-7.39	-2.70	-3.46	-2.70	-3.59
Heat Pumps	-34.45	-58.99	-43.45	-65.50	-44.35	-65.18	-49.47	-76.35	-100.16	-147.31	-48.13	-72.39	-41.07	-63.89
Total (electricity)	-144.75	-91.74	-1,198.09	-763.11	-963.54	-614.65	-445.47	-286.08	-92.81	-63.70	-1,018.87	-651.13	-178.17	-114.36
Total (heat)	-39.65	-65.65	-61.51	-85.53	-60.25	-82.58	-62.21	-90.87	-108.96	-157.57	-62.03	-87.92	-47.06	-70.93

LEICESTER, LEICESTERSHIRE AND RUTLAND

	Blaby		Charnwood		Harborough		Hinckley and Bosworth		Leicester		Melton		North West Leicestershire		Oadby and Wigston		Rutland	
Technology	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)
Large Wind	-13.62	-8.68	-102.02	-64.98	-466.72	-297.28	-111.16	-70.81	0.00	0.00	-607.06	-386.68	-39.92	-25.43	-2.56	-1.63	-255.92	-163.01
Medium Wind	-0.89	-0.57	-1.72	-1.10	-13.60	-8.66	-2.41	-1.53	0.00	0.00	-9.19	-5.85	-1.14	-0.73	-0.07	-0.04	-6.37	-4.06
Small Wind	-30.82	-19.63	-104.70	-66.69	-301.05	-191.76	-123.36	-78.58	-0.21	-0.13	-291.19	-185.48	-64.74	-41.24	-2.10	-1.33	-100.87	-64.25
Small Scale Wind <6kW	-3.55	-2.26	-13.79	-8.78	-30.82	-19.63	-19.13	-12.19	0.00	0.00	-23.51	-14.97	-22.01	-14.02	0.00	0.00	-27.14	-17.28
Managed Woodland (heat)	-0.20	-0.20	-2.19	-2.19	-1.66	-1.66	-1.35	-1.35	-0.04	-0.04	-1.94	-1.94	-2.37	-2.37	-0.02	-0.02	-2.07	-2.07
Managed Woodland (elec)	-0.09	-0.06	-1.13	-0.72	-0.86	-0.55	-0.68	-0.43	-0.03	-0.02	-0.98	-0.62	-1.22	-0.77	0.00	0.00	-1.07	-0.68
Energy Crops (heat) Medium	-0.73	-0.81	-2.52	-2.77	-9.68	-10.64	-4.43	-4.88	-0.27	-0.30	-9.72	-10.69	-4.49	-4.94	-0.73	-0.81	-5.24	-5.76
Energy Crops (elec) Medium	-0.62	-0.43	-2.11	-1.47	-8.07	-5.65	-3.71	-2.59	-0.24	-0.15	-8.10	-5.69	-3.74	-2.63	-0.62	-0.43	-4.36	-3.06
Agricultural Arisings	-1.27	-0.81	-3.24	-2.06	-8.25	-5.26	-3.84	-2.45	-0.10	-0.06	-8.08	-5.15	-2.93	-1.86	-0.05	-0.03	-12.42	-6.65
Waste Wood (heat)	-0.77	-0.85	-0.97	-1.07	-0.55	-0.61	-0.61	-0.67	-2.48	-2.74	-0.32	-0.36	-0.80	-0.88	-0.30	-0.33	-0.23	-0.25
Waste Wood (elec)	-1.46	-1.03	-1.85	-1.30	-1.05	-0.74	-1.15	-0.81	-4.72	-3.32	-0.61	-0.43	-1.51	-1.06	-0.56	-0.39	-0.43	-0.30
Poultry Litter	-0.08	-0.05	-0.96	-0.61	0.00	0.00	-0.16	-0.10	0.00	0.00	-0.70	-0.45	0.00	0.00	0.00	0.00	-0.06	-0.04
Wet Organic Waste	-3.88	-2.47	-5.79	-3.69	-15.47	-9.85	-9.57	-6.10	-0.57	-0.36	-12.24	-7.79	-5.55	-3.54	-0.51	-0.33	-2.62	-1.67
Biomass Co-firing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste (MSW)	-5.83	-4.09	-8.66	-6.07	-6.27	-4.39	-6.77	-4.75	-20.21	-14.16	-3.52	-2.47	-6.91	-4.84	-2.76	-1.94	-3.20	-2.24
Commercial and Industrial	-6.86	-4.59	-8.68	-5.81	-4.92	-3.29	-5.42	-3.63	-25.72	-17.22	-2.88	-1.93	-7.10	-4.76	-2.64	-1.77	-1.03	-0.69
Landfill Gas	-11.61	-2.02	-2.40	-0.42	-7.56	-1.31	-4.01	-0.70	0.00	0.00	0.00	0.00	-8.64	-1.50	0.00	0.00	0.00	0.00
Sewage Gas	0.00	0.00	-8.62	-5.90	0.00	0.00	-0.49	-0.34	0.00	0.00	-1.32	-0.90	0.00	0.00	0.00	0.00	0.00	0.00
Hydro	-0.14	-0.09	-0.59	-0.38	0.00	0.00	0.00	0.00	-0.12	-0.08	0.00	0.00	-1.10	-0.70	-0.02	-0.01	-0.12	-0.08
Solar PV	-8.39	-6.18	-13.64	-9.08	-7.44	-5.05	-10.19	-7.45	-29.10	-21.30	-4.72	-3.31	-8.61	-5.92	-4.50	-3.04	-3.63	-2.63
Solar Thermal	-2.54	-2.99	-4.00	-4.22	-2.11	-2.28	-3.01	-3.53	-8.43	-9.91	-1.35	-1.52	-2.41	-2.64	-1.31	-1.41	-1.05	-1.22
Heat Pumps	-48.30	-69.86	-76.89	-106.76	-43.63	-61.01	-54.76	-79.27	-133.72	-195.53	-26.43	-37.49	-50.81	-71.37	-26.70	-37.27	-19.77	-28.47
Total (electricity)	-89.12	-52.95	-279.89	-179.06	-872.08	-553.43	-302.05	-192.43	-81.00	-56.80	-974.11	-621.73	-175.11	-108.99	-16.39	-10.96	-419.23	-266.64
Total (heat)	-52.55	-74.71	-86.58	-117.02	-57.63	-76.20	-64.16	-89.69	-144.94	-208.52	-39.75	-51.99	-60.87	-82.19	-29.06	-39.83	-28.35	-37.77

PROTECTED LANDSCAPES

	Peak District NP		Lincolnshire Wolds AONB	
Technology	mtCO2 saved (2020)	mtCO2 saved (2030)	mtCO2 saved (2020)	mtCO2 saved (2030)
Large Wind	0.00	0.00	0.00	0.00
Medium Wind	0.00	0.00	0.00	0.00
Small Wind	0.00	0.00	0.00	0.00
Small Scale Wind <6kW	-4.99	-3.18	-14.49	-9.23
Managed Woodland (heat)	-22.48	-22.48	-3.62	-3.62
Managed Woodland (elec)	-36.59	-23.31	-1.84	-1.17
Energy Crops (heat) Medium	0.00	0.00	-10.23	-11.25
Energy Crops (elec) Medium	0.00	0.00	-8.55	-5.99
Agricultural Arisings	*	*	*	*
Waste Wood (heat)	*	*	*	*
Waste Wood (elec)	*	*	*	*
Poultry Litter	*	*	*	*
Wet Organic Waste	*	*	*	*
Biomass Co-firing	*	*	*	*
Municipal Solid Waste (MSW)	*	*	*	*
Commercial and Industrial	*	*	*	*
Landfill Gas	*	*	*	*
Sewage Gas	*	*	*	*
Hydro	-2.36	-1.51	0.00	0.00
Solar PV	-3.55	-2.26	-1.10	-0.86
Solar Thermal	-22.51	-22.51	-0.31	-0.40
Heat Pumps	-0.72	-0.99	-5.72	-8.55
Total (electricity)	-47.50	-30.25	-25.98	-17.25
Total (heat)	-45.71	-45.98	-19.88	-23.82

* Figures for these technologies are reported in the relevant Local Authority as it was not possible to disaggregate the results between protected landscapes and the rest of the Local Authority

Appendix 4.4

Summary of conversion factors

The following appendix presents the conversion factors which have been used to calculate the generation capacity (in GW/h) associated with each form of renewable energy.

Capacity factors used to calculate generation capacity for each renewable energy resource (ie converting MW installed capacity to GWh generation capacity)

Technology Type	Capacity factors	Source of capacity factors
Commercial scale wind	18%	Ofgem Renewables Register June 2010
Small scale wind	16%	SEE-STATS June 2010
Managed woodland as electricity	86%	Ofgem Renewables Register June 2010
Managed woodland as heat only	45%	Carbon Trust (2009), Biomass heating a practical guide for potential users
Energy crops as electricity	86%	Ofgem Renewables Register June 2010
Energy crops as heat only	45%	Carbon Trust (2009), Biomass heating a practical guide for potential users
Waste wood as electricity	60%	DECC's digest of UK Energy Statistics
Waste wood as heat	60%	DECC's Digest of UK Energy Statistics
Agricultural arisings	60%	as for managed woodland
Poultry litter	60%	DECC's digest of UK Energy Statistics
Biomass co-firing	90%	DTI (2007) Meeting the Energy Challenge (Annex B: Overview of Modelling of the Relative Electricity Generating Costs of Different Technologies)
Municipal solid waste	60%	DECC's digest of UK Energy Statistics
Commercial and industrial waste	60%	DECC's digest of UK Energy Statistics
Wet organic	60%	DECC Energy Trends June 2010
Landfill gas	60%	DECC 2010 Renewable Electricity in Scotland, Wales, Northern Ireland and the regions of England 2009
Sewage gas	50%	DECC 2010 Renewable Electricity in Scotland, Wales, Northern Ireland and the regions of England 2009
Hydro	59%	SEE-STATS June 2010
Solar - PV	9%	SEE-STATS June 2010
Solar - hot water	5%	NERA/AEA UK Supply Curve for Renewable Heat
Heat pumps	26%	NERA/AEA UK Supply Curve for Renewable Heat

GW/h = Amount in MW x 365 (days in year) x 24 (hours in day) x capacity factor)

Conversion factors used to calculate carbon emitted from each renewable energy resource

Technology Type	$CO2_2$ Emitted ($MtCO_2/GWh$)	Source of conversion factors
Commercial scale wind	0	Ofgem Renewables Register June 2010
Small scale wind	0	SEE-STATS June 2010
Managed woodland as electricity	0	Ofgem Renewables Register June 2010
Managed woodland as heat only	0	Carbon Trust Biomass Heating a Practical Guide for Potential Users 2009
Energy crops as electricity	0	*as for managed woodland*
Energy crops as heat only	0	*as for managed woodland heat only*
Waste wood as electricity	0	*as for managed woodland*
Waste wood as heat only	0	*as for managed woodland heat only*
Agricultural arisings	0	*as for managed woodland*
Poultry litter	0	DECC Energy Trends June 2010
Biomass co-firing	0	Ofgem Renewables Register June 2010
Municipal solid waste	0	DECC Energy Trends June 2010
Commercial and industrial waste	0	*as for MSW*
Wet organic	0	DECC Energy Trends June 2010
Landfill gas	0	Ofgem Renewables Register June 2010
Sewage gas	0	SEE-STATS June 2010
Hydro	0	SEE-STATS June 2010
Solar - PV	0	SEE-STATS June 2010
Solar - hot water	0	NERA/AEA UK Supply Curve for Renewable Heat
Heat Pumps - 2009/2020	0.1212	NERA/AEA UK Supply Curve for Renewable Heat + HM Treasury/DECC 'Valuation of energy use and greenhouse gas emissions for appraisal and evaluation' June 2010
Heat Pumps - 2031	0.0772	NERA/AEA UK Supply Curve for Renewable Heat + HM Treasury/DECC 'Valuation of energy use and greenhouse gas emissions for appraisal and evaluation' June 2010

Conversion factors used to calculate carbon displaced from each renewable energy resource

Technology Type	CO_2 Displaced ($MtCO_2/GWh$) 2009	CO_2 Displaced ($MtCO_2/GWh$) 2031	Source of conversion factors
Commercial scale wind	-0.3939	-0.2509	HM Treasury/DECC 'Valuation of energy use and greenhouse gas emissions for appraisal and evaluation' June 2010
Small scale wind	-0.3939	-0.2509	
Managed woodland as electricity	-0.3939	-0.2509	
Managed woodland as heat only	-0.242	-0.242	Calculated from DECC 'Total sub-national final energy consumption' Revised June 2010
Energy crops as electricity	-0.3939	-0.2509	HM Treasury/DECC 'Valuation of energy use and greenhouse gas emissions for appraisal and evaluation' June 2010
Energy crops as heat only	-0.155	-0.155	Calculated from DECC 'Total sub-national final energy consumption' Revised June 2010
Waste wood as electricity	-0.3939	-0.2509	HM Treasury/DECC 'Valuation of energy use and greenhouse gas emissions for appraisal and evaluation' June 2010
Waste wood as heat only	-0.242	-0.242	Calculated from DECC 'Total sub-national final energy consumption' Revised June 2010
Agricultural arisings	-0.3939	-0.2509	HM Treasury/DECC 'Valuation of energy use and greenhouse gas emissions for appraisal and evaluation' June 2010
Poultry litter	-0.3939	-0.2509	
Biomass co-firing	-0.3939	-0.2509	
Municipal solid waste	-0.3939	-0.2509	
Commercial and industrial waste	-0.3939	-0.2509	
Wet organic	-0.3939	-0.2509	
Landfill gas	-0.3939	-0.2509	
Sewage gas	-0.3939	-0.2509	
Hydro	-0.3939	-0.2509	
Solar - PV	-0.3939	-0.2509	
Solar - hot water	-0.242	-0.242	Calculated from DECC 'Total sub-national final energy consumption' Revised June 2010
Heat Pumps - 2009/2020	-0.242	-0.242	