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Building Engineering - Sustainability

Local Government Yorkshire and Humber

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Low carbon and renewable energy capacity in Yorkshire and Humber

Final report

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Final report

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Executive Summary

1 Executive Summary

This study was commissioned by Local Government Yorkshire and Humber to assess the resource for low carbon and renewable energy generation across the Yorkshire and Humber region. The findings of this study provide an evidence base to assist sub-regional stakeholders and local authorities in the preparation of their own targets, policies and strategies for renewable energy development at the sub-regional and local levels.

1.1 The opportunity

Through the Climate Change Act, the UK has established a legally binding target to reduce carbon emissions by 80% on 1990 levels by 2050. The UK is also committed to generate at least 15% of energy demand from renewable energy sources by 2020. This will require new approaches to the way we generate and supply energy and manage energy demand.

The geographical characteristics of the Yorkshire and Humber region, combined with a comprehensive infrastructure network inherited from its legacy of industry and energy production, means that the region has great potential to exploit a range of renewable energy technologies.

Renewable energy has the benefit of zero net carbon dioxide emissions, and can play an important role in enabling the Yorkshire and Humber region to meet its share of national carbon targets.

Renewable energy can also deliver substantial economic, social and environmental benefits at the local and regional level, by creating jobs, through the manufacture, installation, operation and maintenance of renewable energy technologies, as well as providing a new impetus for rural diversification and regeneration.

1.2 Objectives of the study.

The objectives of this study were:

- To provide an assessment of the potential for low carbon and renewable energy across the region in a clear and justifiable way that is consistent with the other English regions, and meets the requirements of national government for such studies;
- To provide a common and robust evidence base on the potential for renewable energy to inform and support policy making by individual local authorities in the region, as part of developing their local development documents;
- To identify strategic delivery actions, for each of the four sub regions, to tackle strategic barriers and facilitate deployment of renewable energy opportunities.

1.3 Summary of renewable energy resource

This study has found that by 2025 the region has the potential resource to install approximately 5,500 MW of renewable energy generation capacity (around 3,600 MW of renewable electricity plus around 1,900 MW of renewable heat) and generate around 16,100 GWh of renewable energy annually. (These figures exclude biomass co-firing in coal fired power stations, large scale power generation from dedicated biomass power stations taking imported biomass as feedstock, and offshore wind and marine renewables).

This would represent nearly a fivefold increase on existing operational and consented capacity. The main contributions to the resource, excluding offshore technologies and biomass co-firing, come from commercial scale wind and biomass energy generation. The resource is spread across the sub regions (see Figure 1 below).

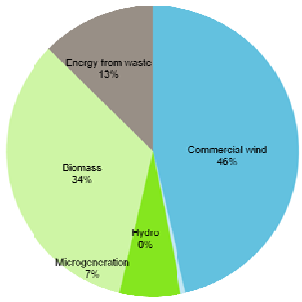

Figure 1 Distribution of potential renewable energy resource (annual energy output) in Yorkshire and Humber by technology

Yorkshire and Humber is currently slightly behind the other English regions in terms of installed renewable energy capacity, but is catching up fast. Further activity to encourage wider understanding of renewable energy amongst planning officers, members and local communities through education and awareness raising could help to increase deployment. Region wide or sub-regional guidance for planning officers on the interpretation of planning application material would be welcomed by developers. Adopting design principles, such as those produced by Scottish Natural Heritage on the cumulative effect of wind farms, could also encourage consistency in assessing applications.

1.4 Larger scale renewable electricity generation

Commercial scale wind energy represents a key opportunity for increasing the renewable energy capacity. Most of the economically viable resource lies in a band going through the centre of the region from north to south and along the east coast of the region in East Riding of Yorkshire.

Hydropower has an important but limited role to play, particularly by bringing Yorkshire's rich heritage of mills back into use and increasing awareness of the benefit of renewables.

The majority of the potential biomass energy resource is located in York and North Yorkshire, where there are particular opportunities for growing energy crops, whilst avoiding any potential conflicts with food security. Straw also represents a significant resource for the region, with a large potential resource in the Hull and Humber Ports sub-region, and there are proposals for several schemes that could utilise this resource.

Biomass co-firing in the three coal fired power stations in the region is a current and future significant source of renewable energy capacity in the region. There is the potential for a proportion of the region's biomass resource to be used for this co-firing, as well as in dedicated biomass power and CHP plants.

In general, the electricity distribution network is sufficiently equipped to deal with the expected increase in renewable energy deployment, although some parts of the network in the Humber area may need to be upgraded to meet demand.

1.5 Larger scale renewable heat generation

There is potential for new biomass and waste energy facilities in the region to be configured and operated in a Combined Heat and Power (CHP) mode, to enable them to supply heat as well as generate electricity. This has the potential to maximise the efficiency of any facility, in terms of the useful energy recovered from the fuel, as well as any carbon savings. However, this requires such facilities to be co-located with heat demands, either residential, commercial or industrial loads that can be supplied heat via a district heating network.

The study has found that district heating with CHP could be viable in the majority of the region's urban settlements. However, installing a district heating network is a major capital investment and there is a limited range of proven stewardship and procurement models. The biomass fuel supply chain in the Yorkshire and Humber region is currently in its infancy and the market conditions are variable. There is a potential role for local authorities to collaborate with the sub-regional bodies to establish a supply chain to provide some degree of long term stability.

At least three energy from waste plants are currently in development in the region. A number of waste disposal contracts are due to be retendered in the short to medium term and these could provide the opportunity to co-locate energy from waste facilities with major heat loads and the opportunity for stakeholders in the region to maximise the energy and carbon benefit of these schemes by stipulating that they supply low carbon heat into local heating networks.

1.6 Production of biogas

Biogas can be produced from anaerobic digestion of crops, segregated food waste, and mixed municipal, commercial and industrial waste streams. Landfill gas and sewage gas production currently represents around 20% of regional renewable energy generation, and it is all used to generate electricity.

With appropriate cleaning techniques, biogas can be injected directly into the existing gas network and used in homes without modification to appliances and avoiding the need for investment in new distribution infrastructure. The region has an extensive and robust gas distribution network but policy needs to provide the necessary incentives in order to encourage synthetic gas production. This will be out of the hands of local authority and sub regional partners, although lobbying of government on the issue may help to form policy development.

1.7 Microgeneration

Microgeneration typically refers to the array of small scale technologies that can be integrated into new building development or retrofitted to existing buildings. The Feed In Tariff has resulted in a dramatic increase in the number of electricity generating, microgeneration technologies installed in the region. The Renewable Heat Incentive is likely have a similar effect on the deployment of heat generating, microgeneration technologies.

Capabilities on project:
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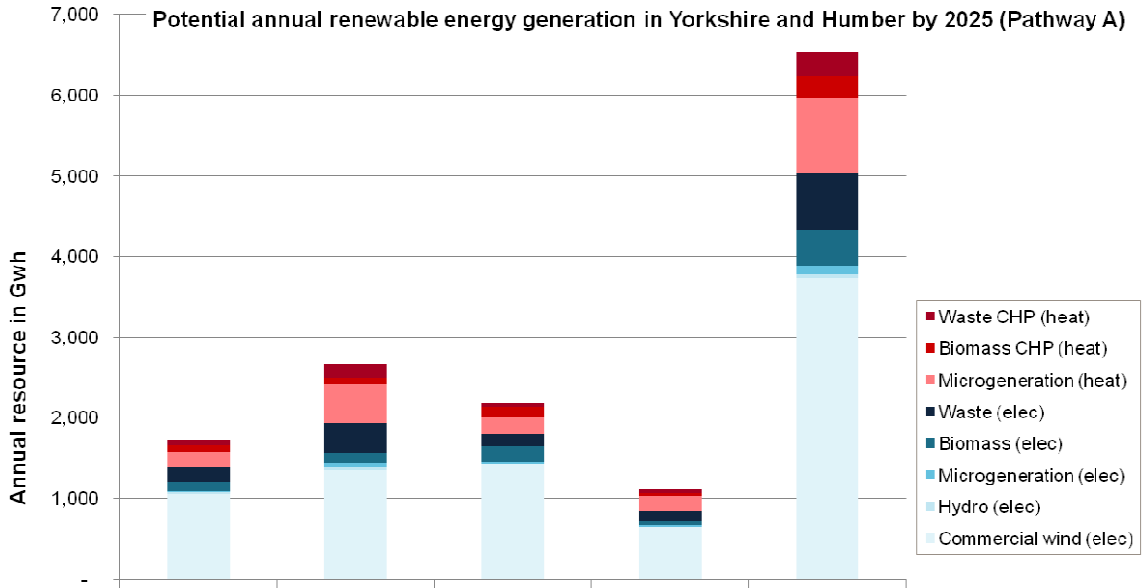

	York and North Yorkshire	Leeds City Region	Hull and Humber Ports City Region	South Yorkshire	Yorkshire and Humber
Waste CHP (heat)	70	162	55	58	296
Biomass CHP (heat)	76	81	123	32	276
Microgeneration (heat)	195	488	207	183	926
Waste (elec)	178	359	160	122	706
Biomass (elec)	122	130	197	52	442
Microgeneration (elec)	16	63	16	25	106
Hydro (elec)	17	34	0	5	44
Commercial wind (elec)	1,050	1,344	1,428	642	3,736

Figure 2 Distribution of renewable energy resource for Yorkshire and Humber by sub region (for renewable energy Pathway A)

1.8 Using the resource effectively

Scenario modelling suggests that with an ambitious but reasonable attempt to increase energy efficiency of the building stock, it should generally be possible for the Yorkshire and Humber region to meet its share of the UK's 15% renewable energy target, mainly due to the significant resource for renewable electricity generation from commercial scale wind energy turbines and the significant contribution from biomass co-firing. Achieving the necessary levels of renewable heat generation is likely to be challenging.

It should also be noted that the available renewable energy resource will be under demand from other sectors, such as transport, agriculture, industry and commerce. A coordinated approach to delivery will be necessary to ensure that the available resource is used as efficiently as possible.

1.9 Using the outputs of the study

A suite of Energy Opportunities Plans has been produced as a resource for assessment and prioritisation of opportunities. These should provide a tool when developing planning policies, targets and delivery mechanisms within the LDF process, and can bring added benefit and support to development plan documents. They can be used to support policies that stipulate requirements for renewable energy, whether these are through the setting of targets that exceed Building Regulations, the requirement for Code for Sustainable Homes or BREEAM, or a requirement for connecting to, or investing in, infrastructure to facilitate district heating.

They can also be used to inform actions in corporate strategies, as well as investment decisions taken by the sub regional bodies and local enterprise partnerships.

Although the Energy Opportunities Plans provide an overview of potentially feasible technologies and systems within the region, they do not replace the need for site specific feasibility studies for proposed sites.

1.10 Keeping the study relevant

Collating data on renewable energy installations has proved to be a major challenge and highlights the need for a coordinated approach to be taken to maintaining up to date information on new installations.

Ideally, the conclusions of the study should evolve to reflect changes in policy and targets. The 2010/11 Climate Change Skills Fund for Yorkshire and Humber could be used to facilitate this process. The quantitative information and spatial datasets should be made available to stakeholders in a live format that can be easily kept up to date. A web-based GIS system would be the most accessible way of presenting the information. It could be linked to the Yorkshire and Humber Renewable Energy toolkit, although questions around ownership of the datasets and maintenance requirements would have to be addressed.

An online forum was set up online to encourage discussion amongst stakeholders. This is located at www.yorkshirehumberrenewables.maxforum.org and could also form part of a dissemination package.

1.11 Strategy for delivery

This study provides an action plan for delivery of low carbon and renewable energy for each of the four functional sub regions, developed in collaboration with key stakeholders.

One of the key challenges facing delivery will be constraints on public spending and the availability of public sector funding for infrastructure. Tightening Building Regulations and zero carbon building policy will create demand for low carbon solutions on new developments. This could create a cost effective opportunity to increase the region's low carbon and renewable energy capacity.

While the study has explored a time horizon of 10-15 years, most of the actions needed to ensure delivery are in the short term. This partly relates to the urgency of mitigating climate change, meeting energy targets and improving security of energy supply, but also to the timing of new development, with many of the major regeneration areas (such as the Aire Valley) already having masterplans or development briefs or in the process of preparing them.

Local authorities and sub regional bodies will also need to ensure that the plans developed take into account the needs and ambitions of the local community and are fully supported. This will require genuine consultation and strong leadership.

1.12 Recommendations

Although there are specific actions and recommendations for each city region/ sub region, there are a number of common key strategic actions to facilitate the deployment of renewable energy. These are as follows:

1. Develop local policies and targets to support renewable energy in the LDF process, including policies for new development and strategic sites (including viability testing).
2. Develop greater understanding of the relationship between renewable energy development and the sub-region's landscape character and natural environment.
3. Educate communities, authorities and members about appropriate technologies for the sub-region.
4. Develop skills in local communities and support mechanisms to help communities deliver renewable energy schemes.
5. Investigate and integrate local manufacture and management of renewable energy technologies within local economic strategies.
6. Identify delivery vehicles, and the role and capacity of local authorities to assist in delivery.
7. Share local knowledge and skills through a coordinated forum.
8. Stimulate the development of regional biomass supply markets.
9. Identify a lead coordinator for activity in the sub-region, who can act as a promotional lead and also coordinate funding to local priorities.
10. Identify opportunities on brownfield land for renewable energy installations in tandem with regeneration and redevelopment initiatives.

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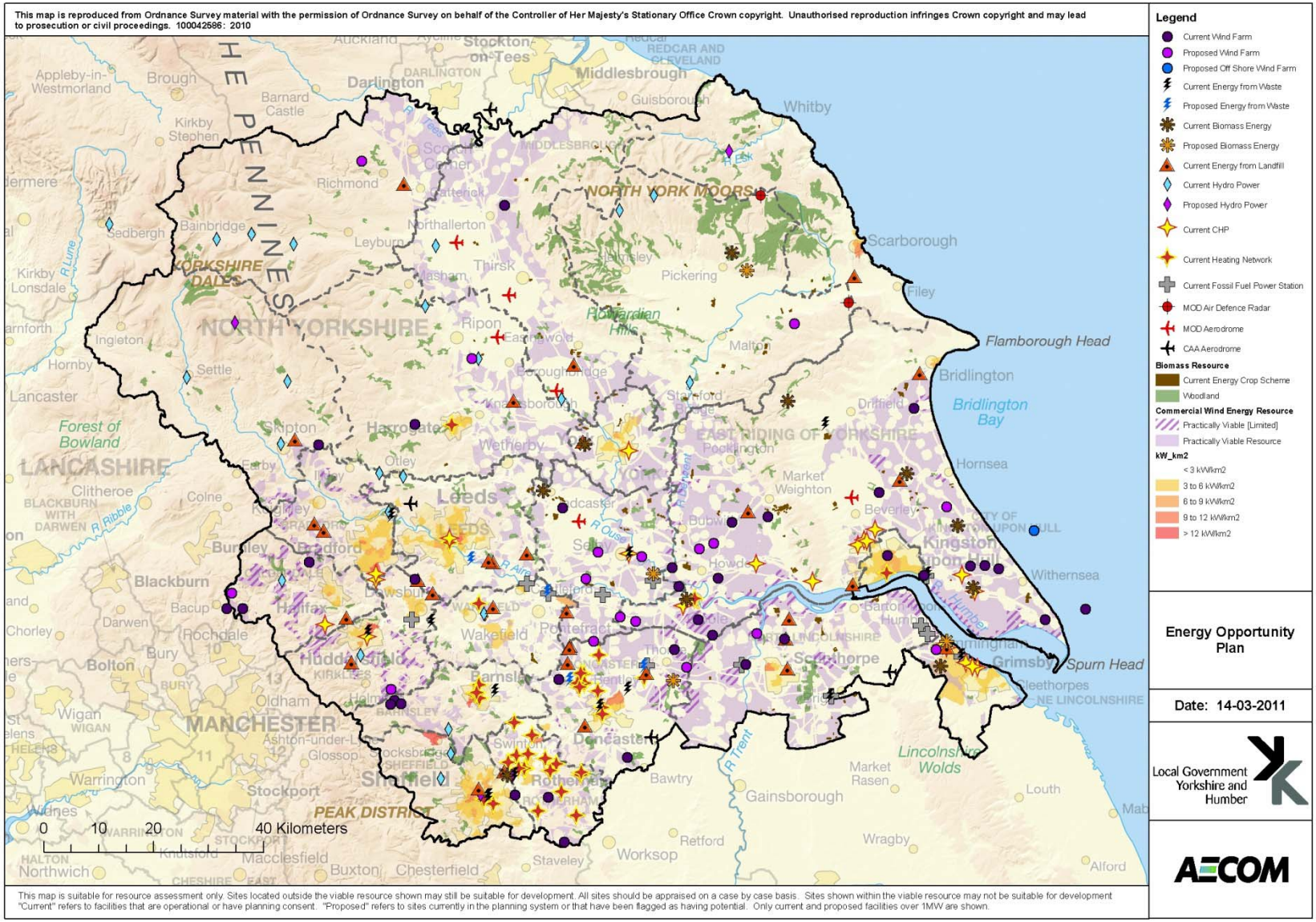

Figure 3 Energy Opportunities Plan for the Yorkshire and Humber region. “Current” refers to facilities that are operational or have planning consent. “Proposed” refers to facilities currently in the planning system or sites that have been flagged as having potential. Only current and proposed facilities over 1MW are shown. The areas with purple hatched shading described as “Practically viable [Limited]” represent areas where commercial scale wind energy development should be viable but the number of turbines may be restricted due to environmental constraints. Please refer to section 5.15 and appendix A for more details.

Introduction

2 Introduction

AECOM was commissioned by Local Government Yorkshire and Humber to produce a robust evidence base of the potential for low carbon and renewable energy generation in the Yorkshire and Humber region.

2.1 The study area

The local authorities in the region have been working together as functional sub-areas, to share the burden of producing some of the evidence base needed for policy-making and develop an approach to strategic issues which goes beyond local authority boundaries. These were reflected in the preparation of the Yorkshire and Humber Plan to provide a more local context to strategy making and implementation.

Figure 4 Functional sub-regions in the Yorkshire and Humber region (Source: Local Government Yorkshire and Humber, 2010).

Recently these areas have become more formalised as Leeds, Sheffield and Hull and Humber Ports have established themselves as City-Regions and North Yorkshire and York are recognised as a sub-region with a Local Authority Leaders Board. These arrangements have come under further change as a result of the Coalition Government's invitation for groups of Local Authorities to form Local Enterprise Partnerships (LEPs). At the time of writing, Leeds City Region, Sheffield City Region and North Yorkshire and York are at various stages of advancing proposals to become LEPs. The situation in the Hull and Humber Ports City Region is less clear. This study will report on a regional, sub-regional and local authority geography. The sub-regional geography will comprise the sub-regions shown in Figure 4, some of which overlap.

Some of the local authorities that comprise the Sheffield City Region are in the East Midlands Region. Broad conclusions have been made for the City-Region as a whole but the data collected relates primarily to the South Yorkshire authorities only i.e. Sheffield City Council, Rotherham Metropolitan Borough Council, Doncaster Metropolitan Borough Council and Barnsley Metropolitan Borough Council.

2.2 Background to study

This study contributes to the already significant body of research on low carbon and renewable energy generation in Yorkshire and Humber. In particular, it builds upon the Planning for Renewable Energy Targets in Yorkshire and Humber study, completed by AEA Technology in 2004 on behalf of the Government Office for Yorkshire and Humber and the Yorkshire and Humber Assembly and hereafter referred to as “SREATS.”

The SREATS study focused on the potential capacity for electricity generation, and did not consider the potential for supplying renewable and low carbon heat. The results identified potential renewable energy targets at a regional, sub-regional and local authority level from 2010 to 2021, which fed into preparation of the Yorkshire and Humber Plan.

2.3 Objectives of the study

The key objectives of this study were:

- To provide an assessment of the potential for low carbon and renewable energy across the region in a clear and justifiable way that is consistent with the other English regions, and meets the requirements of national government for such studies;
- To provide a common and robust evidence base on the potential for renewable energy to inform and support policy making by individual local authorities in the region, as part of developing their local development documents;

- To identify strategic delivery actions, for each of the four sub regions, to tackle strategic barriers and facilitate deployment of renewable energy opportunities.

When the study was originally commissioned at the beginning of 2010, there was more of a focus on identifying potential renewable energy targets at a regional and sub-regional level. However, with the change in Government in May 2010, the focus of the study shifted away from targets, and instead provides an indication of the economically viable renewable energy potential for each local authority. The outputs of the report should provide the flexibility for local authorities to then set evidence based targets if desired.

This means that the study is an evidence base report and does not set policy or targets. Further work by local authorities and on a sub-regional basis is now advised to translate the evidence in this report into Local Development Frameworks and for the purposes of Development Management.

The study has been completed in three stages, with a separate report produced as an output after each stage. The stages were as follows:

Part A: Scoping Study – a gap analysis and review of existing work was carried out in order to refine the approach taken to assessing the resource in the rest of the study.

Part B: Opportunities and Constraints Mapping – this provided an initial assessment of the resource in the region, based on physical and geographical characteristics.

Part C: Delivery – this involved a more detailed assessment of the renewable energy resource for the region. The economic viability, deployment constraints and options for delivery were considered in more detail in order to inform the evidence base for renewable energy policies in local development frameworks.

This report is the output for Part C of the study. The Energy Opportunities Plans presented as part of the Part B report have been updated according to the economic viability constraints affecting the resource. A delivery strategy has also been prepared, which sets out the priority actions for further work and the responsibilities of public and private sector stakeholders in carrying out these actions.

It should be highlighted that whilst the information presented here is appropriate for a strategic regional study, it is not a sufficient basis for planning decisions about individual renewable energy proposals.

2.4 Scope of study

This study assesses the potential for low carbon and renewable energy generation in the Yorkshire and Humber region between 2010 and 2025, which is the period of influence of most Core Strategies in the region.

The methodology used for this study is derived from the “Renewable and Low Carbon Energy Capacity Methodology for the English Regions” issued by the government department for Energy and Climate Change (DECC) in January 2010. This is referred to throughout this report as the “DECC methodology.”

The methodology used is in line with government policy as currently set out in PPS1 Supplement on Climate Change and PPS22 on Renewable Energy and is designed to be “policy neutral” in that it does not introduce or suggest policy changes.

The low carbon and renewable energy technologies that have been considered are:

- District heating and CHP;
- Commercial scale wind energy;
- Hydro energy (small scale, low head);
- Biomass (including use in co-firing and energy generation from dedicated energy crops, managed woodland, industrial wood waste and agricultural arisings, or straw);
- Energy from waste (including energy generation from slurry, food and drinks waste, poultry litter, municipal solid waste, commercial and industrial waste arisings, landfill gas production and sewage gas production);
- Microgeneration (including small scale wind energy, solar, heat pumps and small scale biomass boilers).

The potential for the development of biofuels was not part of the scope, although it is recognised that these represent an important renewable fuel for transport use.

An assessment of the potential from emerging technologies such as geothermal energy generation and fuel cells was outside of the scope.

An assessment of the impact of demand reduction measures (for example, energy efficiency measures or passive solar design) was outside the scope. However, the rate of uptake of these measures will affect the uptake of renewable energy technologies and should be considered an important element of energy strategies.

The potential from offshore renewables (i.e. offshore wind and marine technologies) was also outside the scope of the study. Strategies for offshore generation are determined at a national level and are beyond the direct influence of regional bodies. An understanding of the implications that offshore wind farm development will have on the region's coastal authorities is recommended as this has implications on transmission infrastructure and the diversity of the economic sector.

Finally, whilst it is acknowledged that there is a link between low carbon and renewable energy deployment and the climate change agenda, this study does not consider the effect of renewable energy generation on carbon emissions in the region. Potential carbon savings will be dependent on the level of fossil fuel generation displaced, which in turn is dependent on the future carbon intensity of the grid. Estimation of future grid carbon emissions would require complex analysis that is outside the scope of this study.

2.5 Using the outputs of the study

The challenges of climate change and increasing renewable and low carbon energy capacity cannot and should not be delivered through planning alone. The planning system has a distinct role to play in promoting decentralised renewable and low carbon energy in the right locations. To assist this process, the opportunities for generating low carbon and renewable energy in each sub-region and local authority have been mapped using GIS. We refer to these maps as 'Energy Opportunities Plans. They have been designed to indicate the spatial distribution of opportunities that are currently available and that will be available in the near future.

The Energy Opportunities Plans and associated evidence base should provide a tool when developing planning policies, targets and delivery mechanisms within the LDF process, and can bring added benefit and support to development plan documents. They can be used to support policies that stipulate requirements for renewable energy, whether these are through the setting of targets that exceed Building Regulations, the requirement for Code for Sustainable Homes or BREEAM, or a requirement for connecting to, or investing in, infrastructure to facilitate district heating.

They can also be used to inform actions in corporate strategies, such as the delivery strategy produced as an output of this study or the Regional Energy Infrastructure Study[1], as well as investment decisions taken by the sub regional bodies and local enterprise partnerships.

It should be noted that although the Energy Opportunities Plans provide an overview of potentially feasible technologies and systems within the region, they do not replace the need for site specific feasibility studies for proposed development sites.

2.6 Structure of the report

The remainder of the report is structured as follows:

Chapter 2 contains a brief overview of the methodology used for resource assessment and strategic delivery strategies.

Chapter 4 contains a brief description of the Yorkshire and Humber region and introduces the major national and regional policies and other drivers influencing the uptake of renewables in the region.

Chapter 5 presents the results of the resource assessment with implications for the region.

Chapter 6 presents the results of modelling of scenarios for use of the renewable energy resource.

Chapter 7 describes existing opportunities and barriers for the implementation and delivery of renewable energy facilities.

Chapter 8 sets out action plans for each sub-region to facilitate the delivery of renewable energy.

Chapter 9 provides a list of recommendations from the study.

Appendix A contains details of the methodology and assumptions used and results of the potential for generating energy from both conventional and from low carbon and renewable sources, by technology.

Appendix B contains results of the renewable energy resource by local authority.

Appendix C contains details of the stakeholder consultation process.

Appendix D is a list of funding sources available for low carbon and renewable technologies.

Appendix E contains a list of the installed renewable energy technologies (larger than 1 MW) across the region.

[1] The Regional Energy Infrastructure Strategy, Regional Energy Forum, February 2007

Methodology for study

3 Methodology for study

This report is the output for Part C of the study, which involved an assessment of the economically viable resource for renewable energy. An overview of the methodology used is described in this chapter. A detailed description of the methodology, with all assumptions, is provided in Appendix A.

3.1 Overview of methodology

The methodology followed for the study is shown below in Figure 5.

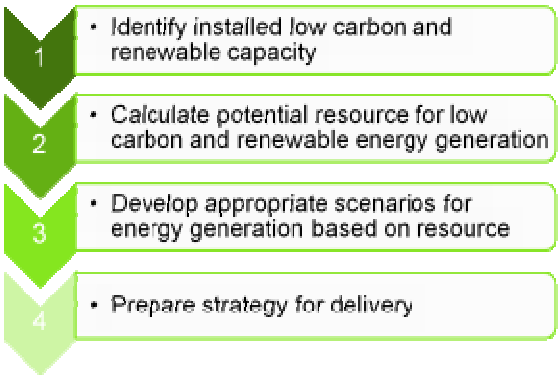

Figure 5 Methodology for study

The conclusions for each sub-region were inferred by aggregating the data for all the local authorities contained in that sub-region. Where a local authority is located within more than one sub-region, the data for that local authority was counted in the summary figures for all sub-regions it was located within. Consequently, the resource for Yorkshire and Humber is not equivalent to the resource for the sum of the sub-regions.

3.1.1 Identification of installed capacity

There is no single source of information on installed renewable energy facilities in Yorkshire and Humber. Where information does exist, it is often out dated or inaccurate. Collating and aggregating the available data within the timeframe of the study has proved to be a major challenge and highlights the need for a coordinated approach to be taken to monitoring new installations.

Information at a national level was combined with information from more local sources such as CO2 Sense. A list of all the renewable energy facilities over 1MW, along with associated data sources, is provided in Appendix E.

3.1.2 Assessment of resource potential

Assessing the resource for low carbon and renewable energy has been a sequential process and has been largely based on the DECC methodology. Constraints have been applied that progressively reduce the natural resource (i.e. the maximum theoretical potential) to what is practically achievable and then economically viable.

The DECC methodology was developed to ensure that a consistent and comparable approach was taken across all English regions. The stages involved are shown in Figure 6. The result of stages 1 to 4 is an assessment of the potential accessible resource and was the subject of Part B of this study.

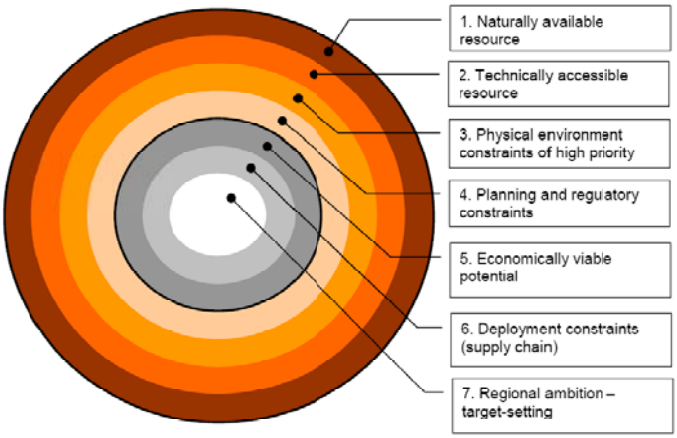

Figure 6 Stages for developing a comprehensive evidence base for renewable energy potential (Source: Renewable and Low-carbon Energy Capacity Methodology for the English Regions, SQW Energy, January 2010)

Part C of the study was dedicated to assessing the economically viable resource (stages 5-6), although an approach for this was not provided in the DECC methodology.

The AECOM project team has developed a bespoke approach, based on extensive experience of advising on renewable energy projects combined with consultation with local stakeholders (section 3.2).

GIS mapping was carried out to assess the economically viable resource for community scale technologies, i.e. those technologies that are usually delivered independently of new development, such as wind farms.

Landscape sensitivity to commercial scale wind turbines was taken into account, based on the categorisations in the SREATs report and in the recent “Landscape Capacity Study

for Wind Energy Developments in the South Pennines" report.[2] The resource was then reduced to mitigate the effect of cumulative impact on the visual quality of the landscape. Further details of the commercial scale wind energy assessment are provided in Appendix A section A.7.

Development driven technologies generally comprise the microgeneration technologies and district heating with CHP.

The economically viable resource for the uptake of microgeneration technologies in the existing stock was assessed using an AECOM model that uses a discrete choice methodology based on factors that describe an occupant's "willingness to pay."

The resource for district heating was estimated by assessing the capacity for heat generation for those renewable energy technologies that are likely to be used with CHP to generate both heat and electricity.

For technologies driven by new development, AECOM developed a model that selects the most cost effective combination of technologies that will enable the development to achieve compliance with the Building Regulations standards active at that time.

The approach taken for each technology is described in detail in Appendix A. Where the DECC methodology was unclear as to the assumptions that should be used, AECOM has applied assumptions based on experience in this sector.

3.1.3 Scenario modelling

Scenario modelling was carried out to ascertain the contribution that Yorkshire and Humber could make towards achieving the UK's 2020 renewable energy target. For each scenario, the mix of renewables that could meet the target was assessed.

3.1.4 Preparation of action plans for delivery

The results of the resource assessment, the stakeholder engagement process and the Energy Opportunities Plans were drawn together to produce delivery strategies for each of the four functional sub-regions in Yorkshire and Humber. These set out appropriate actions for the delivery of low carbon and renewable energy technologies, along with recommended timescales, indicators that would imply success and expected outcomes of the actions.

[2] Landscape Capacity Study for Wind Energy Developments in the South Pennines, Julie Martin Associates, January 2010

3.2 Stakeholder engagement

3.2.1 Steering group

The AECOM project team was guided by a steering group, which included representatives from the regional development agency Yorkshire Forward, the local authorities and statutory consultees. A list of the steering group members has been provided below.

- Local Government Yorkshire and Humber
- Government office for Yorkshire and Humber
- Yorkshire Forward
- CO2 Sense
- Environment Agency
- Royal Society for the Protection of Birds (RSPB)
- Energy Saving Trust
- Forestry Commission
- Natural England
- Barnsley Metropolitan Borough Council
- East Riding of Yorkshire Council
- City of York Council
- Leeds City Council
- Kirklees Metropolitan Council
- Calderdale Metropolitan Borough Council
- Sheffield City Council
- Kingston upon Hull City Council

3.2.2 Meetings with experts

The AECOM project team also held discussions (face to face and through email and telephone calls) with a number of technical experts, including representatives of the following organisations:

- Yorkshire Forward
- CO2 Sense
- Microgeneration Partnership
- Natural England
- Environment Agency
- National Farmers Union

- David Farnsworth (Biomass consultant)
- SSE, operators of Ferrybridge “C” power station
- CE Electric (main district network operator for Yorkshire and Humber)
- Banks Renewables (wind energy developers)
- RWE/Npower (wind energy developers)
- Renewable Energy Systems Ltd (wind energy developers)
- Civil Aviation Authority (CAA)
- Osprey Consulting on behalf of Leeds Bradford international airport
- Humberside airport
- Defence Estates on behalf of the Ministry of Defence
- Forestry Commission
- Dalkia (energy from waste developers)

3.2.3 Stakeholder involvement

This study has been completed through collaboration with a range of stakeholders in the region.

A questionnaire was issued to all local authorities at the outset of the study, requesting the following:

- Details of completed local development framework evidence based studies;
- Details of current targets, policies or guidance on renewable and low carbon energy and details relating to any existing installed renewable energy and low carbon schemes, including district heating and CHP);
- Details of local studies into biomass availability;
- Details of local studies into infrastructure delivery plans (energy infrastructure in particular);
- Details of studies investigating landscape sensitivity to wind turbines;
- Details of Waste DPDs in place based on information which amends that the RSS waste forecast.

Drafts of the reports produced after each stage of the study (including this report) were circulated to all local authorities and other relevant stakeholders in the region for comment before issuing.

A final round of consultation on this report was carried out just prior to publication of the report by DECC.

Two workshops were held during the study to harness the views of stakeholders in the region. The first was held in May 2010 and was attended by the members of the steering group (section 3.2.1). The aims were to:

- Introduce the project and get views on the approach taken, including regional priorities and major challenges;
- Ensure that the project team had access to any data and other information necessary for the study. This fed into Part A: Scoping Study.

The second workshop was held in November 2010 and a wider range of stakeholders were invited, including at least one representative from each of the local planning authorities (Appendix C). The aims of the workshop were to:

- Obtain information on existing initiatives and to understand the actions needed to overcome current constraints on the delivery of low carbon and renewable energy technologies;
- Test findings from the study such as key opportunities, constraints and scenarios for low carbon and renewable energy deployment;
- Gather local views on key strategic actions needed at a sub-regional level to make the most of opportunities and facilitate deployment;
- Liaise with stakeholders to identify clear priorities for each sub-region, which could inform a final delivery plan.

3.2.4 Online forum

An online forum was set up at the following website to encourage discussion of the strategic barriers and opportunities for renewable energy amongst stakeholders. www.yorkshirehumberrenewables.maxforum.org.

Figure 7 Screenshot of online forum (Source: online forum, website accessed November 2010).

Yorkshire and Humber in Context

4 Yorkshire and Humber in context

The geographical characteristics of the Yorkshire and Humber region, combined with a comprehensive infrastructure network inherited from its legacy of industry and energy production, means that the region has great potential to exploit a range of renewable energy technologies.

This section describes the geographical and socioeconomic factors and policy drivers affecting energy generation in the region.

4.1 The Yorkshire and Humber region

There are 24 local planning authorities in the Yorkshire and Humber region, including the 21 borough or district councils, North Yorkshire County Council, North York Moors National Park and the Yorkshire Dales National Park.

Around 80% of the region is rural in nature and home to 20% of the region's population. The rural areas are very diverse; there are remote rural areas in the north and east parts of the region, more accessible rural areas to the west and south and a large expanse of coastal land to the east.

Figure 8 Location of Yorkshire and Humber with respect to the other English regions (Source: Yorkshire and Humber Plan, Government office for Yorkshire and Humber, May 2008)

4.2 Policy context

4.2.1 National policy context

There is a comprehensive range of legislation at national level which supports the installation of low carbon and renewable energy technologies across the country.

The Climate Change Act (2008) set a legally binding target to reduce UK carbon emissions by 80% by 2050. The Committee on Climate Change is responsible for setting binding 5-year carbon budgets on a pathway to achieve the 2050 target. The first three carbon budgets, announced in the 2009 Budget, aim for carbon savings of 34% by 2020.

The UK Low Carbon Transition Plan[3] sets out an approach to meeting national carbon saving targets. The plan calls for carbon emissions from existing homes to be reduced by 29% by 2020 and emissions from places of work to be reduced by 13% by 2020 (against a 2008 baseline).

The UK is committed to supply 15% of gross energy consumption from renewable sources by 2020. This is part of an EU commitment to increase the proportion of energy supplied from renewables to 20% by 2020. The UK Renewable Energy Strategy[4] anticipates that renewables will need to contribute around 30% of electricity supply, 12% of heating energy and 10% of transport energy to meet this target.

The Coalition: our programme for government (2010)[5] included support for an increase in the EU emission reduction target to 30% by 2020. It also confirmed that the Coalition intends to retain the target of 80% emissions reductions by 2050.

The recently published Consultation on Planning Policy Statement (PPS): Planning for a Low Carbon Future in a Changing Climate (2010) reviews and consolidates the PPS1: Planning and Climate Change[6] and PPS22: Renewable Energy[7]. The consultation encourages local authorities to plan for low carbon and renewable energy on a strategic level through the development of planning policies that encourage the introduction of decentralised energy systems served by low carbon and renewable energy supplies.

[3] The UK Low Carbon Transition Plan, DECC, July 2009
[4] The UK Renewable Energy Strategy, DECC, July 2009
[5] The Coalition: our programme for government, Cabinet Office, May 2010
[6] Planning Policy Statement: Planning and Climate Change – Supplement to Planning Policy Statement 1, CLG, 2007
[7] Planning Policy Statement 22: Renewable Energy, ODPM, 2004

A principal objective of the Energy Bill 2011[8] is investment in low carbon energy supplies; however, this update did not introduce any new legislation with respect to renewables.

4.2.2 Regional and sub-regional policy context

The Regional Spatial Strategy (RSS), commonly known as the Yorkshire and Humber Plan, was adopted in 2008 and contained a number of policies designed to increase the installed renewable energy capacity in the region. It expected local authorities to set targets for grid-connected renewable energy and set an interim 'decentralised and renewable or low carbon energy' target for new developments for the period before Local Development Frameworks are adopted.

The RSS is proposed to be abolished through the Localism Bill, although at the time of writing it remains part of the Development Plan. Whatever the fate of the RSS, there remains a need for strategic planning which transcends local authority boundaries, to ensure that the approach to tackling climate change and increasing the supply of renewable and low carbon energy is both efficient and effective.

Figure 9 Functional sub-regions in Yorkshire and Humber

4.3 The trajectory to zero carbon

In the 2008 Budget, the Government announced its ambition that all new non-domestic buildings will be zero carbon from 2019 and all new homes, schools and other public buildings will be zero carbon from 2016.

The requirement for zero carbon status is expected to be administered through the Building Regulations. The policy is expected to drive a significant increase in the installation of onsite microgeneration technologies. The government has introduced the concept of "allowable solutions" for those developments that are unable to reach zero carbon status through onsite carbon reductions. Few details have been announced, but it is understood that allowable solutions may include exports of low carbon or renewable heat from the development to other developments, and investments in low carbon and renewable energy infrastructure.

4.4 Energy security and diversity

The coming decade will see many changes in the UK's energy mix. Due to the Large Combustion Plants Directive (LCPD), which places strict limits on the emissions of sulphur and nitrogen oxide, approximately 15% of the UK's electricity generating capacity is scheduled to be shut down by 2016.[9] This will include some generating capacity at Ferrybridge "C" coal power station, one of the region's major energy generation facilities.

By 2023, further closures may be driven by the proposed EU Industrial Emissions Directive, which consolidates seven environmental directives (including the LCPD), into a single directive and requires even more stringent emissions limits.

Investment in renewable energy technologies will replace the capacity due to close with cleaner technologies and will contribute to more secure energy supplies by moving the UK away from dependence on hydrocarbons.

4.5 The link between energy and waste

All local authorities face the need for a major change in their approach to waste management and the European landfill directive sets out clear targets for each waste disposal authority up to 2020. Energy from waste technologies provide great potential to generate energy, converting the waste stream from a problem into a resource that can bring about a substantial reduction in a local authorities' carbon emissions.

[8] Energy Bill 2011, DECC, December 2010

[9] Statutory Security of Supply Report, DECC, November 2010

4.6 Financial incentives for low carbon and renewable energy generation

The government has put in place a series of funding mechanisms intended to bring down the cost of low carbon and renewable energy technologies by stimulating the market. To date these have included market mechanisms such as the Renewables Obligation (for electricity) and the Climate Change Levy, and targeted subsidies such as the Low Carbon Buildings and Bioenergy infrastructure programmes. The extension of Permitted Development rights to specific microgeneration technologies was also intended to stimulate the market.

4.6.1 Renewables Obligation Certificates (ROCs)

The Renewables Obligation requires licensed electricity suppliers to source a specific and annually increasing percentage of the electricity they supply from renewable sources. The current level is 11.1% for 2010/11 rising to 15.4% by 2015/16. More information about the Renewables Obligation is provided in Appendix D.

4.6.2 Feed in tariffs

The feed in tariff (FIT) scheme came into effect in April 2010 for installations not exceeding 5 MW and has been designed to incentivise small scale, low carbon electricity generation by providing payments according to the amount of energy produced by householders, communities and businesses. The technologies included are wind, solar PV, hydro, anaerobic digestion and non-renewable micro CHP.

The tariff levels proposed have been calculated to ensure that the total benefits an investor can be expected to achieve (from the generation tariff, the export tariff and/or the offsetting benefit) should compensate the investor for the costs of the installation as well as providing a reasonable rate of return.

4.6.3 Renewable heat incentive

The Government intends to introduce a Renewable Heat Incentive in April 2011. Renewable heat producers of all sizes will receive payments for generation of heat. Unlike FITs, tariffs will be paid not on the basis of a metered number of kWh generated, but instead on a “deemed” number of kWh, namely the reasonable heat requirement (or heat load) that the installation is intended to serve. There is no upper limit to the size of heat equipment eligible under the Renewable Heat Incentive and anyone who installs a renewable energy system producing heat after 15th July 2009 is eligible. The following technologies will be included in the scheme: ground source heat pumps (but not air source heat pumps), anaerobic digestion to produce biogas for heat production, biomass heat generation and CHP, liquid biofuels (but only when replacing oil-fired heating systems), solar thermal heat and hot water and biogas injection into the grid

Tariff levels will be calculated to bridge the financial gap between the cost of conventional and renewable heat systems at all scales, with additional compensation for certain technologies for an element of the non-financial cost and a rate of return of 12% on the additional cost of renewables, with 6% for solar thermal.

4.6.4 Tax incentives

A number of tax measures are in place to help make renewables more attractive. New zero-carbon homes benefit from stamp duty relief. Investment in certain energy-saving plant and machinery benefits from enhanced capital allowances. A reduced rate of VAT applies to professional residential installation of certain microgeneration technologies. Revenue from sales of electricity and ROCs from household microgeneration are exempt from income tax.[10]

[10] The UK Renewable Energy Strategy, DECC, July 2009

Discussion of results

5 Discussion of results

The results of the low carbon and renewable energy resource assessment are presented in this chapter. These are shown at the regional and sub-regional level. Results for individual local authorities can be seen in Appendix B.

5.1 Current energy demand

Annual energy figures for the Yorkshire and Humber region in 2008 are shown in below in Table 1 and in Figure 10. It should be noted that the sub-regions do overlap. Consequently, the demand for Yorkshire and Humber is not equivalent to the sum of the demand of the sub-regions.

The region has around 8.5% of the UK's population and contributes to around 10% of total UK energy demand. Leeds City Region has the highest annual demand, corresponding to over half the demand for the entire region.

North Lincolnshire also has an unusually high relative energy demand, contributing to 18% of total regional demand. This is due to high industrial use from the oil refineries in the port area.

Area	Energy demand (GWh)
Yorkshire and Humber total	110,646
York and North Yorkshire sub-region	14, 781
Leeds City sub-region	50,411
Hull and Humber Ports City sub-region	34,515
South Yorkshire sub-region	23,367

Table 1 Annual energy demand for 2008 for the Yorkshire and Humber region (Source: Total sub-national final energy consumption: 2008 in GWh, DECC website, accessed January 2011).

5.2 Current energy generation

Figure 11 shows the distribution of energy supply and demand in the region. It shows that after oil production used for transport, the mix consists predominantly of centralised energy generation from coal (18% of the region's energy production) and natural gas (16% of the region's energy production). Embedded, or decentralised low carbon and renewable energy generation currently makes up only 1-1.5% of the total mix.

Also of note are the high conversion losses involved in the use of natural gas and coal, particularly for electricity generation. This highlights the opportunity to reduce those losses by increasing the levels of decentralised energy generation.

There are three major coal fired power stations in the region, Drax, Eggborough and Ferrybridge "C" representing around 7,600 MW of generating capacity (Table 2). There are two smaller gas-oil fired power stations, one at Drax and one at Ferrybridge, which provide extra capacity and start-up power.

In February 2009, Powerfuel were granted Section 36 planning consent to build a 900 MW integrated coal gasification, gas fired power station on the site of Hatfield Colliery in Doncaster. It is due to commence operation in 2012.

Coal Power station	Capacity (MW)
Drax	3,750
Eggborough	1,960
Ferrybridge "C"	1,923
Total	7,633

Table 2 Coal power station capacity in Yorkshire and Humber (Source: Planning for Renewable Energy Targets in Yorkshire and Humber, AEAT, December 2004).

There is approximately 6,300 MW of installed gas fired power station capacity in the region, as shown in Table 3.

Gas Power station	Capacity (MW)
Castleford	56
Centrica South Humber Bank	1,285
Conoco	1,180
Glanford Brigg	268
Keadby	735
Killingholme	1,565
Saltend	1,200
Thornhill	42
Total	6,331

Table 3 Gas power station capacity in Yorkshire and Humber (Source: CO2 Sense database)

There are no nuclear power stations in the region. No new sites were identified in the government's most recent announcement into future nuclear power sites.[11]

[11] Press Release: 2010/107 Huhne highlights urgent need for new energy, DECC, October 2010

Capabilities on project:
Building Engineering - Sustainability

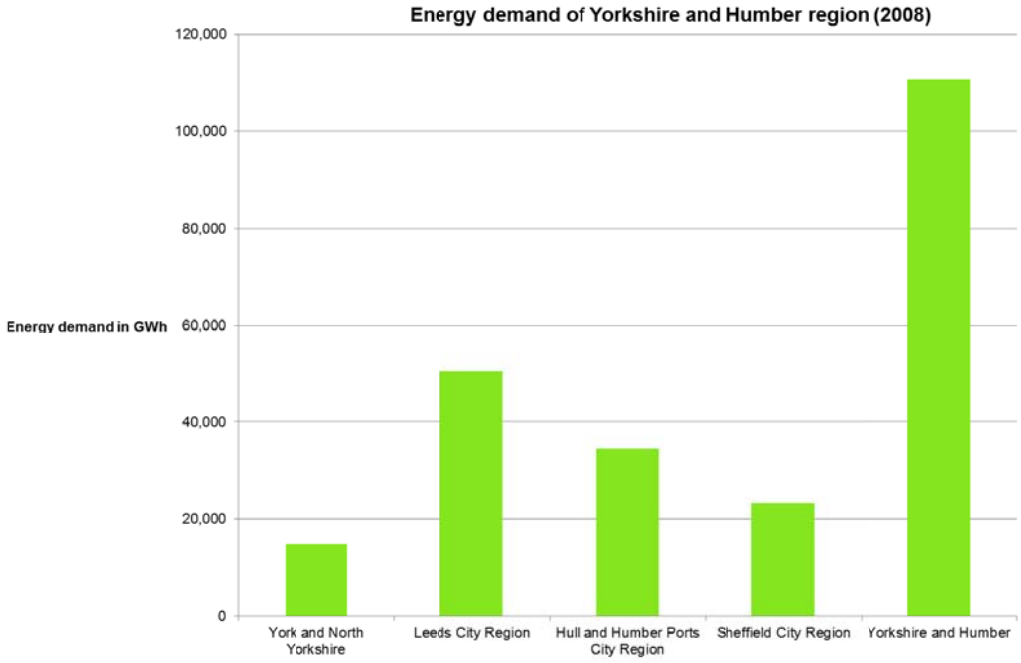

Figure 10 Annual energy demand of Yorkshire and Humber region in 2008 (domestic, industrial and commercial), in GWh

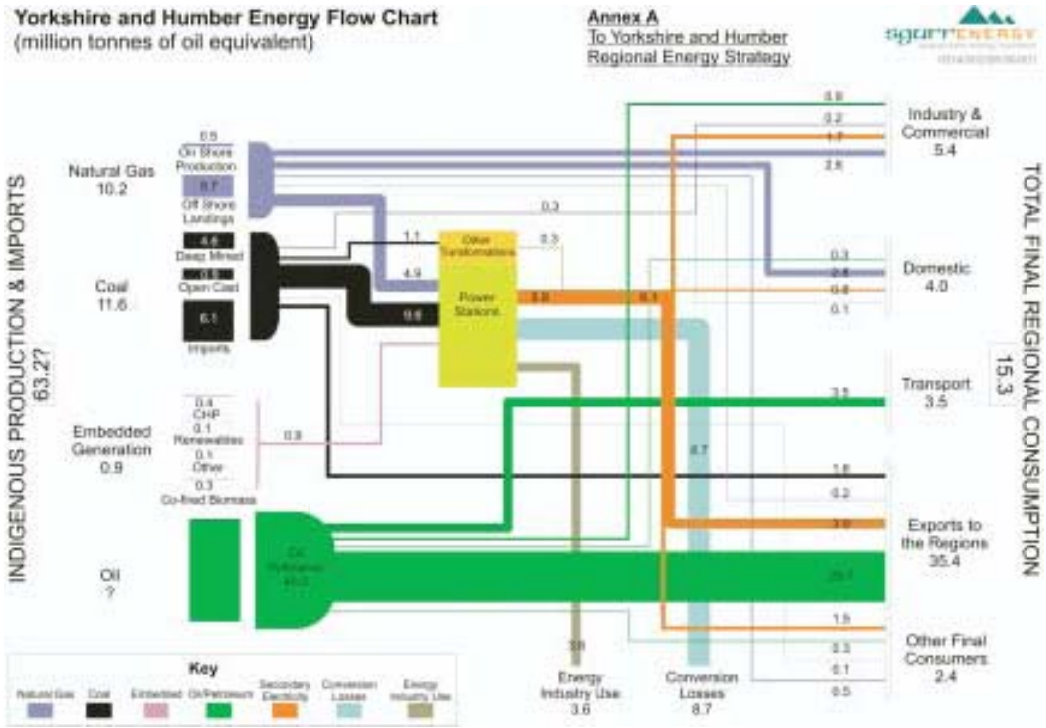

Figure 11 Current flows of energy in the region (million tonnes of oil equivalent) (Source: The Regional Energy Infrastructure Strategy, Regional Energy Forum, February 2007)

5.3 Current energy supply and distribution

5.3.1 Electricity distribution

The main district network operators in the region (DNOs) are NEDL and YEDL. Some responsibility for electricity transmission is held by Electricity North West (ENW) in the west of the region around Craven and Richmondshire and by Central Networks East in the south of the region.

The peak electricity demand in the region is around 4.5 GW. The electrical network is fed through the main 132kV supply which is transformed down to 33kV at bulk supply points. It is then served through primary sub-stations which transform the voltage from 33kV to 11kV and 6.6kV for distribution to local areas. Smaller substations then step down the voltage for use by non-domestic sectors and in homes. A map of the high voltage 132kV network and major substations in the region is shown in Figure 12.

A 2005 “Energy and the RSS” study[12] found technical constraints regarding connection in and around York, Bradford, Sheffield, Driffield and Scunthorpe. Weak capacity areas were identified throughout the region, with the largest areas concentrated in North Yorkshire and towards the western boundary of the region. North Yorkshire in particular was found to have very limited capacity on both 33 and 66kV networks. Significant investigations into reinforcement requirements will be required in North Yorkshire. All 66kV circuits in the rest of the region have sufficient capacity to support the implementation of diversified sources of energy.

Consultation with the major DNOs in the region, YEDL and NEDL, as part of this study confirmed this conclusion, and highlighted that thermal rating of 66 kV lines is an issue north of the Humber.

Regarding the electrical distribution network under responsibility of other DNOs, Arup commented on low carbon and renewable energy generating capacity through Electricity North West networks (ENW), as follows:

'In general, ENW considered that the electricity distribution network in the North West "will not be a barrier to connection of renewable electricity generators. However, with a high rate of connections, there may be delays in providing connections and upstream adaptations to the network to comply with engineering standards... When generators trigger the need for network development, they will be charged a proportion of the costs. The unit cost of connection involving work at 132kV and 400kV would be higher than at 33kV or 11kV." The company suggests that the theoretical maximum level of biomass, hydro, landfill and sewerage schemes "can be accommodated by the distribution network in normal project timescales without delaying the project". No comment is made in relation to onshore wind at this time... "[13]

5.3.2 Gas distribution

National Grid owns and operates the high pressure gas transmission system in England, Scotland and Wales. Gas travels from the National Transmission System and reaches most consumers via Local Distribution Zones (LDZ), which operate at three pressure levels: Intermediate (2 to 7 bar), Medium (75 mbar to 2 bar) and Low (less than 75 mbar). A map of the Medium and Intermediate pressure networks is shown in Figure 13.

There are two Gas Distribution Operators (DOs) in the region; Northern Gas Networks and National Grid Gas. There are four Local Distribution Zones; the North (NO) LDZ; the North East (NE) LDZ; the East Midlands (EM) LDZ; and the North West (NW) LDZ.

In general terms, gas supply is not constrained in the region, as it benefits from a number of connections to the national High Pressure Transmission Network, as well as having an extensive and robust core network around the main urban areas. However, many rural areas have no gas supply.[13]

5.3.3 Potential for renewable gas injection into grid

With appropriate cleaning techniques, synthetic gas or “syngas” generated from renewable energy sources can be injected directly into the existing gas infrastructure network and used in homes without modification to appliances. This can make it efficient to deliver from the plant to the consumer as there is minimal investment in new infrastructure.

Currently, renewable gas production in the form of landfill gas and sewage gas represents around 69 MW of renewable energy generation in Yorkshire and Humber. However due to incentives such as the ROCs (section 4.6.1), all of this gas is used to generate electricity. In order to encourage synthetic gas production, policy needs to provide the necessary incentives.

[12] Yorkshire and Humber Assembly – Energy and the RSS, Enviros, January 2005

[13] Yorkshire and Humber Assembly - Regional Integrated Infrastructure Scoping Study, Arup, September 2008

The Renewable Heat Incentive due for implementation in April 2011 will help in this regard, but it will also be necessary to fund investment in gasification technology and ensure that regulation allows plants to be developed on a commercial scale in areas where injection into the network is close to large load demand.

5.4 Conclusions from assessment of current energy baseline

Electricity provision in the region is adequate to meet growth aspirations up to 2025 but local strategic reinforcements may be needed at some substations. The size and timescales of these would depend upon the scale of new development expected.

The primary challenge for YEDL and other DNOs in the region will be adapting the network to cope with increasing levels of decentralised, renewable energy generation connected to the local electrical distribution network, predominantly in the form of solar PV and wind turbines. This can often be expensive and inefficient, particularly if adopting existing standard connection solutions. Since the existing distribution network has not been designed to incorporate significant levels of decentralised generation, this can lead to non-compliance with network design standards in respect of thermal rating, voltage and fault levels. The typical solution to this is reinforcement of the existing distribution network.

DNOs are obligated to guarantee supply even when the renewable energy plant is not operating (e.g. due to maintenance, breakdown or intermittent operation), hence it needs to provide sufficient network capacity to back-up the supply even though this may only be needed occasionally. This can result in additional costs associated with reinforcing the network.

Ofgem’s price controls have placed constraints on DNOs which means that they are not able to invest speculatively in capacity.

The gas network within the region is generally robust and flexible. Northern Gas Networks and National Grid are carrying out major refurbishment programmes of gas mains throughout Yorkshire and Humber as part of their overall asset management plans.

There may be issues with connection of low carbon and renewable energy technologies to the gas network. Connection of gas-fired CHP to the existing gas network can present a particular problem because of the demand requirements, on start-up and shut down which can cause shock waves. It may be possible to connect small CHP units (below 1MW) to the low pressure network but bigger plants need to be connected to the Medium or Intermediate pressure system and very large CHP plants may have to connect to the high pressure transmission system. Hence the reinforcement costs can be significant.

Capabilities on project:
Building Engineering - Sustainability

Figure 12 Electricity network in Yorkshire and Humber

Capabilities on project:
Building Engineering - Sustainability

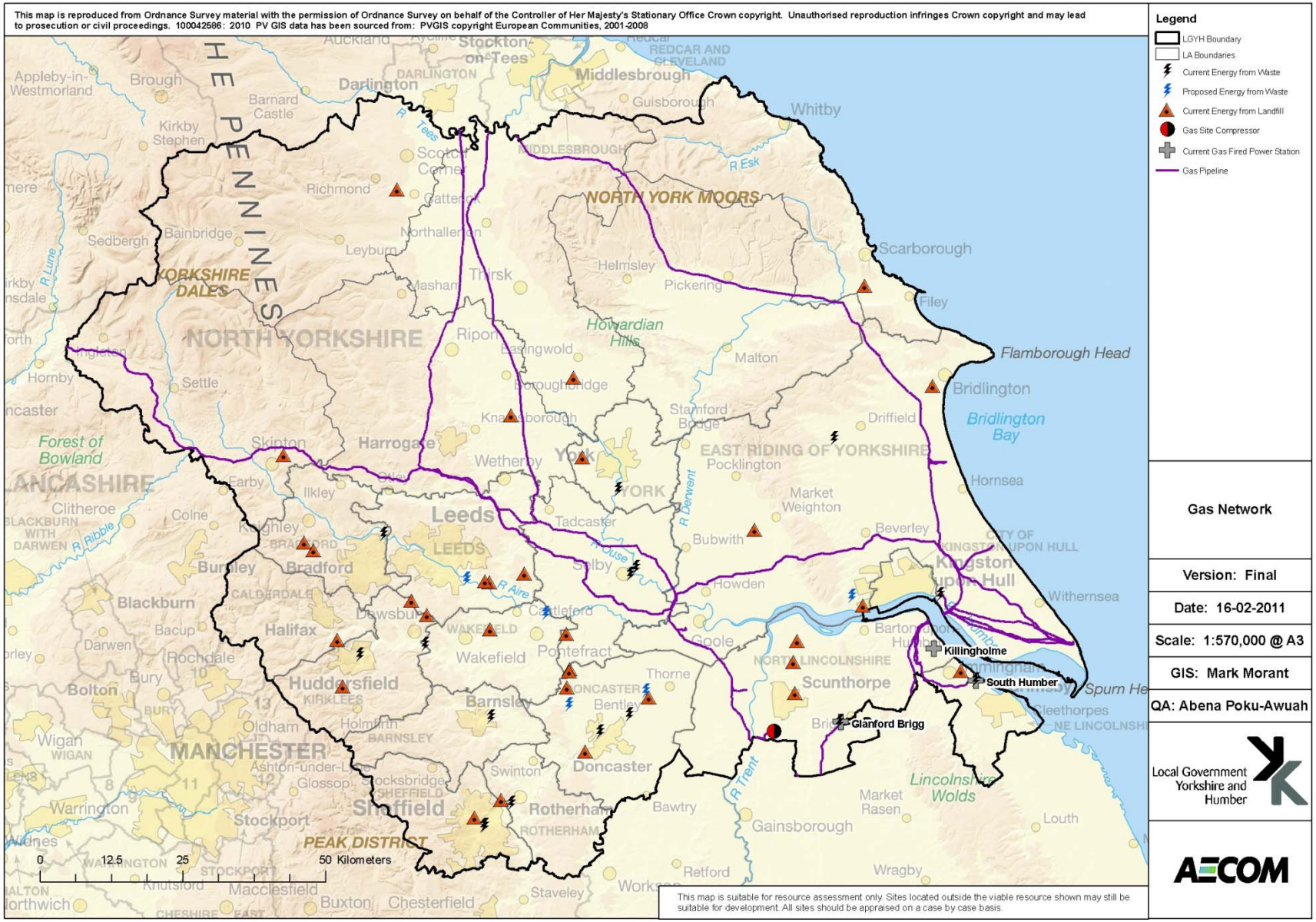

Figure 13 Gas network in Yorkshire and Humber

5.5 Summary of renewable energy resource

This study has found that the region has the capacity to install approximately 5,905 MW and generate around 16,100 GWh of renewable energy annually. The main contributions to the resource come from commercial scale wind and biomass energy generation (Figure 14). The majority of the renewable energy resource is located within the Leeds City region (Figure 16).

A detailed description of the resource by technology is provided in the following sections 5.8 to 5.14. The resource is described in terms of capacity in MW, annual generation potential in GWh and in terms of the energy demand of a typical home. For the purposes of comparison, a typical home has been assumed to have an annual energy demand of 0.015 GWh.[14]

It should be noted that the resource identified represents the maximum economically achievable resource (i.e. not what will actually be delivered). Chapter 6 describes the results of scenario modelling which shows the impact of delivering a proportion of the resource identified.

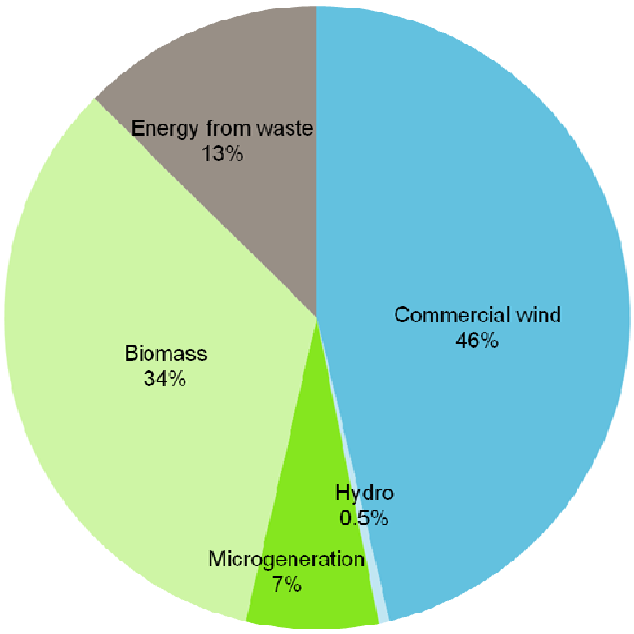

Figure 14 Distribution of renewable energy capacity in Yorkshire and Humber by technology

[14] The challenge of existing UK houses, Boardman, B, IABSE Henderson Colloquium, Cambridge, July 2006

5.6 Overall progress against targets

The SREATs study set out regional targets for some renewable energy technologies which were adopted in the RSS and are shown in Table 4 below, along with the progress made.

Technology	RSS 2010 target MW	YH installed capacity 2010 MW	RSS 2021 target MW
Onshore wind	341	153	725
Offshore wind	240	-	600
Biomass co-firing	100	548	90
Biomass plant	14	10	275
Hydro	4	1.5	4
Solar PV	9	7	138
Marine	-	0.6	30
Total	**708**	**720**	**1,862**

Table 4 SREATs targets for renewable energy generation in the Yorkshire and Humber region (Source: Planning for renewable energy targets in Yorkshire and Humber, AEAT, December 2004)

Based on national energy statistics data, as of 2009 the region had 340MW_e of onshore, installed renewable electricity generating capacity, including biomass co-firing (in coal fired power stations). This compares with the SREATS onshore target of 708MW_e.

This study has found that there was around 301MW of renewable energy generating capacity (both heat and electricity) in the region as of December 2010, excluding the contribution from biomass co-firing. The current biomass co-firing proportion equates to around 548 MW. Around 20% of the installed capacity is comprised of renewable electricity generated from landfill gas, which is unlikely to still be available by 2025.

Figure 15 below shows a comparison of the regional performance against the other English regions, as of the end of 2009. It suggests that the region is somewhat lagging behind others. However, this does not paint the full picture. From the information collected during this study there is approximately 624MW of renewable energy schemes with planning consent but which are still to be constructed. There is around 1,643MW still to be determined in the planning system.