Northwest renewable and low carbon energy capacity and deployment

Project report

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Northwest
REGIONAL DEVELOPMENT AGENCY

SQW

Contents

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Foreword by NWDA

The evidence contained in this report has been developed by the Northwest Regional Development Agency, in conjunction with stakeholders from across the region, according to the energy capacity assessment methodology published by the Department for Energy & Climate Change and Department for Communities & Local Government in 2010.

The study is intended to assist Local Planning Authorities in preparing planning policies on renewables, as stated in the guidance issued with the Secretary of State's letter revoking Regional Strategies (6th July 2010) advising that, in preparing local policies on renewables, LPAs *'may find it useful to draw on data that was collected by the Regional Local Authority Leaders' Boards and more recent work, including assessments of the potential for renewables and low carbon energy'*.

The data contained within this study is primarily regional and sub-regional, however much of the original data can be interrogated down to local authority level. This original data is available on request. In addition, the scenarios contained in the report for potential deployment of renewables are only intended to illustrate, given current constraints and trends, how the region could contribute to national renewable energy deployment targets.

Executive summary

1. The UK's Renewable Energy Strategy (RES) was published in 2009. It sets out the measures that the Government will pursue to achieve the target to source 15% of the UK's energy needs from renewable sources by 2020, as part of broader efforts across the European Union. Under expected national scenarios this translates to meeting 30% of the UK's electricity demand from renewable sources by 2020. This involves a step change in the provision of renewable energy capacity in the UK and action at the sub-national scale is necessary to help to plan and deliver this strategy between now and 2020. In particular, most onshore renewable energy development projects across a wide range of commercial scale, small and microgeneration technologies are controlled at sub-national levels. In support of this agenda the North West Development Agency (NWDA) commissioned SQW and Land Use Consultants to undertake this project to refresh the evidence base for the potential for renewable energy in the Northwest.

2. The focus of the project has been to present the results at sub-regional and regional scales for all of the technologies assessed. The project's evidence base is also highly relevant for use at the local scale in response to the requirements of national planning policy to consider the contribution of renewable energy and low carbon initiatives and opportunities for climate change mitigation and adaptation. The evidence base from this project has the specific advantages of being based on up to date data including local data sources, being informed by numerous other local/sub-national studies and being consistent with national guidance, i.e. the renewable energy capacity assessment methodology published by DECC and CLG in 2010.

3. The project has produced a comprehensive assessment of the **potential accessible renewable energy resources at 2020**. The results of this assessment by technology group, resource/technology sub-categories and by sub-region are summarised in Table 1. The full results, data sources and accompanying assumptions are provided in the main body and Annexes to this report. A breakdown by sub-region is shown in Figure 1.

4. The five sub-regions have quite different profiles in terms of the potential accessible resources across different technologies (not that these profiles necessarily translate into the most viable/deployable resources). For example:

   - **Cheshire** has a significant commercial scale wind resource (4,806MW or 20% of the Northwest's resource) and the largest sub-regional small scale wind resource (235MW or 35% of the Northwest's resource). Cheshire also has the largest landfill gas resource (48% of the Northwest's resource) and is the only sub-region with potential for biomass co-firing due to the location of the Fidler's Ferry power station.

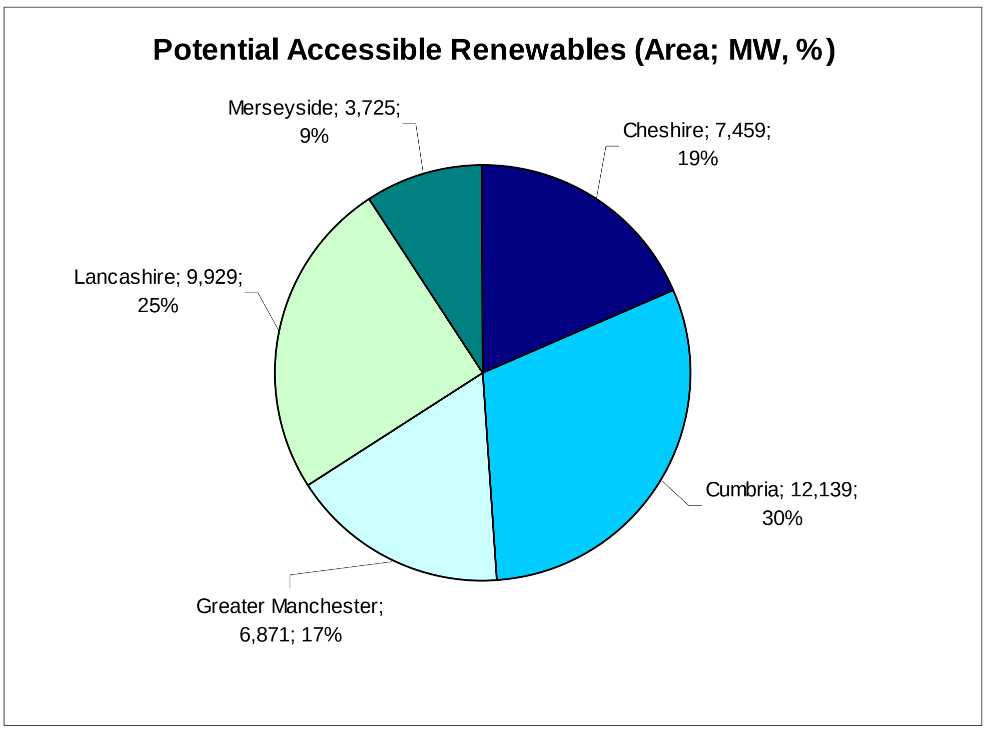
   - **Cumbria** has a very large commercial scale wind resource (10,399MW or 44% of the Northwest's resource) but also extensive areas of designated land due to their landscape and environmental quality. Cumbria has the largest sub-regional resource in terms of managed woodland (plant biomass) and wet organic waste (animal biomass). Cumbria also has 66% of the Northwest's small scale hydropower potential accessible resource.

- **Greater Manchester** has the largest sub-regional solar photovoltaic and solar thermal resource (880MW in combination or 38% of the Northwest's resource). Similarly it has the largest sub-regional resource for both ground source and air source heat pumps (4,529MW or 37% of the total resource in the Northwest).

- **Lancashire** has an extensive commercial scale wind resource (6,497MW or 28% of the Northwest's total) and a corresponding 30% of the Northwest's total small scale wind resource. It has a relatively balanced accessible resource potential across most biomass categories, with medium to high resources relative to other parts of the Northwest. It has significant microgeneration potential including 2,554MW for ground source and air source heat pumps (21% of the Northwest's total resource).

- **Merseyside** also has significant microgeneration potential including 2,516MW for ground source and air source heat pumps (20% of the total Northwest's resource) and 474MW of solar photovoltaic and solar thermal potential resource (again 20% of the Northwest's total resource).

Figure 1: Potential accessible renewable energy resource by sub-region (MW)



Source: SQW and Land Use Consultants

Table 1: Accessible renewable energy resource by technology group, sub-categories and sub region (at 2020)

Technology group	Total energy (MW)	Sub-categories	Electricity (MW)	Heat (MW)	TOTAL (MW)	Cheshire	Cumbria	Greater Manchester	Lancashire	Merseyside
Wind	**24,456**	Wind – commercial	23,587		**23,587**	4,806	10,399	1,265	6,497	619
		Wind – small scale	669		**669**	235	220	0	201	13
Biomass	**1,118**	Plant Biomass – Managed woodland	20		**20**	2	13	1	3	1
		Managed woodland (HEAT)		122	**122**	12	81	6	9	4
		Energy crops	11		**11**	3	3	1	3	2
		Energy crops (HEAT)		60	**60**	16	15	4	15	10
		Waste wood	39		**39**	7	12	7	10	4
		Agricultural arisings (straw)	11		**11**	4	2	1	3	1
		Animal Biomass (Wet Organic Waste)	206		**206**	49	99	7	49	2
		Animal Biomass (Poultry Litter)	9		**9**	3	3	1	2	0
		Municipal Solid Waste (MSW)	211		**211**	33	17	77	43	41
		Commercial & Industrial Waste (C&IW)	135		**135**	22	9	56	26	22
		Landfill gas	68		**68**	32	3	8	14	11
		Sewage gas	28		**28**	6	0	16	4	3
		Co-firing of biomass	198		**198**	198	0	0	0	0
Hydro	**77**	Small scale hydropower	77		**77**	4	47	13	10	3
Microgen.	**14,671**	Solar Photovoltaics (PV)	1,158		**1,158**	153	90	440	238	237
		Solar Water Heating (SWH)		1,158	**1,158**	153	90	440	238	237
		Ground Source Heat Pump		2,471	**2,471**	344	207	906	511	503
		Air Source Heat Pump		9,884	**9,884**	1,376	829	3,623	2,043	2,013
TOTALS			26,426	13,695	40,122	7,459	12,139	6,871	9,929	3,725
Percentage (%)						**18.6%**	**30.3%**	**17.1%**	**24.7%**	**9.3%**

5. The forecast of potential accessible energy resources at 2020 was then examined to consider how much of the total theoretical opportunity might be practically achievable and foreseeable. The focus of the analysis was upon constraints that are likely to have a material impact on the potential deployment of renewable energy sources at 2020 at a strategic scale, rather than minor constraints that might have temporary and/or localised effects.

6. Four types of constraints were investigated and applied: economic viability, transmission constraints, supply chain constraints, planning constraints. A modelling tool was developed to produce **renewable energy constraints and deployment scenarios to 2020.** The results associated with two scenarios are presented in Table 2.

Table 2: Summary of regional onshore renewable energy scenario results and benchmarks

Result/Benchmark (and source)	Electricity Generation (GWh/year)	Electricity Capacity (MW)
2008 regional electricity consumption (DECC statistics)	34,569	-
Scenario A results – Northwest onshore renewable scenario for 2020 (this study)	**4,900**	**2,000**
Scenario A results – Northwest onshore scenario for 2020 as a percentage of 2008 electricity demand	14%	15%
Scenario A results – Northwest onshore scenario plus expected minimum national contribution of offshore wind and wave/tidal for 2020	9,567	3,844
Scenario A results – Northwest onshore scenario plus expected minimum national contribution of offshore wind and wave/tidal for 2020 as a percentage of 2008 electricity demand	28%	29%
Scenario B results – aspirational/stretch Northwest onshore renewable scenario for 2020 (this study)	**5,723**	**2,260**
Scenario B results – Northwest onshore scenario for 2020 as a percentage of 2008 electricity demand	17%	17%
Scenario B results – Northwest onshore scenario plus expected minimum national contribution of offshore wind and wave/tidal for 2020	10,390	4,104
Scenario B results – Northwest onshore scenario plus expected minimum national contribution of offshore wind and wave/tidal for 2020 as a percentage of 2008 electricity demand	30%	31%

Source: SQW; DECC 2009; DECC 2010; UK Government, 2009.

7. An initial assessment of low carbon energy potential (i.e. Combined Heat and Power or tri-generation (to include cooling), and district heating schemes) has also been prepared. Unlike most of the renewable energy categories which are assessed on the basis of the supply side (i.e. resource availability), low carbon opportunities are a function of available heat demand. The assessment of low carbon energy potential has been based on the UK Heat Map[1]. The results of this initial assessment are provided in Table 3.

[1] DECC UK Heat Map. http://chp.decc.gov.uk/heatmap/

Table 3: Low carbon energy potential for the Northwest by sub-region

Sub-region	Low Carbon Energy Potential (MW)	Percentage of Total (%)
Cheshire	4,388	18
Cumbria	1,523	6
Greater Manchester	9,016	37
Lancashire	4,970	20
Merseyside	4,716	19
Northwest Region Total	**24,613**	**100**

Source: SQW

8. The data assembled within this project provide an extensive evidence base for sub-national/local policy making and action. The primary conclusion arising from the project is that:

- **There is a very large potential accessible onshore renewable energy resource in the Northwest region (40GW) and a significant proportion of it is considered viable. Two deployment scenarios are presented to provide more than 2GW of electricity generating capacity. This is equivalent to generating at least 15% of regional electricity demand from onshore renewable sources[2]. Taken in combination with the anticipated minimum contributions from offshore wind and marine renewable energy sources nationally, the 15% generating capacity from onshore renewables would put the Northwest in line with the Renewable Energy Strategy target of 30% of electricity by 2020. However there are considerable challenges, constraints and uncertainties associated with scaling up the deployment of renewable energy projects to this level across the Northwest in time for the 2020 UK and EU targets.**

9. Three supporting conclusions are that:

- **The successful deployment of commercial scale onshore wind and microgeneration technologies are critical to the overall growth in renewable capacity, together accounting for approximately 75% of the capacity at 2020 under the deployment scenarios presented.** For commercial wind the issues surrounding aviation, environmental and other planning constraints will need to be successfully dealt with through the planning processes and the site specific investigations and consultations with relevant parties. Potential constraints associated with the cumulative impact of commercial wind and potentially other renewable energy developments may also need to be examined. Microgeneration technologies offer exciting opportunities for local economic development and employment as well as their renewable energy supply potential. However there is relatively little experience in the UK with many of these technologies to use to predict the uptake in the context of the new Feed in Tariffs as well as local policy measures.

[2] This is based on regional electricity demand in 2020 being at or below 2008 levels i.e. within national projections which forecast a reduction in national electricity demand of 2.8% over that period, DECC, 2010a.

- **The Northwest region has a theoretical capacity potential of approximately 25GW for low carbon sources (i.e. Combined Heat and Power or tri-generation (to include cooling), and district heating schemes) warranting further, more detailed consideration.** The more densely built environment of Greater Manchester accounts for over one third of the potential.

- **The renewable energy capacity evidence base has been significantly strengthened and updated through this project. However, inevitably for this rapidly developing sector there are still gaps and uncertainties to fill to improve the robustness of growth aspirations, plans and monitoring mechanisms.** For example early insights need to be drawn from the current round of proposals for small scale hydropower projects. Also the information base for regional/sub-regional electricity and heat demand is currently weak but will be increasingly important to understand in light of potential shifts across different fuel types (e.g. due to the electrification of road transport).

10. The data assembled within this project provides an extensive evidence base for sub-national/local policy making and action. Next steps for consideration by local authorities, sub-regions, MAA areas and other stakeholders could include:

- **Dissemination of the results and extended evidence base from the project to local authorities to assist with plan development and related activities. For example the evidence base can support local assessments of deployable resource scenarios, identifying renewable energy deployment targets and establishing delivery mechanisms.** The evidence base includes the assessment of the majority of renewable energy technologies using local source data and all but one using sub-regional source data. The project also provides supplementary useful information in terms of the review of data sources, methodological assumptions and references to other studies.

- **Reviewing and refining initiatives/interventions to facilitate the roll out of appropriate microgeneration technologies in support of economic development goals as well as renewable energy targets.**

- **Preparation of a monitoring process in order that the progress to accelerate the deployment of renewable energy capacity can be tracked, reviewed and actions taken**. The development of monitoring processes will need to take account of ongoing planning and energy policy developments and associated research such as DECC's recent scoping study on *Options for a Local Authority Renewable Energy National Indicator* (DECC, 2010c).

1: Introduction

1.1 The North West Development Agency (NWDA) commissioned SQW and Land Use Consultants to undertake a study entitled 'Northwest Renewable and Low Carbon Energy Capacity and Deployment' (the project).

1.2 The project re-examines the existing evidence base for the potential for renewable energy within the Northwest to contribute to the UK's 2020 targets through action at sub-national scales[3]. It was originally intended that this would be used to shape the preparation of the Regional Strategy for the Northwest and the review of the renewable energy targets. During the preparation of this study however the new Coalition Government revoked Regional Strategies and is seeking to return decision making powers on planning to local councils (Quartermain, 2010).

1.3 The findings of this project provide an evidence base to assist sub-regions and local authorities in the preparation of their own targets and strategies for renewable energy development at the sub-regional and local levels. The project findings are also relevant in the context of the Coalition's Programme for Government such as to "…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" (HM Government, 2010). In addition, Councils are now allowed to sell renewable electricity to the grid and benefit fully from the feed in tariff[4].

1.4 The project has a specific emphasis on ensuring that this evidence base is consistent with national guidance as well linking to other activities across the Northwest. The project therefore builds on previous/ongoing studies in the region and then applies the methodology recently prepared by SQW and Land Use Consultants for the Department of Energy and Climate Change (DECC) and the Department for Communities and Local Government (CLG) (DECC/CLG, 2010).

1.5 The project focuses on land-based renewable energy, including both commercial scale renewables and microgeneration (on-site and building-integrated renewables). It examines renewable resources within the region rather than the effects of importing or exporting resources for energy generation in a different region. The project also provides a high level assessment of low-carbon energy categories which are defined by DECC as being combined heat and power (CHP) generation (and tri-generation to include cooling) and district (community) heating schemes.

1.6 The project does not assess offshore wind or marine (wave and tidal) renewable energy sources because those technologies are not controlled by the spatial planning regime within the region, instead they are governed by other frameworks (e.g. the

[3] The Renewable Energy Strategy (RES) published in July 2009 sets out the measures that the Government will pursue to achieve the target to source 15% of the UK's energy needs from renewables by 2020 (HM Government, 2009).

[4] Secretary of State Chris Huhne wrote to local authority leaders to announce this on 9 August 2010.

Crown Estate's licensing arrangements). However, for benchmarking purposes the contributions of offshore wind and marine renewable energy sources are factored in based on an apportionment of minimum national estimates for the deployment of these resources (see Chapter 5).

1.7 Other energy sources including nuclear and fossil fuel sources are also excluded from this project. It is fully recognised that in implementing the Regional Strategy there are various relationships between the technologies covered by the project and those that are excluded. For example, energy industry and supply chain opportunities in the region may cross over these markets. It is also important to note that the project is strategic in nature and is not intended to provide guidance for the assessment and development of specific renewable energy projects/sites.

1.8 The authorities in the Northwest have been pro-active in assessing the available renewable energy resource at sub-national scales for a number of years. There is an extensive library of completed studies that may be relevant to this project as well as a number of ongoing pieces of work to support regional, sub-regional and local understanding and target setting. The scoping stage of this project, as documented in the project Scoping Report and summarised in Section 2, reviewed the evidence base produced by those other studies to identify their applicability for use in this project.

Overview of the project methodology

1.9 Developing the regional evidence base for renewable energy capacity in the Northwest involves a sequential process. Layers of analysis are applied that forecast and progressively reduce the total <u>theoretical</u> opportunity to what is <u>practically</u> achievable and foreseeable. As with all predictive/forecasting activities a series of assumptions and judgments are made in order to derive sensible estimates based on the best available information and expert views at the time. The key assumptions have been fully documented within this report (see Annex A) to aid comprehension of the project's results and to support any subsequent studies.

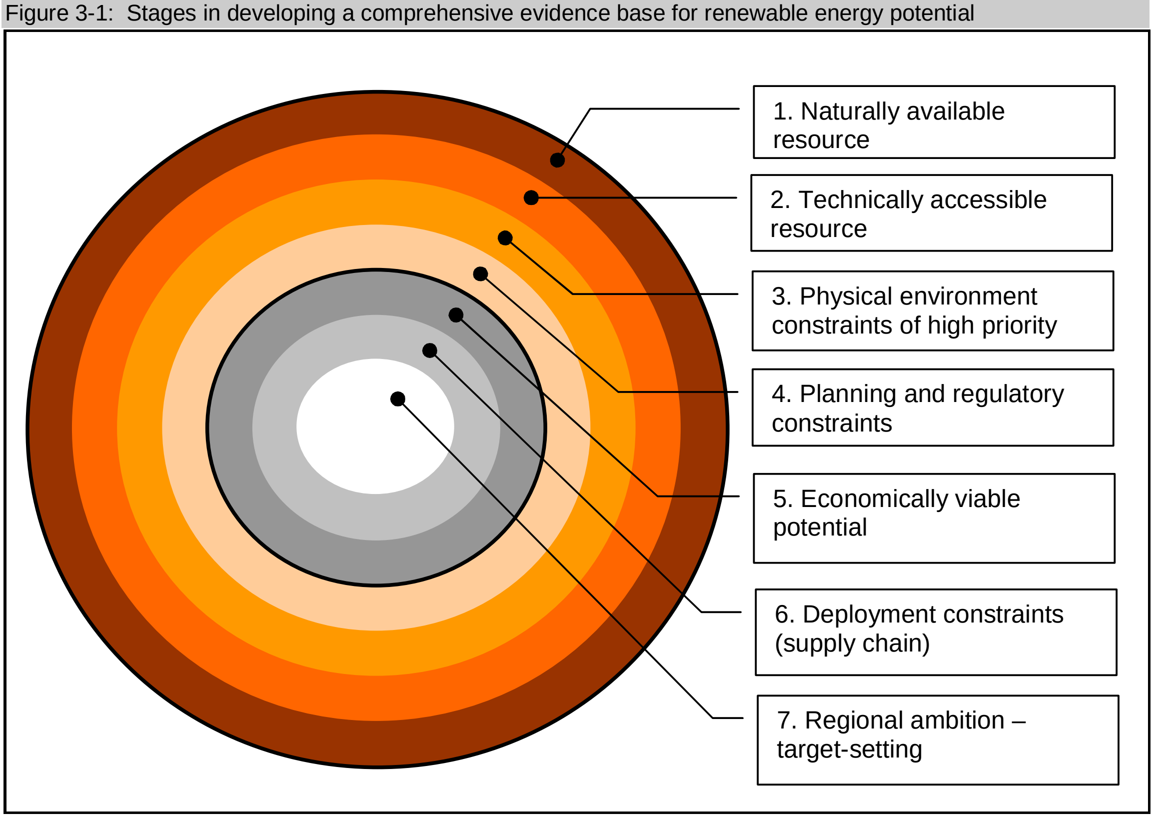
1.10 Figure 3-1, reproduced from the DECC/CLG methodology, provides a summary of the key stages involved in developing the comprehensive evidence base and analysis of renewable energy capacity. Stages 1 to 4 are covered in the DECC/CLG methodology which has been followed in this project. The result of stages 1 to 4 is an assessment of the **potential accessible resource** for renewable energy technologies across 18 sub-categories (see Chapter 3).

1.11 Stages 5 to 7 from Figure 3-1 are not included in the DECC/CLG methodology. A bespoke approach has therefore been developed for this project to analyse the **renewable energy constraints and deployment scenarios to 2020** (see Chapter 5).

1.12 The SQW/Land Use Consultants project team is grateful to the NWDA and the project Steering Group for its advice and guidance throughout the project. A total of four project Steering Group meetings were held throughout the work in addition to a stakeholder workshop. The Steering Group comprised representatives of a range of local and regional organisations involved in the planning and deployment of renewable energy at sub-national scales.

- 4NW
- Cumbria County Council
- Envirolink Northwest
- Environment Agency
- Forestry Commission
- Government Office of the Northwest
- Natural England
- Northwest Development Agency

Figure 3-1: Stages in developing a comprehensive evidence base for renewable energy potential



Source: DECC/CLG, 2010

The structure of the report

1.13 The remainder of this report is organised as follows:

- Chapter 2 summarises previous work assessing renewable energy potential and highlights the implications for this project. It also reviews information on regional energy demand to 2020.
- Chapter 3 describes the results of the assessment of potential accessible resources (in accordance with stages 1 to 4 of the DECC/CLG methodology)
- Chapter 4 provides a preliminary assessment of low carbon energy potential (i.e. Combined Heat and Power (CHP) or tri-generation (to include cooling), and district heating schemes)
- Chapter 5 describes the results of the investigation and analysis of constraints and deployment scenarios to 2020.
- Chapter 6 draws together strategic conclusions from the project and suggests some next steps to support implementation

1.14 The report is supported by the following annexes:

- Annex A provides a comprehensive description of the data sources, methodology and assumptions adopted for the assessment of each renewable energy technology. This Annex documents the use of local and other data sources within the project
- Annex B provides the evidence base of previous/ongoing studies
- Annex C provides details of the stakeholder workshop
- Annex D provides the supporting GIS data maps
- Annex E provides a bibliography for the project

2: Previous work assessing renewable energy potential across the Northwest

Introduction

2.1 There are a large number of studies that have been identified across the Northwest which cover renewable and low carbon energy technologies. This chapter provides an overview of those studies and describes how they have been addressed within this project. The chapter also reviews the evidence base associated with understanding electricity consumption to 2020 in the Northwest.

Perspectives from previous studies

Scoping review

2.2 Relevant previous and ongoing studies and data (including GIS data) were identified and reviewed during the scoping phase of this project and subsequently as new reports were published. A total of 37 different studies were identified as listed in Annex B, many of which comprised multiple documents. Studies with potential relevance were identified by the project team, Steering Group members and their contacts/networks. These were filtered and reviewed in terms of their significance for this project via an initial review. The most relevant were systematically assessed in terms of the degree of consistency with the spirit of the national methodology (DECC/CLG, 2010) for each relevant technology and scale. Where studies were not found to have specific relevant data/ information/ methodologies they were captured in the project evidence base.

2.3 In parallel with the review of previous studies and in preparation for the GIS based analysis (required for certain technologies) a “bottom up” review was undertaken of the GIS data sources. This focused on the sources cited in the DECC/CLG methodology to consider their application to the Northwest. The results of the GIS data review fed into the accessible resource assessment which is documented in Chapter 3 of this report.

Compatibility of previous studies with the DECC methodology

2.4 The key finding of the scoping stage was that, with the exception of regional estimates of sewage, none of the studies has produced information for any of the technologies and geographic scales in a way that is clearly and unambiguously consistent with the DECC/CLG methodology. That is not in itself surprising because the methodology was only published in early 2010. Therefore no criticism of the previous studies is implied.

2.5 The most recent and comprehensive study on renewable energy capacity/potential was the 4NW’s 2008 study ‘*Towards Broad Areas for Renewable Energy*

Development'. In terms of consistency, the Toward Broad Areas study does not provide a platform for achieving consistency with the DECC/CLG methodology. The estimates of commercial scale wind from the study are expected to be significantly lower than the estimates arising from applying the DECC/CLG methodology. This is because the Towards Broad Areas study only considered areas with wind speeds of at least 6.5 m/s, whereas the DECC/CLG methodology uses a lower minimum threshold (5 m/s). Another significant divergence is the assumption used in the 4NW study of the use of Combined Heat and Power (CHP) for power generation from biomass fuels, whereas the DECC/CLG methodology assumes use of conventional plant. This assumption could cause up to a 50% decrease in the amount of electricity generation from biomass[5].

2.6 In light of the findings of the scoping review, the information in previous studies was used selectively to support and benchmark the resource assessment/further analysis in this project rather than to directly provide results that would be immediately compatible with the DECC/CLG methodology.

Forecasting electricity demand

2.7 In order to consider the contribution of renewable and low carbon technologies, it is of use to understand the expected or anticipated forecast for demand. The purpose of this section is to explore the best available national and sub-national evidence base for an electricity consumption forecast to 2020. An equivalent demand forecast for heat to 2020 is not provided due to the relative paucity of information.

2.8 In considering electricity demand forecasts to 2020 the following data sources were reviewed:

- The Committee on Climate Change, 2008. *Building a Low Carbon Economy* (including technical appendices and supporting research)
- HM Government, 2009. *Renewable Energy Strategy* (and analytical annexes)
- Ofgem, 2009. *Project Discovery*.
- DECC, 2010a. *Updated Energy and Emissions Projections*.
- Department for Business Innovation and Skills, 2008. *Energy Market Outlook - Electricity Demand Forecast Narrative*

UK electricity demand forecasts

2.9 Within the UK, electricity demand is a product of many influencing factors – including time of year, weather, cost to the consumer, impact of energy efficiency measures, changes in population etc – all of which impact on the annual demand.

[5] The Towards Broad Areas study report states the power conversion efficiency assumed for a CHP plant. The efficiency of CHP varies by scale of the plant, with efficiency rising with size of the unit. The estimate of a 50% decrease in generation is based on the fact that some units do have efficiency up to half of that of a conventional plant.

Given the importance of electricity supplies to the UK economy – forecasts of demand enable assessments of generation adequacy, and an understanding of the potential costs and impacts of electricity supply dependent upon the generation sources used.

2.10 At a National level, demand forecasts are not generally developed through a bottom-up approach – that is, from actual energy demand within a region, and expected growth/decline applied based on changes in the physical and infrastructural assets. Instead, demand forecasts are built from a combination of macro-economic models (using equations to represent changes in energy and/or electricity demand associated with certain economic parameters) and energy emissions projections which are produced by a range of stakeholders – including the Department of Energy and Climate Change (DECC), the Department of Business Innovation and Skills (BIS), National Grid, and other stakeholders.

2.11 Formed from different base statistics, and for arguably different purposes there is not a level of internal consistency that could be of benefit to this project. Arguably, the national trend in electricity demand to 2020 could be considered a useful benchmark on which to compare regional information – with differences to the national trend considered on the basis of specific regional differences such as concentration of heavy industry, manufacturing or major conurbations – all of which act not only as centres of electricity demand, but will also respond differently to energy efficiency measures.

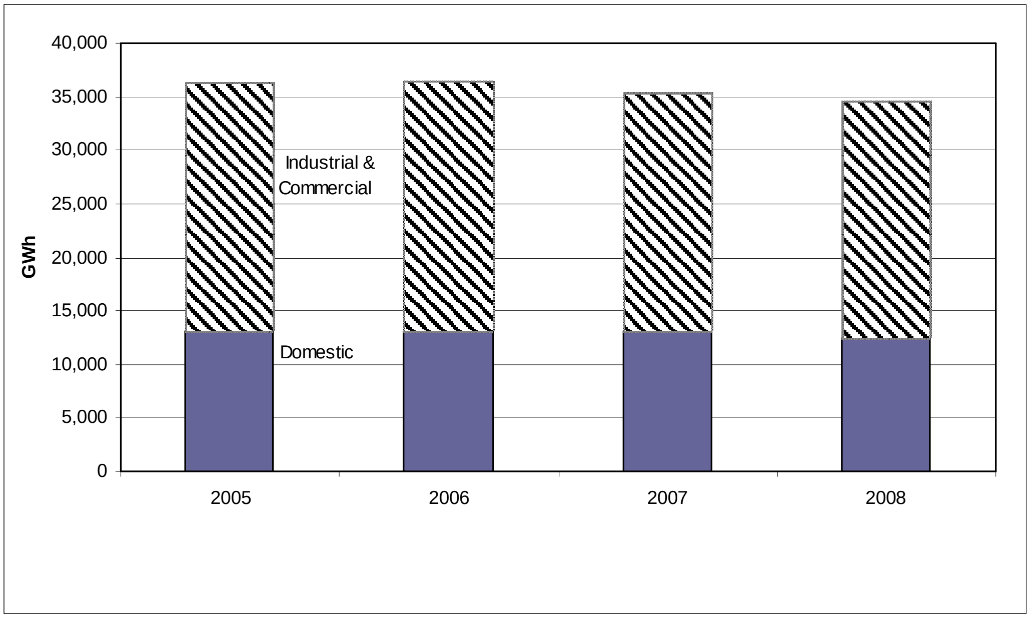
2.12 The energy market outlook from the Department for Business, Innovation and Skills (2008) provides detail at the system demand level through examination of the annual transmission system demand forecast (including station, pumping and export demand). This states that electricity requirements on the GB transmission system rising from 351TWh in 2007/08 to 373TWh in 2022/23 giving an average growth rate of 0.4% pa.

2.13 DECCs most recent projections update states that '*the impact of the recession in the UK has reduced the demand for electricity significantly. Demand is provisionally estimated to fall by around 7.5% between 2008 and 2009. Notwithstanding the effects of the recession, demand had exhibited a declining trend in recent years, falling continuously between 2005 and 2008*'. Overall, however the same projection states that '*electricity demand in the UK is projected to grow by around 2% between 2009 and 2020, with growth restrained by energy efficiency policies. Demand growth is slightly higher thereafter, as the effects of economic growth begin to outweigh the impact of energy efficiency policy, whose effects tend to peak by around 2020*' (DECC, 2010a). **On this basis the projected overall change between 2008 and 2020 is a fall in electricity demand of 2.8%** (DECC, 2010a – Annex E).

Forecasting electricity demand in the Northwest

2.14 Electricity demand for the Northwest in the most recent year reported (2008) was 34,569 GWh (DECC, 2010b). Figure 2-2 uses the same dataset to show recent trends in consumption, showing a total fall in demand of 4.75% over the period 2005-2008. That equates to an average fall in demand of 1.19% annually during this period of economic recession.

Figure 2-1: Electricity consumption in the Northwest 2005 - 2008



Source: DECC, 2010b

2.15 Opinions vary about the predicted electricity demand in the region between now and 2020. A regional environment economy input/output model (REEIO) made prior to the recession predicted a 12% decline in electricity use in the region because of the introduction of energy efficiency measures. Other predictions made prior to the recession produced divergent views with predicted demand somewhere between 32,000 and 43,000 GWh/year (Northwest Energy Council, 2009).

2.16 There is uncertainty as to how the region's electricity demand will change. If the regional perspective is exactly in line with national trends, demand would be expected to be restrained by energy efficiency and other policy measures resulting in a fall in demand of around 2.8% between 2008 and 2020. For the purposes of comparing renewable energy deployment against potential demand within this study (see Chapter 5) a slightly more conservative assumption has been used. That is that electricity demand in 2020 will be at around the same level as 2008, thus allowing for different demographic and economic growth patterns from the national situation.

3: Potential accessible renewable resource

Introduction

3.1 As outlined in Chapter 1, developing the regional evidence base for the Northwest involves a sequential process. In this chapter we deal with the results of the assessment of potential accessible renewable energy resource, stages 1 to 4 as defined in the national methodology (DECC/CLG, 2010).

Methodology for the accessible renewable energy resource assessment

3.2 The assessment of potential accessible resource broadly represents the opportunity for harnessing the renewable energy resource on the basis of what is naturally available and accessible. Some natural resources, for example solar and wind, are available in abundant supply. In these cases the analysis focuses on what the available technology can capture and convert into useful energy.

3.3 The resource and technological scope for the detailed assessment focuses on land-based renewable energy categories only (i.e. not offshore or tidal barrage sources). The technologies include commercial scale renewables and microgeneration (on-site and building-integrated renewables).

3.4 Table 3-1 provides the full list of the renewable energy categories and sub-categories covered by the DECC/CLG methodology. These are largely consistent with the categories that have been used in previous renewable energy assessments at the sub-national scale although few studies include precisely the same categories.

3.5 The DECC/CLG methodology applied in this project is not an exhaustive approach to renewable resource calculation. Instead it seeks to develop a broad assessment of the renewable energy resources at the sub-national scale using the same process of calculation as other regions, hence allowing an "apples with apples" comparison across all the regions of England. As such, some of the assumptions made are broad and some further detailed work has been required to determine specific characteristics of resources and/or technologies in this project. Full details of the assumptions made and alternative sources used to address data gaps can be found in Annex A.

Table 3-1: Renewable categories covered by this methodology

Category	Sub-category level 1	Sub-category level 2
Wind (onshore)	Wind – commercial scale	
	Wind – small scale	
Biomass	Plant biomass	*Managed woodland*
		Energy crops
		Waste wood
		Agricultural arisings (straw)

Category	Sub-category level 1	Sub-category level 2
	Animal biomass	*Wet organic waste*
		Poultry litter
	Municipal Solid Waste (MSW) Commercial & Industrial Waste (C&IW)	
	Biogas (*aka EfW*)	*Landfill gas*
		Sewage gas
	Co-firing of biomass (with a fossil fuel)	
Hydropower	Small scale hydropower	
Microgeneration	Solar	*Solar Photovoltaics (PV)*
		Solar Water Heating (SWH)
	Heat pumps	*Ground source heat (GSHP)*[6]
		Air source heat (ASHP[7]*)*

Source: SQW

Northwest potential accessible resource results – all technologies

3.6 Table 3-2 lists the potential accessible resource of each technology for the Northwest region.

Table 3-2: Potential accessible renewable energy resource in the Northwest by technology (at 2020)

Technology group	MW by technology group	Sub Category Level 1	Sub Category Level 2	MW by sub-category
Wind (onshore)	24,456	Wind – commercial scale	Wind – commercial scale	23,587
		Wind – small scale	Wind – small scale	669
Biomass	1,118	Plant biomass	Managed woodland	20
			Woodland and energy crops (HEAT)	122
			Energy crops	11
			Energy crops (HEAT)	60
			Waste wood	39
			Agricultural arisings (straw)	11
		Animal biomass (aka EfW)	Wet organic waste	206
			Poultry litter	9
		Municipal Solid Waste (MSW)	Municipal Solid Waste (MSW)	211
		Commercial & Industrial Waste (C&IW)	Commercial & Industrial Waste (C&IW)	135
		Biogas (aka EfW)	Landfill gas	68

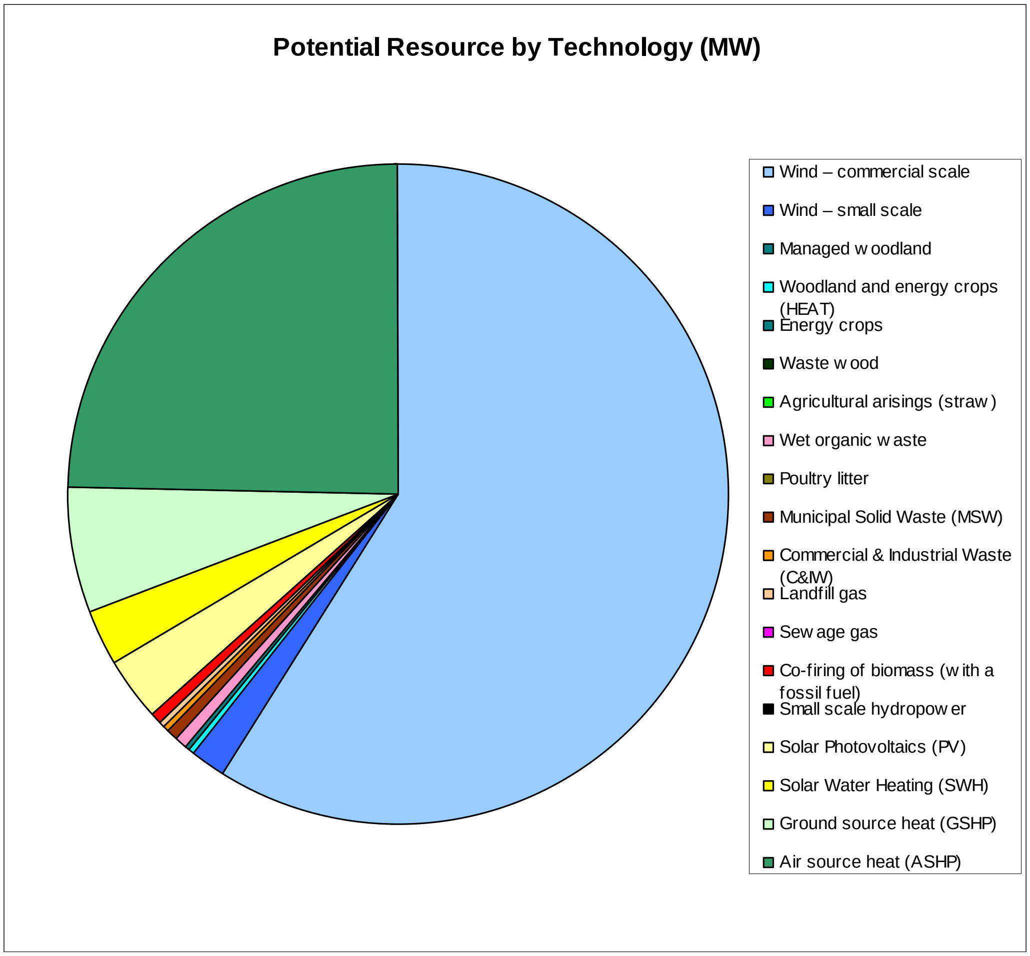
[6] This category covers horizontal trench and vertical borehole systems across the closed loop and open loop types (open loop GSHP uses ground water from an aquifer)
[7] Only those systems that achieve a coefficient of performance (COP) in line with the Renewables Directive (European Parliament and Council, 2009)

Technology group	MW by technology group	Sub Category Level 1	Sub Category Level 2	MW by sub-category
			Sewage gas	28
		Co-firing of biomass (with a fossil fuel)	Co-firing of biomass (with a fossil fuel)	198
Hydropower	77	Small scale hydropower	Small scale hydropower	77
Micro-generation	14,671	Solar	Solar Photovoltaics (PV)	1,158
			Solar Water Heating (SWH)	1,158
		Heat pumps	Ground source heat (GSHP)	2,471
			Air source heat (ASHP)	9,884
TOTAL	**40,122**			**40,122**

Source: SQW and Land Use Consultants

3.7 It can be seen that the total potential accessible renewable energy resource in the Northwest is just over 40GW. Figure 3-1 illustrates the proportion of overall potential resource of each technology. Commercial scale wind has by far the largest potential resource with almost 60% of the total followed by air source heat pumps with around 25%. All the other technology resource potentials combined account for around 15%.

Figure 3-1: Potential accessible renewable energy resource in the Northwest by technology (at 2020)



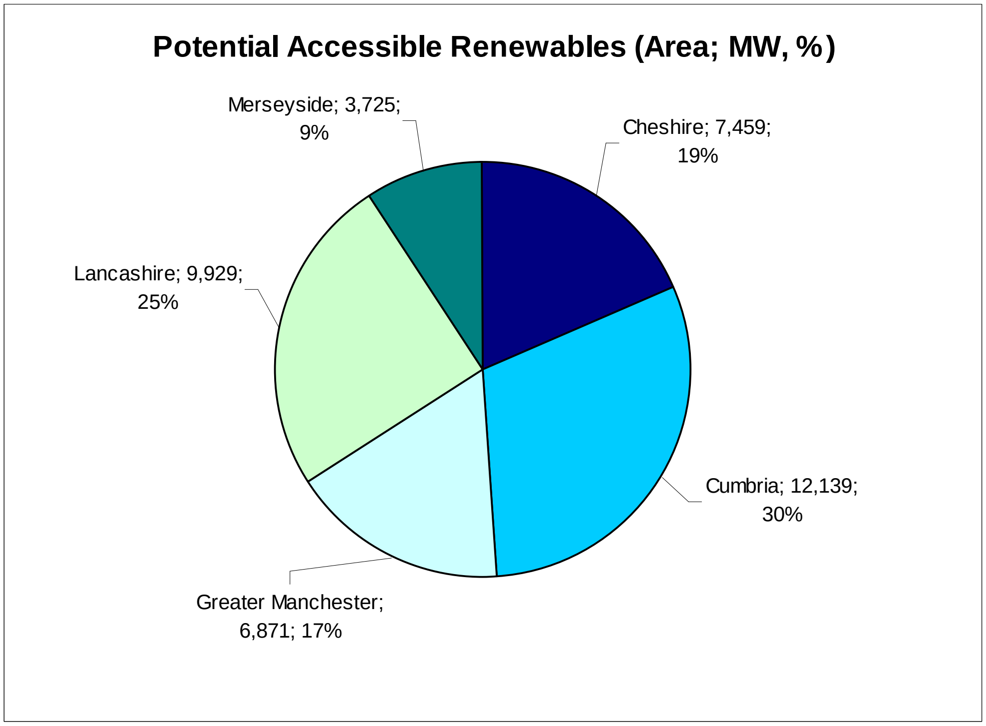
Source: SQW and Land Use Consultants

Northwest Accessible Resource Results – by sub region

3.8 Table 3-3 details the potential accessible resource for each of the sub-regions of the Northwest by technology and displays the geographic split (in MW capacity) of the total capacity displayed in Table 3-2 above.

3.9 Figure 3-2 illustrates how the share of the potential accessible renewable energy (electrical and heat) is made up between the five sub-regions.

Figure 3-2: Potential accessible renewable energy resource by sub-region (MW) (at 2020)



Source: SQW and Land Use Consultants

3.10 It can be seen that based on potential accessible renewable energy resource, Cumbria has the greatest potential with almost a third of the total. This is primarily due to the extensive wind resource in the sub-region. In each of the sub-regions the largest single resource is commercial wind.

3.11 The following sections provide further detail on the technology resource analysis including regional/sub-regional results, maps, commentary and key assumptions. Each technology is broken down into:

- definition and scope (for broad technology categories)
- main assumptions
- results – all of which relate to a forecast of the potential accessible resource for renewable energy production in 2020
- conclusion

Table 3-3: Accessible renewable energy resource by technology group, sub-categories and sub region (at 2020)

Technology group	Total energy (MW)	Sub-categories	Electricity (MW)	Heat (MW)	TOTAL (MW)	Cheshire	Cumbria	Greater Manchester	Lancashire	Merseyside
Wind	**24,456**	Wind – commercial	23,587		**23,587**	4,806	10,399	1,265	6,497	619
		Wind – small scale	669		**669**	235	220	0	201	13
Biomass	**1,118**	Plant Biomass – Managed woodland	20		**20**	2	13	1	3	1
		Managed woodland (HEAT)		122	**122**	12	81	6	9	4
		Energy crops	11		**11**	3	3	1	3	2
		Energy crops (HEAT)		60	**60**	16	15	4	15	10
		Waste wood	39		**39**	7	12	7	10	4
		Agricultural arisings (straw)	11		**11**	4	2	1	3	1
		Animal Biomass (Wet Organic Waste)	206		**206**	49	99	7	49	2
		Animal Biomass (Poultry Litter)	9		**9**	3	3	1	2	0
		Municipal Solid Waste (MSW)	211		**211**	33	17	77	43	41
		Commercial & Industrial Waste (C&IW)	135		**135**	22	9	56	26	22
		Landfill gas	68		**68**	32	3	8	14	11
		Sewage gas	28		**28**	6	0	16	4	3
		Co-firing of biomass	198		**198**	198	0	0	0	0
Hydro	**77**	Small scale hydropower	77		**77**	4	47	13	10	3
Microgen.	**14,671**	Solar Photovoltaics (PV)	1,158		**1,158**	153	90	440	238	237
		Solar Water Heating (SWH)		1,158	**1,158**	153	90	440	238	237
		Ground Source Heat Pump		2,471	**2,471**	344	207	906	511	503
		Air Source Heat Pump		9,884	**9,884**	1,376	829	3,623	2,043	2,013
TOTALS			26,426	13,695	40,122	7,459	12,139	6,871	9,929	3,725
Percentage (%)						**18.6%**	**30.3%**	**17.1%**	**24.7%**	**9.3%**

Source: SQW and Land Use Consultants

Technology by technology assessment

Commercial scale wind

DEFINITION AND SCOPE

The natural energy of the wind can be harnessed to drive a generator that produces electricity.

Commercial scale wind refers to on-shore wind farm developments for commercial energy generation and supply. Most such developments are connected to the national grid, however private-wire schemes are also an option and some already exist. Configurations of groups of wind turbines or individual turbines are used.

Assessing the resource potential and the deployment opportunities relates primarily to the wind speeds available within the region and the ability of current technology to harness this resource in terms of turbine design (size, efficiency) and installation requirements.

Source: DECC/CLG, 2010

Main Assumptions

3.12 The detailed assumptions made to assess the accessible resource for Commercial Wind are given in Annex A. The headline wind turbine assumptions are set out below:

- 2.5MW per turbine
- 135m to tip
- 4 turbines per sq km
- 5m/s windspeed

3.13 The DECC/CLG methodology requires consultation with Natural England to determine the approach to designated landscapes and nature conservation areas. This reflects a desire on the part of Natural England not to treat these areas as ‘no-go areas’ for renewable energy. The results of discussions with Natural England are summarised below:

- Designated areas (National Parks, AONBs and Heritage Coasts): These areas require further assessment outside the scope of this project and although they will be subject to the same opportunities and constraints analysis as areas outside of designated areas, the turbine density within designated landscapes should be assumed to be zero turbines/hectare;
- Areas with 2km of designated areas: In order to protect the setting of designated areas, all land within 2km of a designated area should have an assumed turbine density of zero turbines/hectare;

- Areas beyond 2km of a designated landscape but within an area of high or medium bird sensitivity as mapped by RSPB/Natural England bird sensitivity maps: should have an assumed turbine density of 50% (2 turbines per sq km)[8];
- Nature conservation designations: All International and national nature conservation designations were excluded as a constraint following discussions with Natural England.

3.14 Due to ongoing work regarding potential extensions to National Parks in the North West, Natural England requested that the assessment be undertaken covering both scenarios – i.e. the current boundaries and a scenario where the potential extensions are included. The results below present both variations – with and without the potential National Park extensions. The set of results without National Park extensions are carried forward into the aggregated results and analysis elsewhere in this report.

3.15 Aviation constraints were also considered. Some absolute exclusion zones were included, such as around main airports, but most aviation constraints were “consultation zones”.

3.16 As a requirement of the DECC/CLG methodology, the Ministry of Defence (MOD) was consulted regarding MOD constraints. MOD constraints are likely to have the effect of reducing the potentially available land (and by inference, the potentially available resource) and are important to be discussed further with the MOD when undertaking more detailed analysis such as for individual sites.

Results

3.17 It can be seen from Table 3-4 that the absolute maximum technical potential for the Northwest region is 23,587MW, i.e. 9,400 new turbines. Commercial wind therefore accounts for almost 60% of the total accessible potential renewable resource and will be critical to the overall onshore renewables mix.

Table 3-4: Potential Accessible Commercial Wind Resource (without and with National Park (NP) extensions)

Sub-region	Number of Turbines (without NP extensions)	Electricity (MW Capacity) (without NP extensions)	Percentage of Total (%)(without NP extensions)	Electricity (MW Capacity) (with NP extensions)	Percentage of Total (%) (with NP extensions)
Cheshire	1,923	4,806	20%	4,806	23%
Cumbria	4,160	10,399	44%	7,986	38%
Greater Manchester	506	1,265	5%	1,265	6%
Lancashire	2,599	6,497	28%	6,417	30%

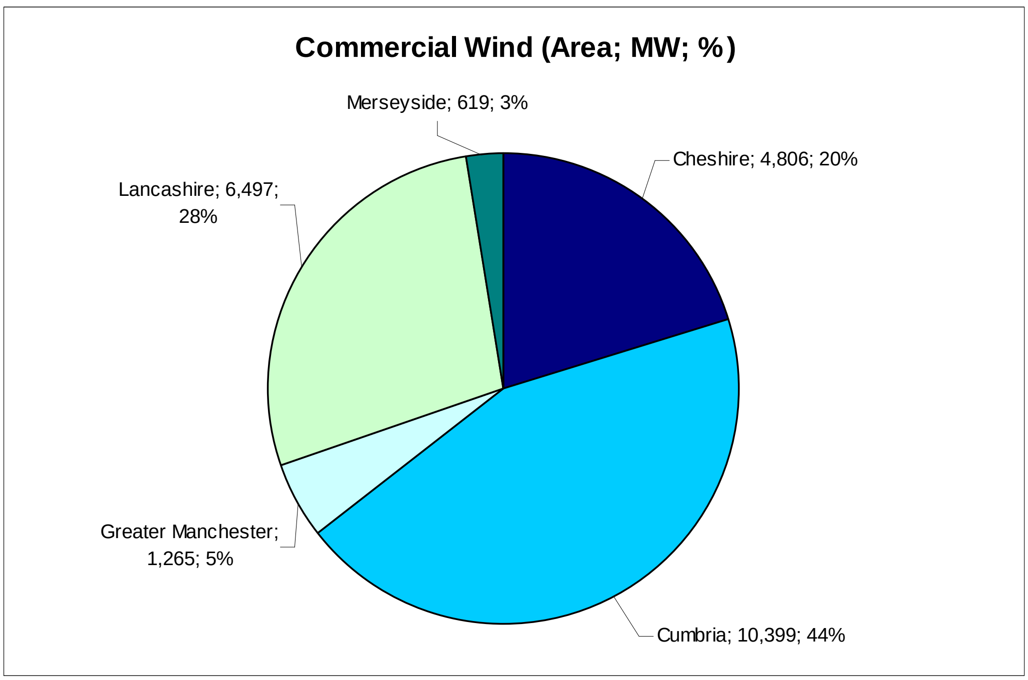
[8] Subsequent discussions with Natural England identified a desire to apply a higher deployment restriction on high bird sensitivity areas of 25% deployment (1 turbine per sq km). Unfortunately this occurred too late in the study to be accounted for. Natural England also expressed a desire to have a similar restriction on deployment in designated and non-designated peat areas (50% deployment), but no GIS data were available to apply this assumption.

Sub-region	Number of Turbines (without NP extensions)	Electricity (MW Capacity) (without NP extensions)	Percentage of Total (%)(without NP extensions)	Electricity (MW Capacity) (with NP extensions)	Percentage of Total (%) (with NP extensions)
Merseyside	248	619	3%	619	3%
Total NW Region	**9,435**	**23,587**	100%	**21,094**	100%

Source: SQW and Land Use Consultants

3.18 Figure 3-3 illustrates the potential accessible Commercial Wind resource by sub-regions. By far the largest Commercial Wind resource is to be found in the Cumbria sub-region with almost half of all the Northwest's potential resource.

Figure 3-3: Potential Accessible Commercial Wind Resource by Sub-region (without National Park extensions)



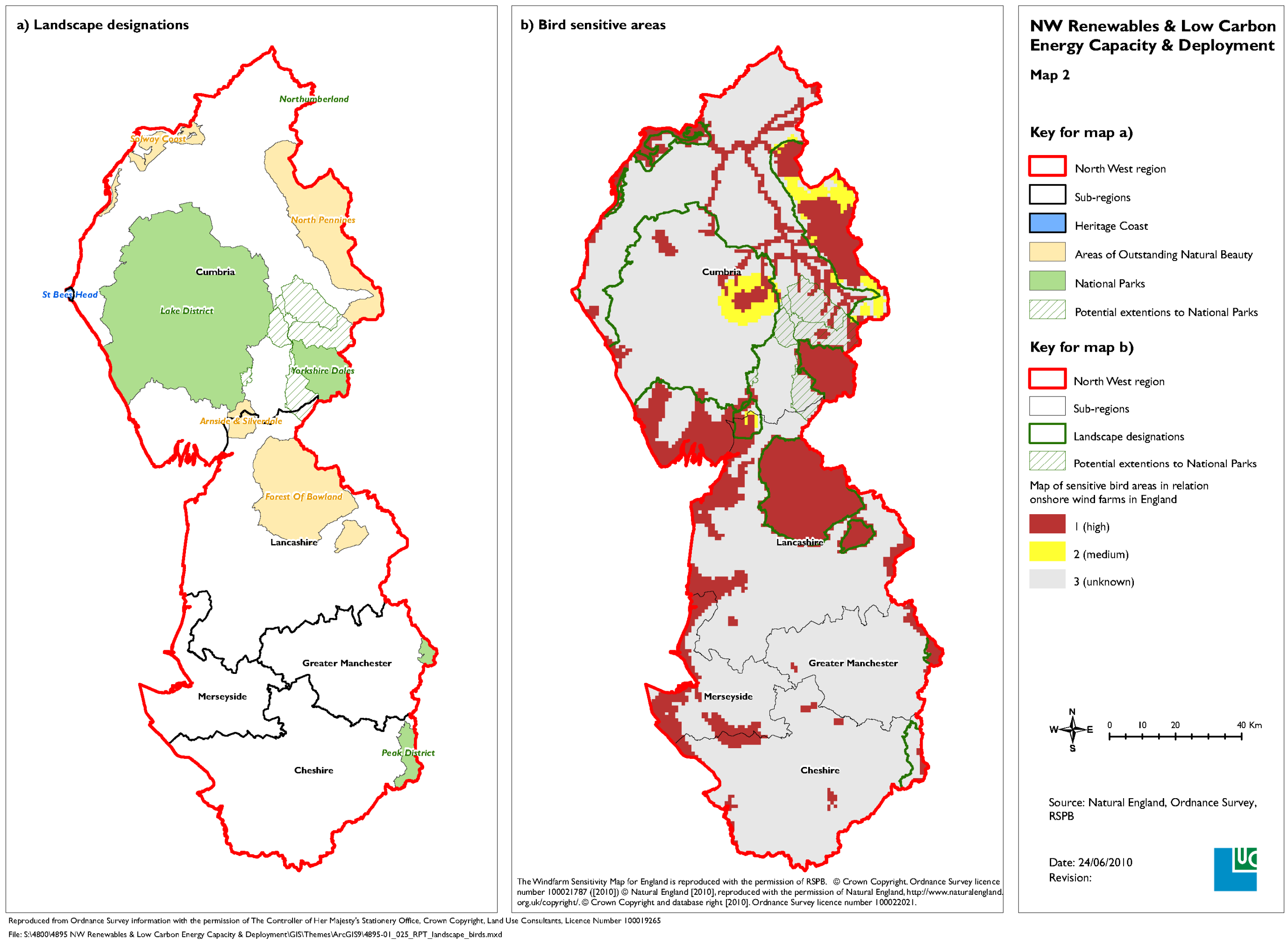
Source: SQW and Land Use Consultants

3.19 Figures 3-4 and 3-5 show typical GIS maps used in the evaluation of the potential accessible resource of commercial wind. Figure 3-4 shows the extent of the landscape designations in the North West. It also illustrates other factors (e.g. bird sensitivities) that have a bearing on the accessible resource.

3.20 Figure 3-5 shows the available resource for Commercial Wind with and without National Park extensions. The different levels of turbine density are shown in different colours with purple having the greatest wind potential with a turbine density of four per kilometre squared.

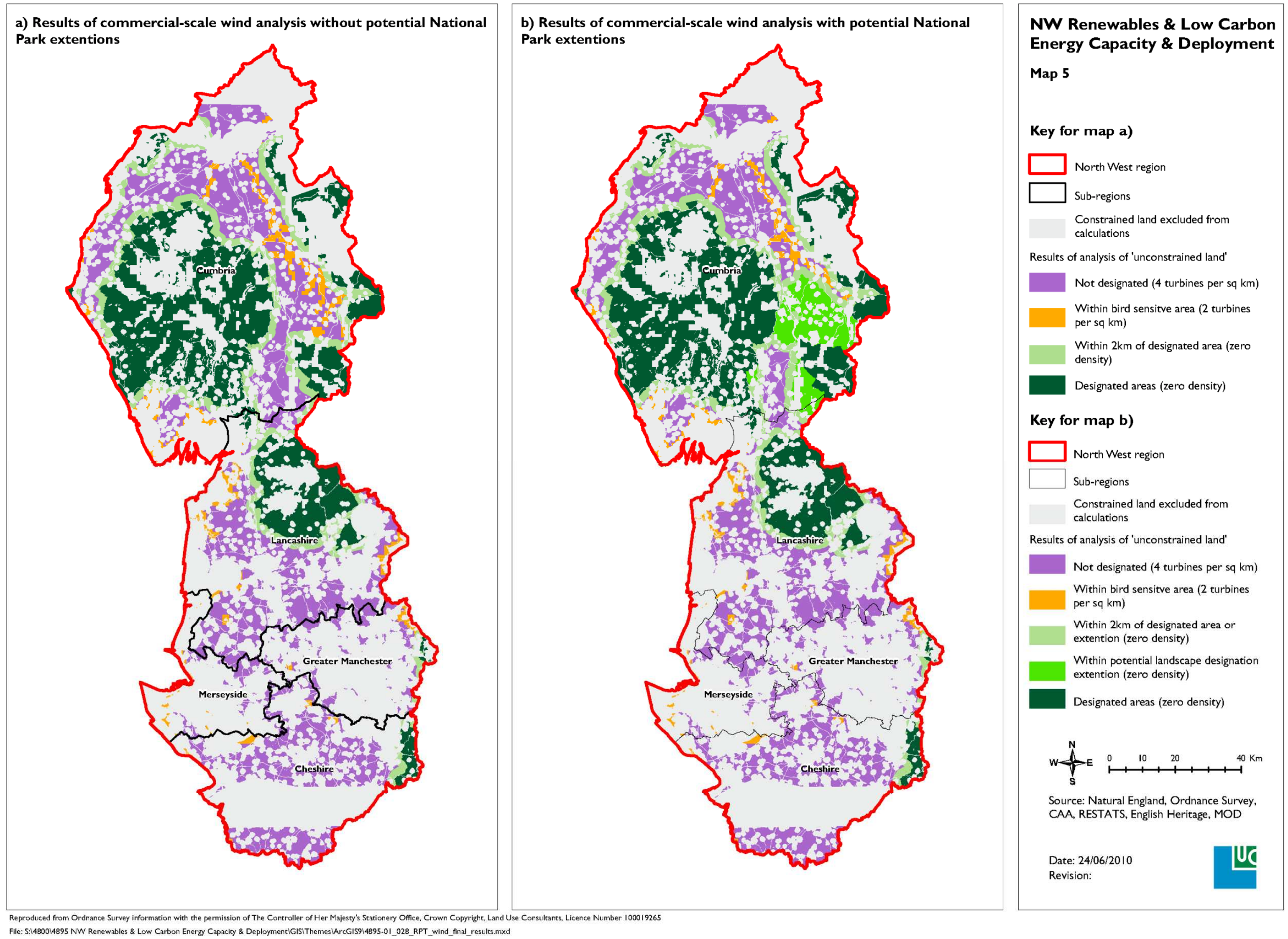
3.21 It can be seen that most of the Commercial Wind resource is found the in the hilly rural areas of the Northwest with very little or no accessible resource in the urban areas (as a consequence of the requirement to restrict land areas with potential to those areas beyond 600m from an urban area).

Figure 3-4: Illustration of the landscape designations and restrictions associated with commercial scale wind



Source: SQW and Land Use Consultants

Figure 3-5: Commercial wind resource map with constraints, with and without potential National Park extensions



Source: SQW and Land Use Consultants

Conclusions

3.22 Commercial Wind proved to be the largest single resource in the Northwest.

3.23 Most of the Commercial Wind resource is situated in the north of the region, particularly Cumbria. However, the greater amount of designated land in the north significantly reduces the amount of wind that can be exploited. This highlights the importance of undertaking more detailed assessment of these areas.

3.24 Although the amount of land available for wind towards the south of the region may be comparable with the amount available in the north, the wind resource (average wind speed) will be significantly less in the south. This is explored in more detail in Chapter 5.

Small scale wind

DEFINITION AND SCOPE

A sub-category of onshore wind is the small scale wind installations which can be defined as having capacity of less than 100 kW and typically comprise single turbines. Small scale wind schemes have different characteristics to large scale developments.

The majority of small scale wind installations are ground-based developments, with only few that are building integrated (on top roofs). Small scale ground-based turbines, by their nature have lower hub/tip heights of about 15m above ground level and are viable at lower wind speeds (4.5 m/s at 10m above ground level).

Source: DECC/CLG, 2010

Main Assumptions

3.25 The assumptions made for calculating the Small Scale Wind resource were consistent with the DECC/CLG methodology. Further details can be found in Annex A.

Results

3.26 Table 3-5 details the potential accessible resource of Small Scale Wind for each sub-region. It can be seen that the Northwest has a theoretical resource of 669MW. This resource is split almost evenly across the three sub-regions of Cheshire, Cumbria and Lancashire. The urban areas of Greater Manchester and Merseyside have virtually no Small Scale Wind potential.

3.27 This lower potential Greater Manchester and Merseyside and other urban and suburban areas is a result of the high “wind scaling factors” (56% for urban areas and 67% for suburban areas) that have been applied to the wind values in accordance with the DECC/CLG methodology. If the scaling factors reduce the wind speed below the minimum level of 4.5m/s at 10m above ground level then there is deemed to be no viable energy resource for small scale wind. Using the DECC/CLG methodology these wind scaling factors have been applied on a ward by ward basis to provide a strategic assessment of the potential resource, but in doing so some local sites within those wards may be have been discounted.

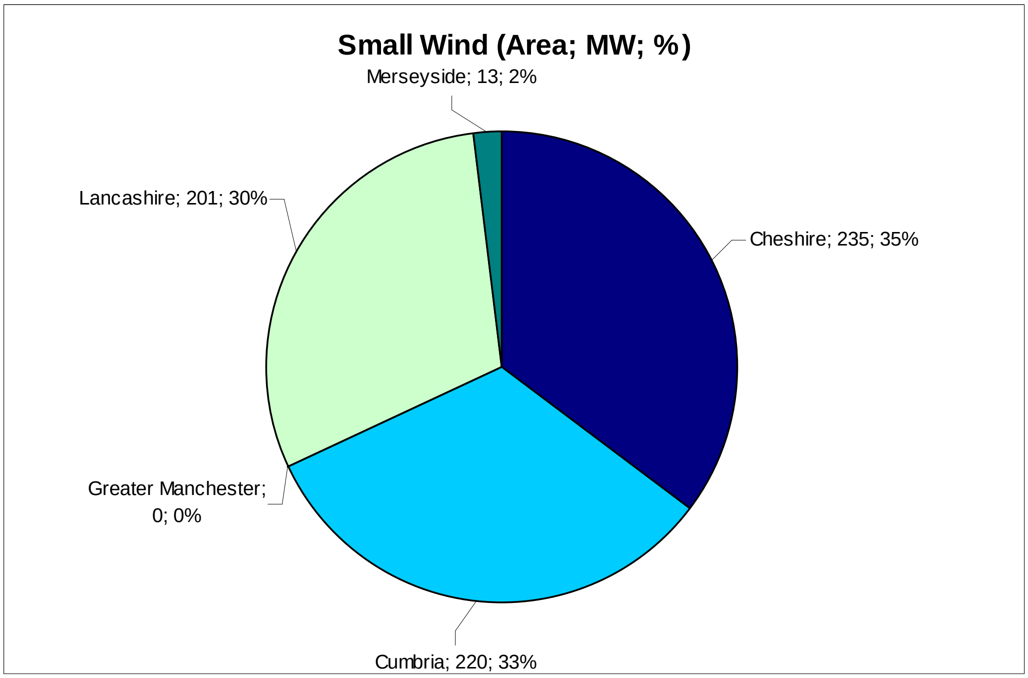
Table 3-5: Potential accessible small scale wind resource

Sub-region	Electricity (MW Capacity)	Percentage of Total (%)
Cheshire	235.2	35%
Cumbria	219.8	33%
Greater Manchester	0.1	0%
Lancashire	200.9	30%
Merseyside	12.6	2%
Total NW Region	**668.5**	**100%**

Source: SQW and Land Use Consultants

3.28 Figure 3-6 illustrates the proportion of the Small Scale Wind resource in each sub-region.

Figure 3-6: Potential accessible small scale wind resource by sub-region



Source: SQW and Land Use Consultants

Conclusion

3.29 The Northwest has a Small Scale Wind resource of 669MW.

Biomass

DEFINITION AND SCOPE

Biomass is a diverse category with regard to the type of available fuels, fuel conversion technology and type of energy output.

Fuels – different fuel categories have been used in the literature and a single agreed categorisation is still difficult to identify. The EU Renewable Energy Directive and the UK Biomass Strategy, however, provide more comprehensive (and legally binding) definitions for biomass fuels. Generally, biomass fuel can arise from plants (woody or grassy), animals (manure, slurry) and human activity (industrial and municipal waste). All of these options are considered in the guidance. In most cases, the useful fuel is in a solid or gaseous form. Bioliquids (i.e. liquid fuel for energy purposes other than for transport) are also available and varied, however they are not directly included in this guidance as (1), they compete with the other biomass fuel categories for natural resource (productive land or bio waste) and therefore are not an additional resource, and (2) they often need to be imported to meet commercial scale demand (e.g. palm seed oil), for which regional resource assessment in not appropriate. Biofuels (e.g. biodiesel and bio-ethanol) are those fuels used for transport purposes and are not included in this study.

Conversion technology – three main processes are currently available and used: (1) direct combustion of solid biomass, (2) pyrolysis and gasification of solid biomass and (3) anaerobic digestion of solid or liquid biomass. Biomass fuels are in principle suitable for use in combined heat and power (CHP) plants, however, its use has not been exploited to its full potential in the UK. Assessing the capacity potential for biomass CHP however will not change the total outcome for the regional biomass opportunity and therefore is not required.

Energy output – this can be in the form of electricity or heat.

Source: DECC/CLG, 2010

Plant biomass

Main Assumptions

3.30 Plant biomass consists of managed woodland, energy crops, waste wood and agricultural arisings (straw) for the generation of electricity and woodland and energy crops for heat. Each of these resources is detailed individually under its own heading in the following sections.

3.31 The assumptions made for plant biomass are as per the DECC/CLG methodology. Assumptions about individual technologies/resources are given in the sections for each technology/resource. A detailed list of the assumptions made for all the technologies can be found in Annex A.

Results

3.32 It can be seen from Table 3-6 that the Plant Biomass potential of the Northwest region is 82MW (electrical) and 182MW (thermal). Cumbria provides the single largest potential for Plant Biomass with over one third of the regions electrical potential and over half of the regions potential Plant Biomass heat provision.

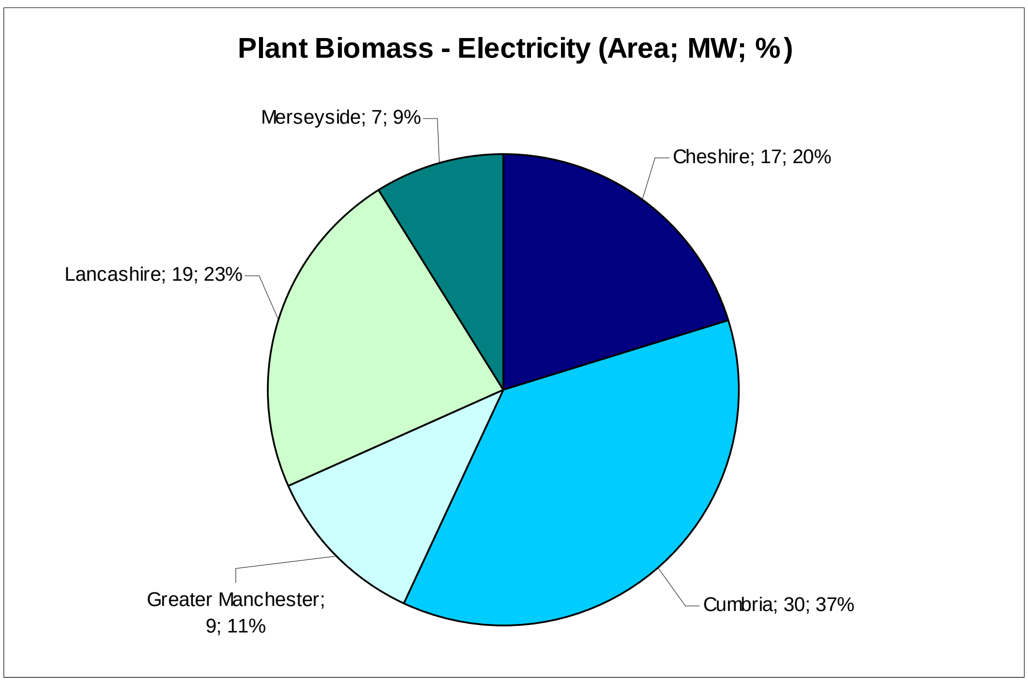
Table 3-6: Potential accessible plant biomass resource

Sub-region	Electricity (MW Capacity)	Percentage of Elec. Total (%)	Heat (MW Capacity)	Percentage of Heat Total (%)
Cheshire	16.7	20%	28.3	16%
Cumbria	30.0	37%	95.5	51%
Greater Manchester	9.2	11%	10.5	6%
Lancashire	18.7	23%	34.0	19%
Merseyside	7.3	9%	13.9	8%
Total NW Region	**81.8**	**100%**	**182.3**	**100**

Source: SQW and Land Use Consultants

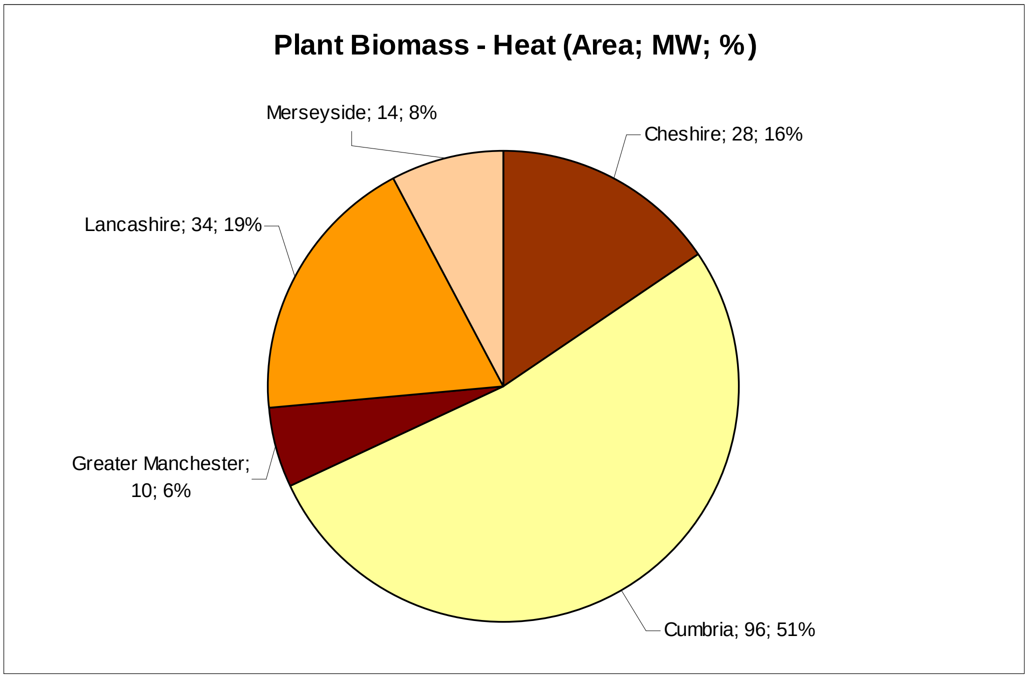
3.33 Figure 3-7 and 3-8 illustrates the proportion of Plant Biomass potential for each sub-region.

Figure 3-7: Potential accessible plant biomass (for electricity production) by sub-region



Source: SQW and Land Use Consultants

Figure 3-8: Potential accessible plant biomass (for heat production) by sub-region



Source: SQW and Land Use Consultants

Conclusions

3.34 Although Plant Biomass only accounts for a small proportion of the overall renewable resource in the Northwest region (0.3% of electrical and 1.3% of thermal resource), it tends to come from existing managed resources. In addition, most forms of Plant Biomass lend themselves to storage and can be easily transported. As such, it can be easily harnessed, managed and play an important role in local energy production.

Managed Woodland

Main Assumptions

3.35 The Forestry Commission was consulted on the assessment of the Managed Woodland resource. It recommended not using the Resource Tool Data as set out in the DECC methodology. Instead, it was suggested to start with the raw data on woodland hectarage from the Forestry Commission to build up a sub-regional picture since the Resource Tool data was not available at sub-regional level. A calorific value of 18GJ/odt of wood (equivalent of stemwood) was used to calculate the resource value. It was then assumed that 50% of the available woodland was uneconomic to harvest. Competition from alternative markets was also taken into account.

3.36 A more detailed list of the assumptions for Managed Woodland can be found in Annex A.

Results

3.37 Table 3-7 shows the accessible Managed Woodland resource for both electricity generation (20 MW) and heat generation (122MW) respectively from the Northwest. Within the Northwest, Cumbria has around two-thirds of the Managed Woodland resource for the generation of electricity, consistent with it's rural characteristics

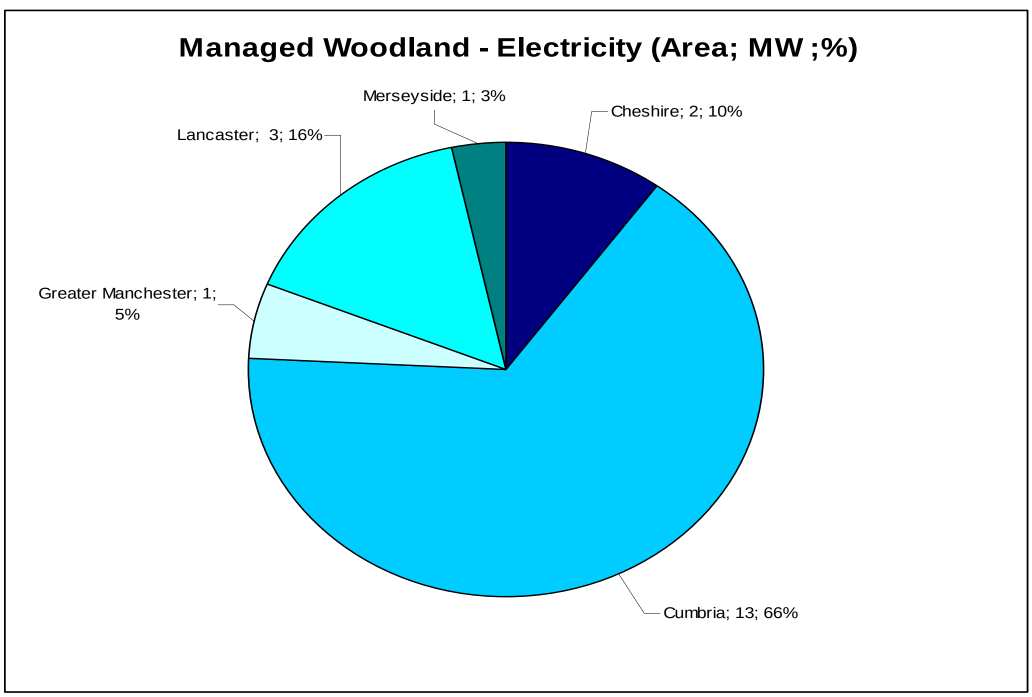
Table 3-7: Potential accessible energy crops resource for electricity and heat generation

Sub-region	Electricity (MW Capacity)	Percentage of Elec. Total (%)	Heat (MW Capacity)	Percentage of Heat Total (%)
Cheshire	2.0	10%	12.3	10%
Cumbria	13.2	66%	80.5	66%
Greater Manchester	1.1	5%	6.5	5%
Lancashire	3.1	16%	19.0	16%
Merseyside	0.7	3%	3.9	3%
Total NW Region	**20.1**	**100%**	**122.3**	**100%**

Source: Source: SQW and Land Use Consultants

3.38 Figure 3-9 illustrates the proportion of Managed Woodland accessible resource for electricity generation in each sub-region.

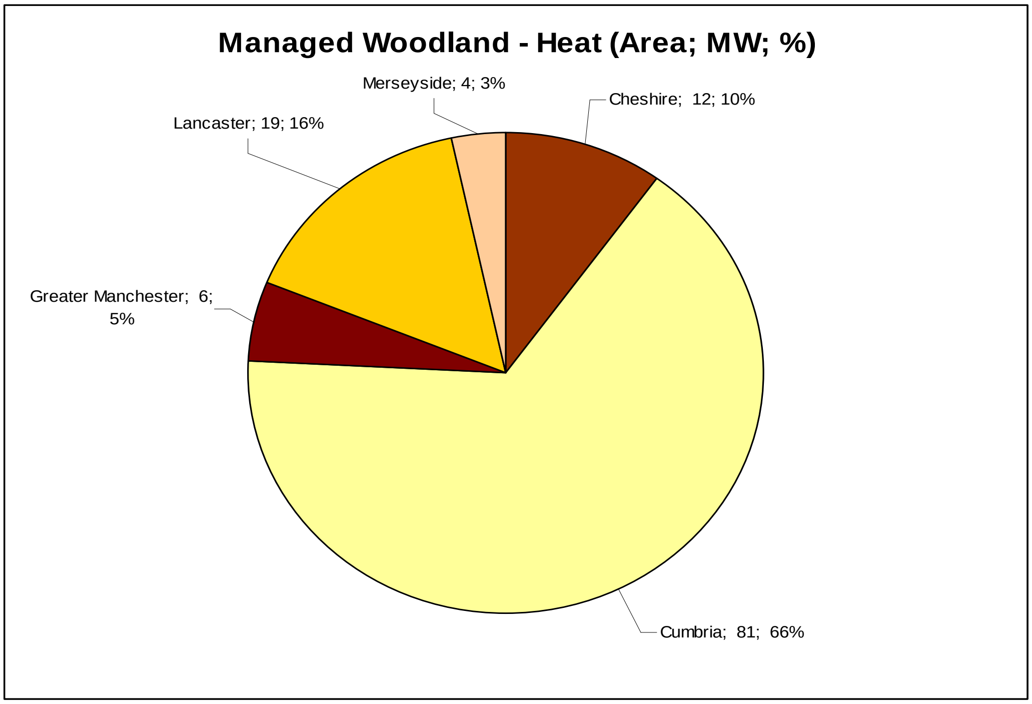
Figure 3-9: Potential accessible managed woodland resource (for electricity generation) by sub-region



Source: SQW and Land Use Consultants

3.39 Figure 3-10 illustrates the proportion of Managed Woodland accessible resource for heat generation in each sub-region.

Figure 3-10: Potential accessible managed woodland resource (for heat generation) by sub-region



Source: SQW and Land Use Consultants

Conclusion

3.40 Cumbria has around two-thirds of the Northwest's accessible resource of managed woodland. Managed Woodland only accounts for less than 0.1% of the accessible renewable electricity generation in the Northwest. However, it is a resource that can be easily managed, transported and stored; giving it added value despite its small size.

Energy Crops

Main Assumptions

3.41 The DECC/CLG methodology requires the generation of estimates for heat and electricity from biomass energy crops under three scenarios - high, medium and low as follows:

- High – Assumes that all available arable land and pasture will be planted with energy crops;
- Medium – Assumes that all abandoned land and pasture will be planted with energy crops; and
- Low – Assumes that new crops will only be planted to the extent of submitted applications to the Energy Crop Scheme.

3.42 The high scenario, as defined in the DECC/CLG methodology, is acknowledged to be neither possible nor desirable due to other uses of the land that are not considered within the assessment (such as food production). This scenario is entirely theoretical.

3.43 Significant data limitations meant that data to calculate the available arable land and pasture extent under the high scenario had to be generated using alternative datasets to the DECC/CLG methodology suggested data sources. This was not ideal and had the effect of falsely inflating the estimates under this scenario.

3.44 Data for the medium scenario were not available as GIS data and as such, it was not possible to determine the mapped extent of land under this scenario.

3.45 It was not possible to quantify the low scenario as there were no applications to the ECS in 2010 (or 2009).

3.46 The results of this assessment are therefore based on the medium scenario.

3.47 Natural England was consulted on the approach to take with regards to designated areas. Unfortunately the guidance was provided at a very late stage in this project and was not able to be taken into consideration.[9]

3.48 Further details of the assumptions used in the calculations can be found in Annex A.

Results

3.49 Table 3-8 shows the accessible Energy Crops resource for both electricity generation and heat (under the medium scenario as defined in the DECC methodology). It can be seen that the Northwest region has an accessible Energy Crops resource of 12MW for electricity generation and 60MW for heat.

3.50 Cumbria has the greatest potential for energy crops followed by the other more rural sub-regions of Lancashire and Cheshire. Both Greater Manchester and Merseyside have considerably less potential, primarily due to their more urban make-up.

Table 3-8: Potential accessible energy crops resource for electricity and heat generation

Sub-region	**Electricity (MW Capacity)**	**Percentage of Elec. Total (%)**	**Heat (MW Capacity)**	**Percentage of Heat Total (%)**
Cheshire	3.0	25%	16	27%
Cumbria	3.0	25%	15	25%
Greater Manchester	1.0	8%	4	7%
Lancashire	3.0	25%	15	25%
Merseyside	2.0	17%	10	17%
Total NW Region	**12.0**	**100%**	60	100%

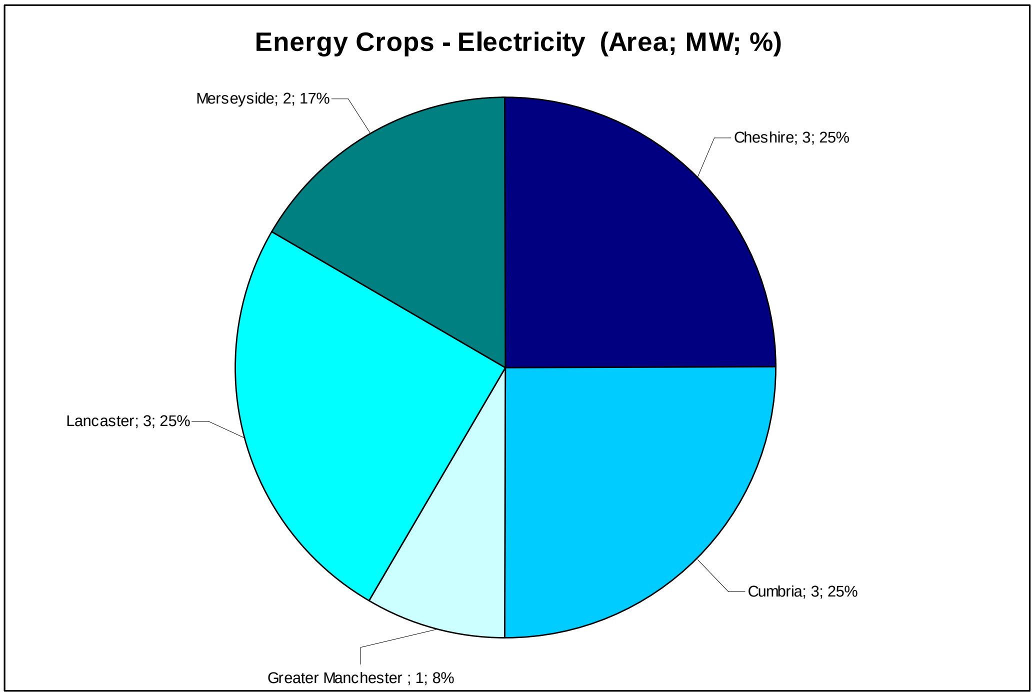
Source: SQW and Land Use Consultants

[9] Although received following the production of estimates for energy crops in the Northwest, the guidance from Natural England was to limit the extent of energy crop potential in protected landscapes under the high scenario to the medium scenario. Natural England also requested that farmland birds be accounted for in the estimates, although data were not available.

3.51 The Energy Crops accessible resource potential of the Northwest accounts for less than 0.1% of its potential renewable electricity generation and around 1.3% of the region's renewable heat.

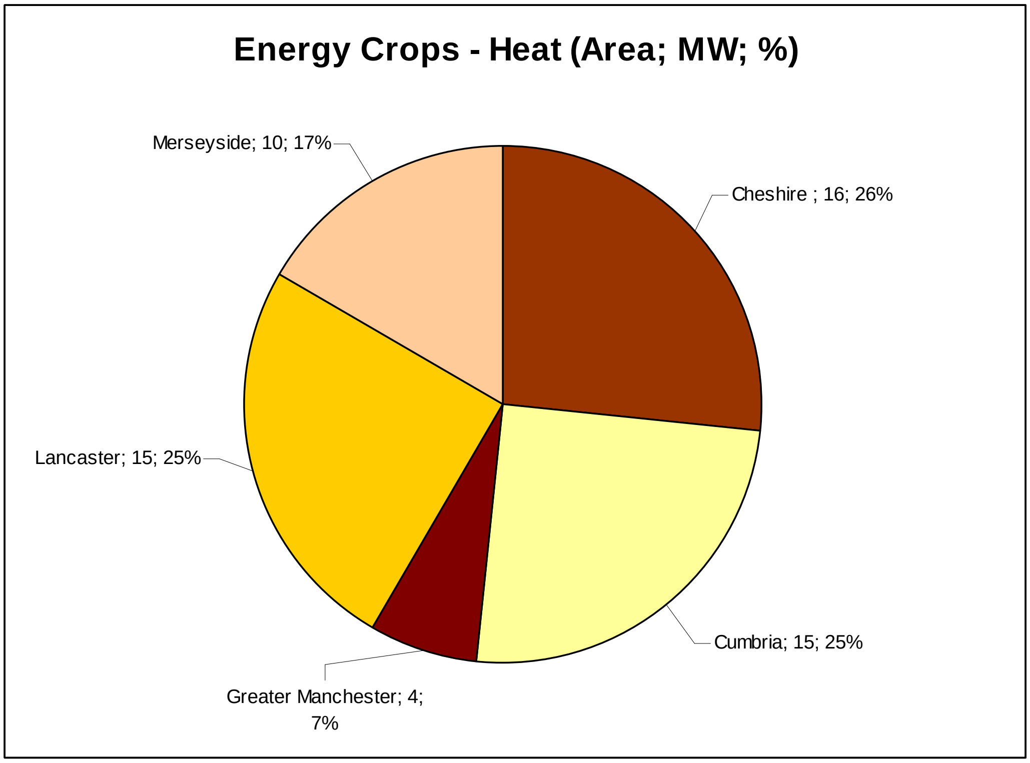
3.52 Figures 3-10 and 3-11 show the proportion for each of the sub-region in the Northwest of Energy Crops potential for electricity generation and heat.

Figure 3-11: Potential accessible energy crops resource (for electricity generation) by sub-region



Source: SQW and Land Use Consultants

Figure 3-12: Potential accessible energy crops (for heat generation) by sub-region



Source: SQW and Land Use Consultants

Conclusion

3.53 The Northwest has an accessible Energy Crops resource of 12MW for electricity generation and 60MW for heat. Although Energy Crops are a relatively small part of the overall renewable energy resource in the Northwest, they offer a potential opportunity for exploitation in Cumbria, Lancashire and Cheshire.

Waste Wood

Main Assumptions

3.54 The DECC/CLG methodology suggested using data from the Sawmill report published by the Forestry Commission with throughput data. Unfortunately this report is no longer published. Instead, the WRAP Report '*Wood Waste Market in the UK*' from August 2009 was used as this gave the most comprehensive and up to date information on waste wood on the region. All the waste wood categories from the report were included except for Municipal Solid Waste wood, since this was already accounted for in the MSW resource category.

3.55 The rest of the assumptions were as per the DECC/CLG methodology. Further details of the assumptions made can be found in Annex A.

Results

3.56 Table 3-9 shows the potential accessible resource for Waste Wood in the Northwest region. It can be seen that the Northwest has 39MW of Waste Wood potential with the resource spread across all sub-regions.

Table 3-9: Potential accessible waste wood resource

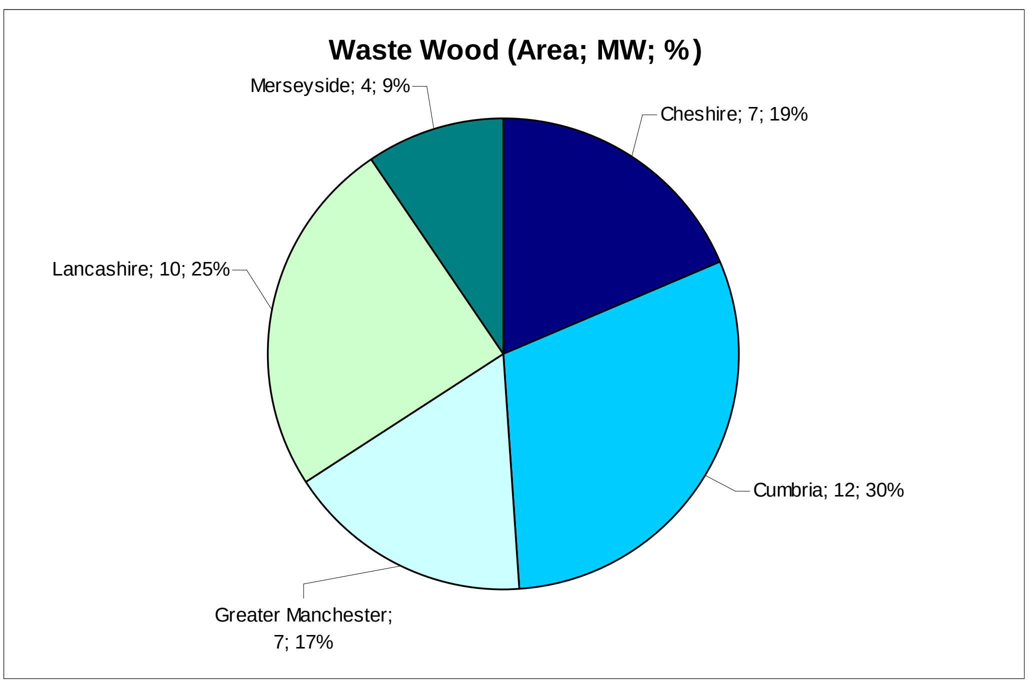
Sub-region	Electricity (MW Capacity)	Percentage of Total (%)
Cheshire	7.3	19%
Cumbria	11.8	30%
Greater Manchester	6.7	17%
Lancashire	9.6	25%
Merseyside	3.6	9%
Total NW Region	**39.0**	**100%**

Source: SQW and Land Use Consultants

3.57 Waste wood accounts for less than 1% of the renewable energy resource in the Northwest.

3.58 Figure 3-12 illustrates the proportion of the Waste Wood resource in each sub-region.

Figure 3-13: Potential accessible waste wood by sub-region



Source: SQW and Land Use Consultants

Conclusion

3.59 The Northwest has 39MW of Waste Wood renewable potential. Although Waste Wood provides a small proportion of the overall renewable potential in the Northwest, it is an easily managed, transported and stored resource that can be easily exploited in any of the sub-regions.

Agricultural Arisings (straw)

Main Assumptions

3.60 The assumptions and data sources for Agricultural Arisings (straw) were in line with the DECC/CLG methodology, details of which can be found in Annex A.

Results

3.61 Table 3-10 shows the accessible resource for Agricultural Arisings (straw) with a total renewable electricity resource of 11MW. Cheshire has the largest proportion of the straw resource with around 40%.

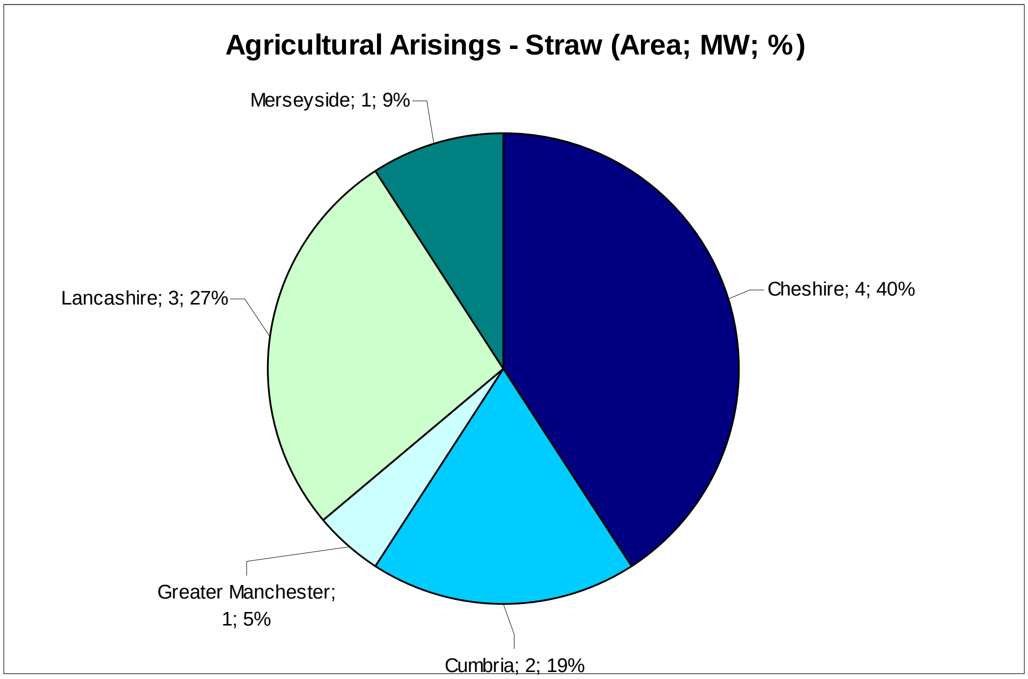
Table 3-10: Potential accessible agricultural arising (straw) resource

Sub-region	Electricity (MW Capacity)	Percentage of Total (%)
Cheshire	4.4	40%
Cumbria	2.0	19%
Greater Manchester	0.5	5%
Lancashire	2.9	27%
Merseyside	1.0	9%
Total NW Region	**10.8**	**100%**

Source: SQW and Land Use Consultants

3.62 Figure 3-13 shows the proportion of the Straw resource potential by sub-region.

Figure 3-14: Potential accessible agricultural arisings (straw) by sub-region



Source: SQW and Land Use Consultants

3.63 Although the Agricultural Arisings resource represents less that 0.1% of the total renewable electricity resource for the region, it constitutes an easily accessible resource that is already well managed. However, by its nature, straw production is very seasonal and is relatively expensive to store and transport due to its comparatively bulky nature and low calorific value. In addition, straw prices fluctuate considerably due to competing uses and depend on seasonal weather. As such, straw is only likely to supplement other biomass source plants.

Conclusion

3.64 Agricultural Arisings (straw) has regional renewable resource potential of 11MW with Cheshire and Lancashire providing around two-thirds of the regions potential.

Animal biomass

Main Assumptions

3.65 The potential renewable resources in the Animal Biomass category of the DECC/CLG methodology consist of Wet Organic Waste and Poultry Litter. Each of these resources is detailed individually under its own heading in the following sections.

3.66 The assumptions made for Animal Biomass are as per the DECC/CLG methodology. Assumptions about individual technologies/resources are given in the sections for each technology/resource. A detailed list of the assumptions made for all the technologies can be found in Annex A.

Results

3.67 Both potential resources are used to produce electricity and account for 215MW of electricity generation capacity. The vast amount (96%) of this comes from Wet Organic Waste.

3.68 Table 3-11 details the results for each sub-region. It can be seen that Cumbria has the biggest Animal Biomass resource with over 100MW, just under half of the entire regions capacity. Cheshire and Lancashire have most of the remaining potential resource with only a small proportion (<5%) in the more urban sub-regions of Greater Manchester and Merseyside.

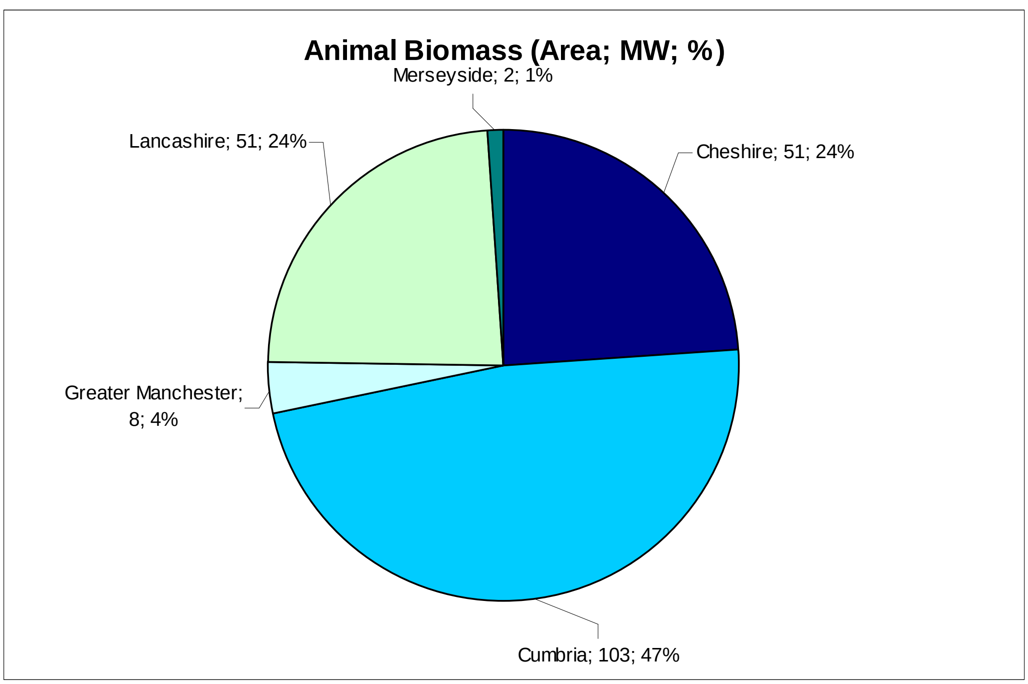
Table 3-11: Potential accessible animal biomass resource

Sub-region	Electricity (MW Capacity)	Percentage of Total (%)
Cheshire	51.4	24%
Cumbria	102.5	48%
Greater Manchester	7.7	4%
Lancashire	51.0	24%
Merseyside	2.1	1%
Total NW Region	**214.7**	**100%**

Source: SQW and Land Use Consultants

3.69 Figure 3-14 illustrates the proportion of Animal Biomass resource in each sub-region.

Figure 3-15: Potential accessible animal biomass resource by sub-region



Source: SQW and Land Use Consultants

Conclusion

3.70 Animal Biomass accounts for 215MW of potential renewable electricity generation in the Northwest, of which almost half is located in Cumbria.

Wet Organic Waste

Main Assumptions

3.71 Some of the data sources recommended in the DECC methodology were not available. For manure and slurry data, DEFRA's 2008 data was used to get the number of livestock in each region. This was then multiplied by a standard animal waste factor obtained from the Biomass Energy Centre. For food and drink waste data the Environment Agency report '*Northwest Commercial and Industrial Waste Survey 200*9' was used. More detailed information about the assumptions can be found in Annex A.

Results

3.72 Table 3-12 shows the results for Wet Organic waste for the Northwest broken down by sub-region.

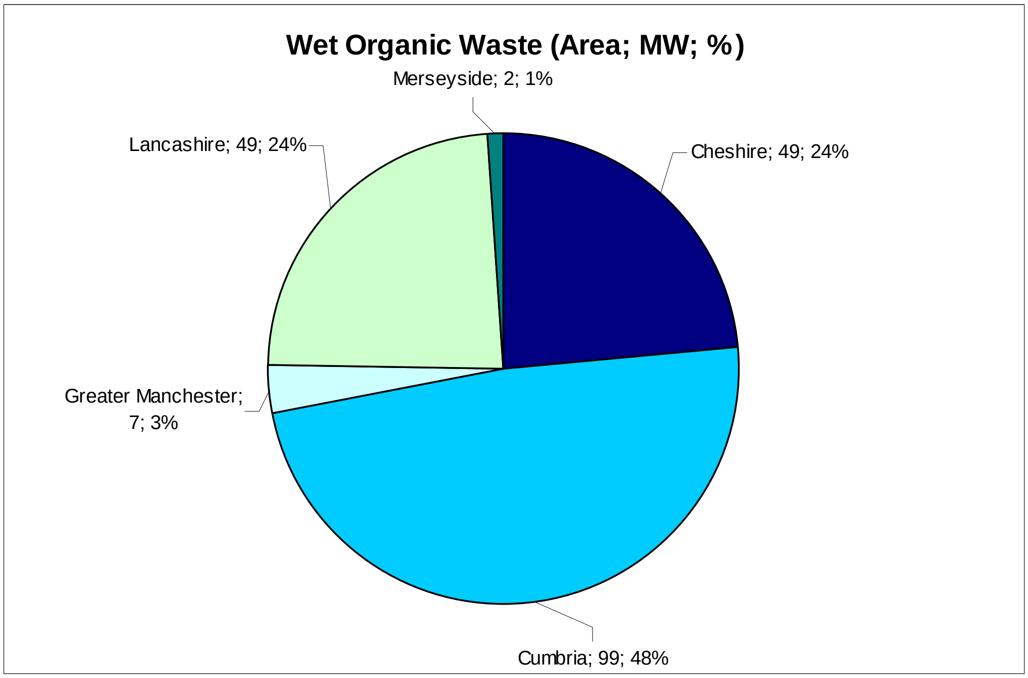
Table 3-12: Potential accessible wet organic waste resource

Sub-region	Electricity (MW Capacity)	Percentage of Total (%)
Cheshire	48.9	24%
Cumbria	99.1	48%
Greater Manchester	7.1	3%
Lancashire	48.9	24%
Merseyside	2.1	1%
Total NW Region	**206.1**	**100%**

Source: SQW and Land Use Consultants

3.73 The Northwest has 206MW of Wet Organic Waste potential resource with Cumbria accounting for almost half of this. Cheshire and Lancashire account for the vast majority of the remaining resource potential with the more urban Greater Manchester and Merseyside accounting for less than 5%. Figure 3-15 illustrates the proportion of Wet Organic Waste potential in each of the sub-regions.

Figure 3-16: Potential accessible wet organic waste by sub-region



Source: SQW and Land Use Consultants

Conclusion

3.74 Wet Organic Waste accounts for 206MW of potential renewable electricity generation in the Northwest, of which almost half is located in Cumbria.

Poultry Litter

Main Assumptions

3.75 The assumptions made for Poultry Litter were inline with those of the DECC/CLG methodology. Comprehensive data was obtained from Defra and calculations carried as per the DECC/CLG methodology.

Results

3.76 Table 3-13 details the potential accessible renewable capacity for Poultry Litter in the Northwest. It can be seen that Poultry Litter has 9MW of potential.

Table 3-13: Potential accessible poultry litter resource

Sub-region	Electricity (MW Capacity)	Percentage of Total (%)
Cheshire	2.5	29%
Cumbria	3.4	40%
Greater Manchester	0.6	7%
Lancashire	2.1	24%

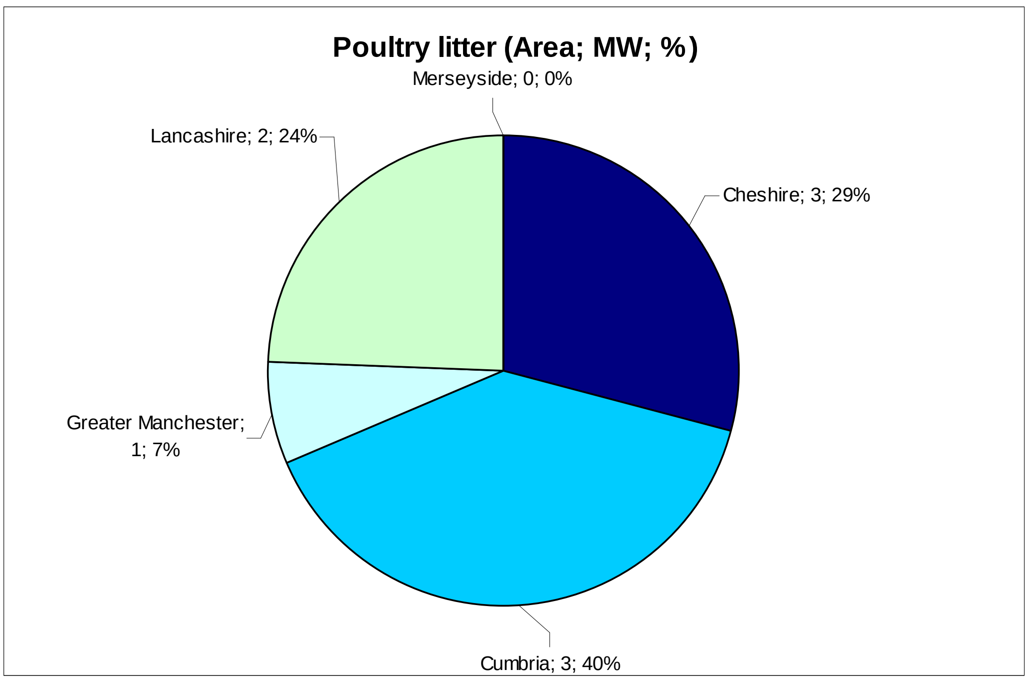
Sub-region	Electricity (MW Capacity)	Percentage of Total (%)
Merseyside	0.0	0%
Total NW Region	**8.7**	**100%**

Source: SQW and Land Use Consultants

3.77 As expected, the more rural the sub-region the greater the potential for this type of resource. Although this is a very small potential capacity, Poultry Litter is a mature and well established technology. It represents an already well managed and accessible resource that can be easily. As such, the only limiting factor is availability of resource.

3.78 Figure 3-16 below illustrates the proportion of the total Poultry Litter resource for each sub-region.

Figure 3-17: Potential accessible poultry litter resource by sub-region



Source: SQW and Land Use Consultants

Conclusion

3.79 Poultry Litter offers a potential renewable resource of 9MW in the Northwest region located primarily in Cumbria, Cheshire and Lancashire.

Municipal Solid Waste

Main Assumptions

3.80 The calculations for Municipal Solid Waste (MSW) followed the DECC/CLG methodology with the exception of the waste data, which was extracted from DEFRA's WasteDataFlow[10] database. The Biodegradable Municipal Waste (BMW) portion of municipal waste was assumed to be 0.68 in line with previous waste composition studies carried out in the region. Reflecting the DECC/CLG methodology the focus is limited to the BMW (the organic) fraction of MSW. More details on the assumptions made can be found in Annex A.

Results

3.81 Table 3-14 details the MSW potential resource in the Northwest and its sub-regions. It can be seen that the total for the region is 210MW with the proportions for each of the sub-regions broadly in line with their population.

Table 3-14: Potential accessible municipal solid waste resource

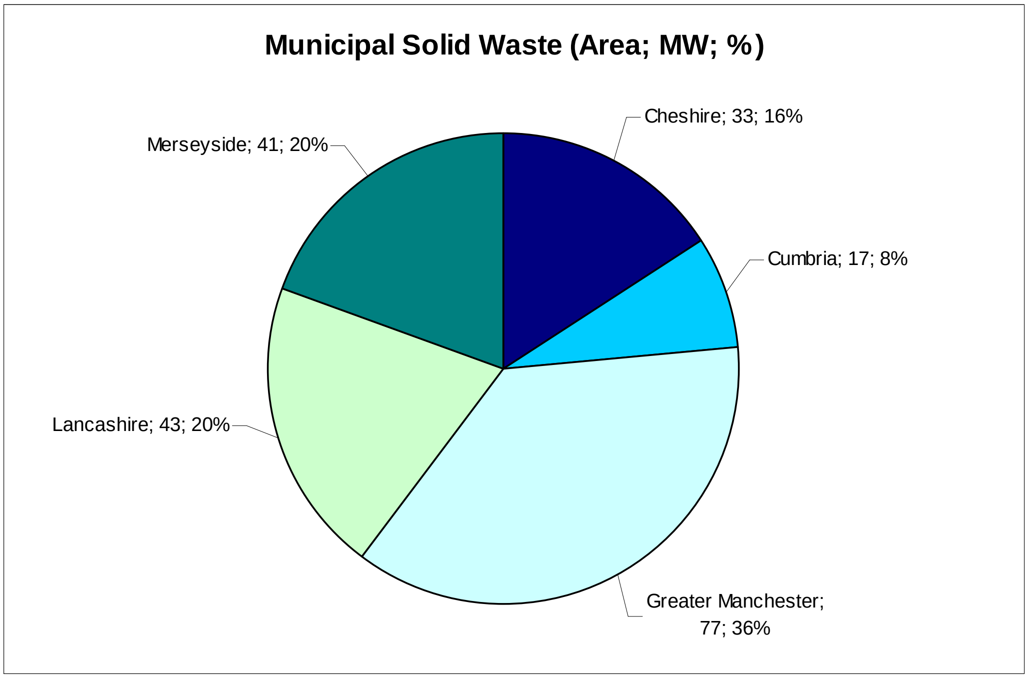
Sub-region	Electricity (MW Capacity)	Percentage of Total (%)
Cheshire	33.1	16%
Cumbria	16.8	8%
Greater Manchester	76.7	36%
Lancashire	42.8	20%
Merseyside	41.1	20%
Total NW Region	**210.5**	**100%**

Source: SQW and Land Use Consultants

3.82 Figure 3-17 illustrates the proportion of MSW potential resource in each sub-region. Greater Manchester has the greatest potential followed by Lancashire and Merseyside.

[10] http://www.wastedataflow.org/

Figure 3-18: Potential accessible municipal solid waste resource by sub-region



Source: SQW

Conclusion

3.83 The Northwest has a potential MSW renewable energy resource of 210MW.

Commercial and Industrial Waste

Main Assumptions

3.84 The DECC/CLG methodology is not explicit in terms of its methodology or the data sources to be used. It was therefore decided that a similar method and assumptions to MSW would be used for Commercial and Industrial Waste (C&IW). The main difference between the two resource calculations were the data source. The C&IW data was taken from the Environment Agency's 2009 '*North West of England Commercial and Industrial Waste Survey Report*'. Only the waste streams that had a high organic content that were not accounted for in any of the other resource categories were included. These were animal and vegetable waste and non-metallic waste. More details on the assumptions made can be found in Annex A.

Results

3.85 Table 3-15 details the C&IW potential resource in the Northwest and its sub-regions. It can be seen that the total for the region is 135MW with Greater Manchester accounting for over 40% of the potential resource.

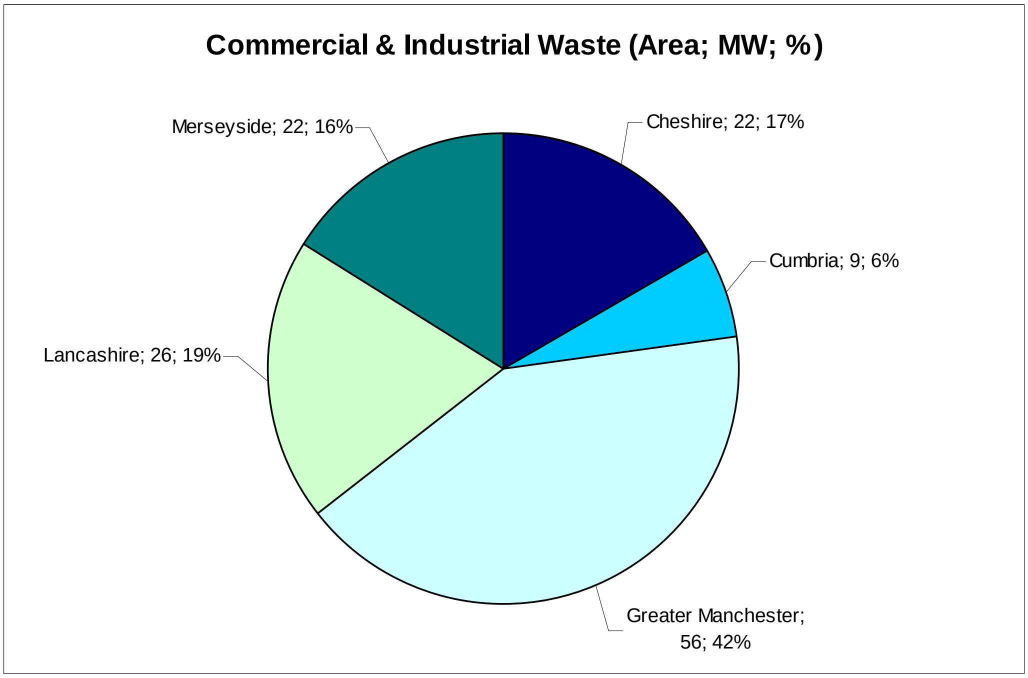
Table 3-15: Potential accessible commercial & industrial waste resource

Sub-region	Electricity (MW Capacity)	Percentage of Total (%)
Cheshire	22.4	17%
Cumbria	8.6	6%
Greater Manchester	56.3	42%
Lancashire	26.4	19%
Merseyside	21.7	16%
Total NW Region	**135.4**	**100%**

Source: SQW and Land Use Consultants

3.86 Figure 3-18 illustrates the proportion of the resource available in each sub-region.

Figure 3-19: Potential accessible commercial & industrial waste resource by sub-region



Source: SQW and Land Use Consultants

Conclusion

3.87 The Northwest has a potential renewable resource from commercial & industrial waste of 135MW

Biogas

Main Assumption

3.88 The potential renewable resources in the Biogas category of the DECC/CLG methodology consist of Landfill Gas and Sewage Gas. Each of these resourced is detailed individually under its own heading in the following sections.

3.89 The assumptions made for Biogas varied from those in the DECC methodology, primarily due to a lack of data. The assumptions made about each of the individual resources are given in the sections for Landfill Gas and Sewage Gas. A detailed list of the assumptions made for all the resources can be found in Annex A.

Results

3.90 Table 3-16 details the potential accessible resource for Biogas for the Northwest. Both the Biogas resources have a combined potential resource capacity of 96MW.

Table 3-16: Potential accessible biogas resource

Sub-region	Electricity (MW Capacity)	Percentage of Total (%)
Cheshire	37.6	39%
Cumbria	2.9	3%
Greater Manchester	23.3	24%
Lancashire	17.8	19%
Merseyside	14.5	15%
Total NW Region	**96.1**	**100%**

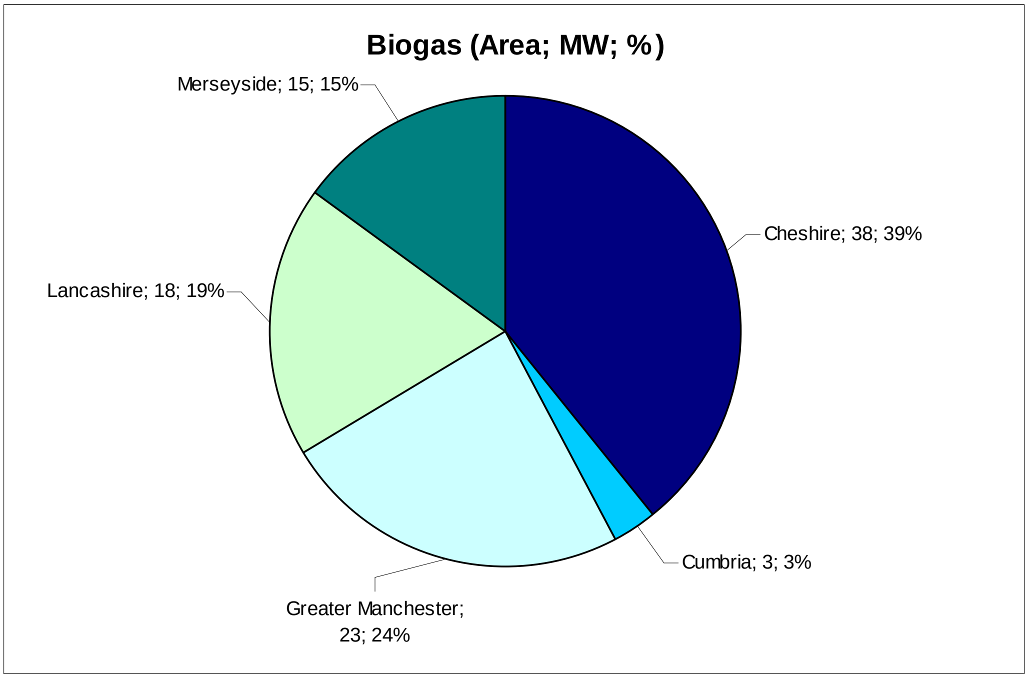
Source: SQW and Land Use Consultants

3.91 Figure 3-19 illustrates the proportion of the Biogas potential in each sub-region. Cheshire as the largest potential with almost 40% of the total. Cumbria has the smallest potential resource with only 3% due to the scarcity of landfill sites and urban sewage systems in the sub-region.

Conclusion

3.92 The Northwest has a potential accessible resource for Biogas of 96MW.

Figure 3-20: Potential accessible biogas resource by sub-region



Source: SQW and Land Use Consultants

Landfill Gas

Main Assumptions

3.93 The EU Landfill Directive and Waste Management legislation mean that the amount of waste sent to landfill will decrease significantly over the next two decades. It was assumed that there would be no new significant landfill sites opened over the period of this analysis. However, Landfill Gas production will lag behind the decrease in waste sent to landfill due to the natural process of waste decomposition. As such, it was assumed that the present day landfill capacity will continue flat for 5 years to 2015, then there will be a straight line reduction until the capacity in 2030 is 20% of today's capacity. The existing capacity of Landfill Gas was extracted from the OFGEM Renewable Obligation register and the potential accessible Landfill Gas resource calculated for the year 2020. More detail on the assumptions made can be found in Annex A.

Results

3.94 Table 3-17 details the potential Landfill Gas resource in 2020 given the above assumption. The Northwest has a Landfill Gas potential of 68MW. It can be seen that Cheshire has the greatest resource with almost half of all the Landfill Gas potential. Landfill Gas accounts for approximately two-thirds of Biogas potential resource.

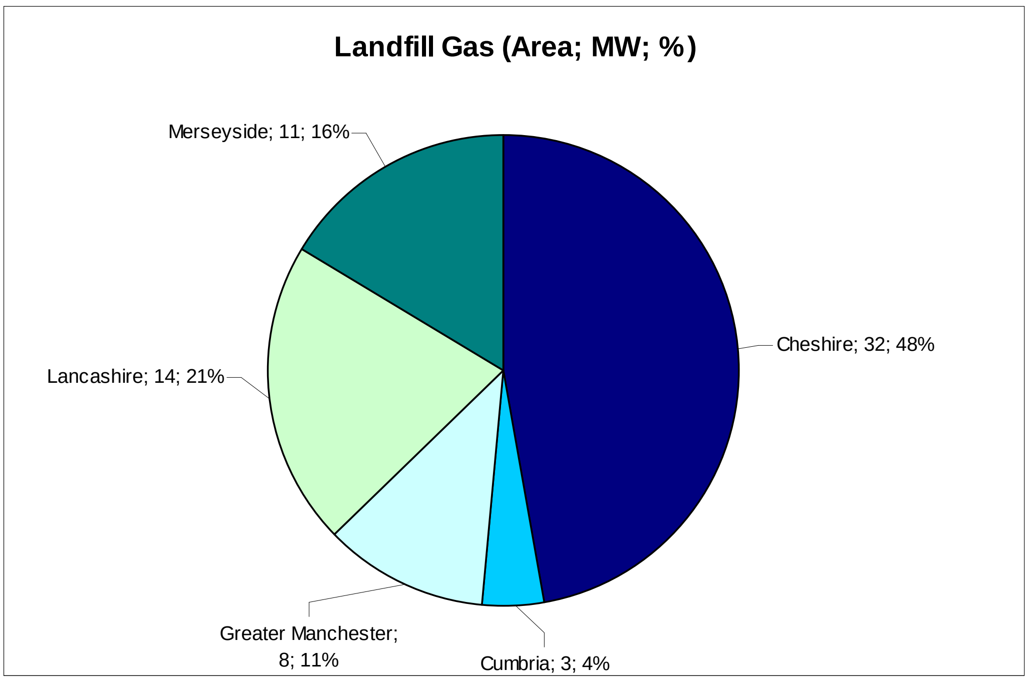
Table 3-17: Potential accessible landfill gas resource

Sub-region	**Electricity (MW Capacity)**	**Percentage of Total (%)**
Cheshire	32	48%
Cumbria	3	4%
Greater Manchester	8	11%
Lancashire	14	21%
Merseyside	11	16%
Total NW Region	**68**	**100%**

Source: SQW and Land Use Consultants

3.95 Figure 3-20 illustrates the share of the regions Landfill Gas potential in each of the sub-region. Cumbria has the least Landfill Gas potential due to the scarcity of existing landfill sites in the sub-region and the likelihood that no new sites will be approved.

Figure 3-21: Potential accessible landfill gas by sub-region



Source: SQW and Land Use Consultants

Conclusion

3.96 The likely potential accessible Landfill Gas resource for the Northwest is 68MW.

Sewage Gas

Main Assumptions

3.97 The DECC/CLG methodology suggested the regional water utility as the source for the data to be used in the calculation of Sewage Gas. Unfortunately, these data were not available. The OFGEM Renewable Obligation register was used instead to calculate the existing Sewage Gas capacity for each of the sub-regions. It was then assumed that there will be 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.

Results

3.98 Table 3-18 details the potential accessible resource for Sewage Gas for the Northwest. In total the Northwest has 28MW of potential capacity, of which more than half is situated in Greater Manchester. Cumbria has the least potential, primarily due to its rural characteristics and lack of urban large integrated sewage systems.

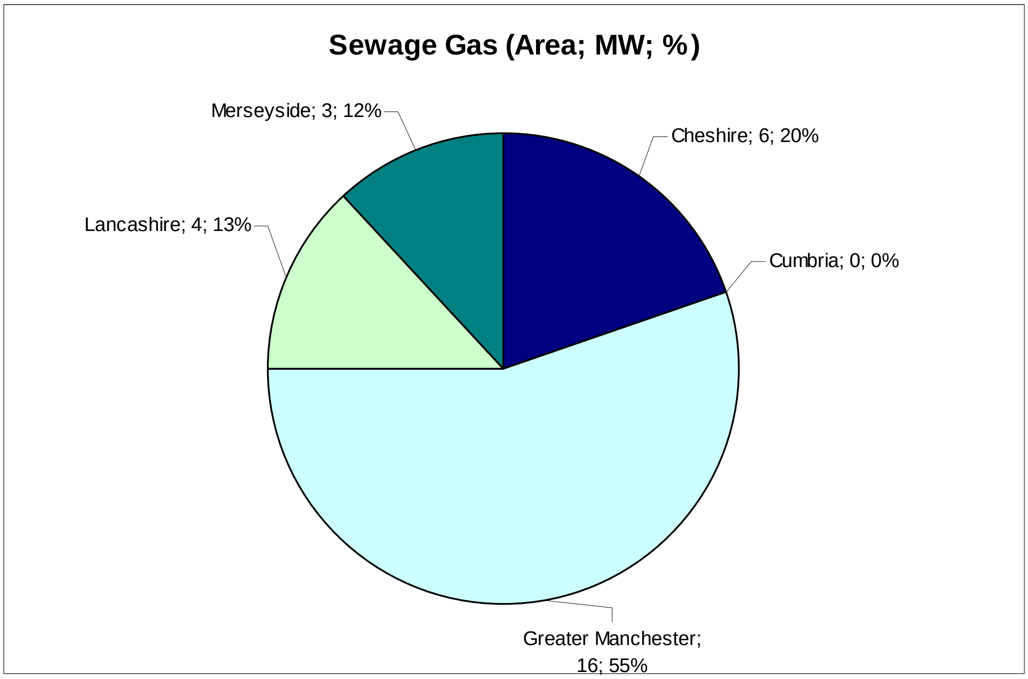
Table 3-18: Potential accessible sewage gas resource

Sub-region	Electricity (MW Capacity)	Percentage of Total (%)
Cheshire	6	20%
Cumbria	0	0%
Greater Manchester	16	55%
Lancashire	4	13%
Merseyside	3	12%
Total NW Region	**28**	**100%**

Source: SQW and Land Use Consultants

3.99 Figure 3-21 illustrates the proportion of Sewage Gas potential in each sub-region.

Figure 3-22: Potential accessible sewage gas resource by sub-region



Source: SQW and Land Use Consultants

Conclusion

3.100 The Northwest has a sewage gas renewable energy resource potential of 28MW.

Biomass co-firing

Main Assumptions

3.101 The assumptions made for Biomass Co-firing were inline with those in the DECC/CLG methodology. More detailed information can be found in Annex A.

Results

3.102 Table 3-19 sets out the detail of the potential Biomass Co-firing capacity in the Northwest region. There was only one coal-fired power station in the Northwest that was applicable under the DECC/CLG methodology. That plant was Fiddler's Ferry in Cheshire. As such, the Northwest potential capacity for Biomass Co-firing was 198MW, all of which was situated in Cheshire.

Table 3-19: Potential accessible biomass co-firing resource

Sub-region	Electricity (MW Capacity)	Percentage of Total (%)
Cheshire	198.0	100%
Cumbria	0	0%
Greater Manchester	0	0%
Lancashire	0	0%
Merseyside	0	0%
Total NW Region	**198.0**	**100%**

Source: SQW and Land Use Consultants

Conclusion

3.103 The Northwest has a potential Biomass Co-firing resource of 198MW.

Small scale hydropower

DEFINITION AND SCOPE

Hydro power involves harnessing the power of flowing or falling water through a turbine in order to produce electricity. The parameters determining the amount of electricity produced include the turbine generating capacity, the turbine discharge flow (the volume of water passing through the turbine at any given time, which will change depending on the time of year) and available head (the vertical distance between the point where the water is highest and the turbine). The larger the head, the more gravitational energy can be converted to electrical energy. Hydropower can also be combined with storage (pumped storage), by pumping water from a low elevation to a high elevation at times of plentiful supply of electricity for release when needed.

For the purposes of assessing the hydropower resource, small-scale hydro power (under 20MW) is considered because opportunities for large-scale hydro (e.g. large dams) are becoming more and more limited. This is because most of the major sites for hydro have already been used along with environmental concerns over the adverse impact of large-scale hydro on local ecosystems and habitats and changes to the natural river flow and intensity. In contrast, small-scale hydro installations can be sited at small rivers and streams with little adverse impact on the river's ecology, for example, on fish migration patterns.

Source: DECC/CLG, 2010

Main Assumptions

3.104 The DECC/CLG methodology recommends the use of the results of the Environment Agency's report '*Mapping Hydropower Opportunities in England and Wales*' (2009) to identify the total regional resource and the portion of that resource which is accessible and viable.

3.105 It must be noted that the Environment Agency study results are intended to be used at a national and regional level, but for the purposes of generating estimates at lower spatial scales, the resultant GIS data from the Environment Agency study was obtained and was divided up spatially into sub-regions. The Environment Agency study is the first phase in a wider programme of work and subsequent phases will refine the ground truth the data, consider environmental sensitivities in more detail and apply the analysis at river catchment scale.

3.106 Opportunities identified in the Environment Agency study were classified according to an environmental sensitivity-hydropower potential matrix. In a separate exercise, a subset of the barriers were identified as potential sites which include those barriers which have the potential to provide a good hydropower opportunity as well as increasing the status of the associated fish population (e.g. by improving fish passage).

3.107 More detailed information can be found in Annex A.

Results

3.108 Table 3-20 details the potential accessible resource for Small Scale Hydropower. The Northwest region has a potential resource of 77MW with over 60% of it located in Cumbria which has the terrain required for this resource.

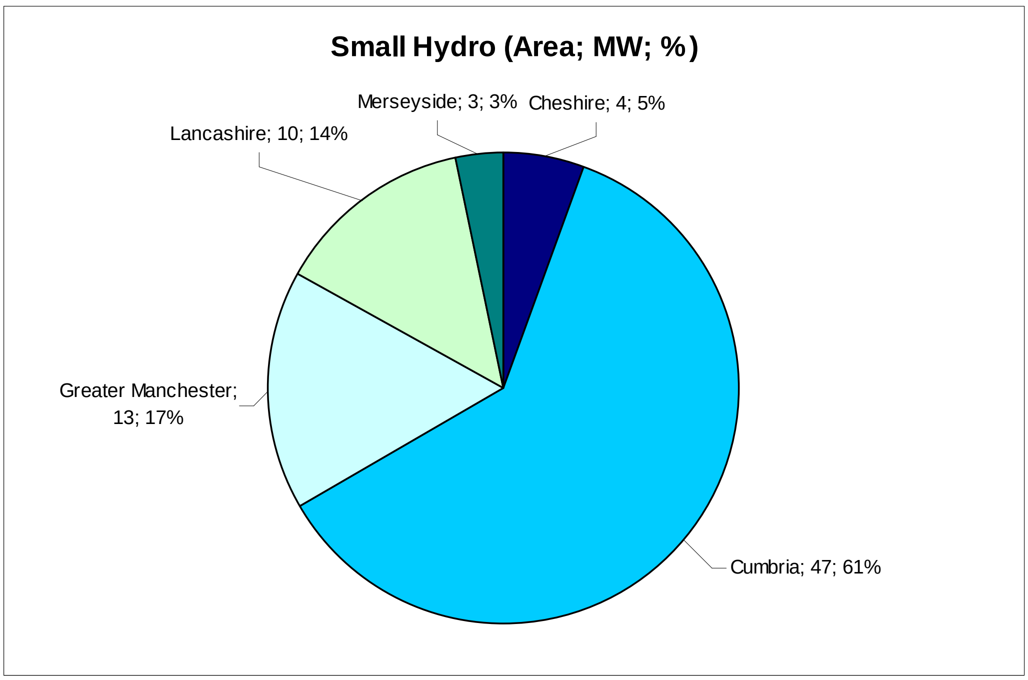
Table 3-20: Potential accessible small scale hydropower resource

Sub-region	Electricity (MW Capacity)	Percentage of Total (%)
Cheshire	4.2	5%
Cumbria	47.2	61%
Greater Manchester	12.8	17%
Lancashire	10.4	14%
Merseyside	2.6	3%
Total NW Region	**77.3**	**100%**

Source: SQW and Land Use Consultants

3.109 Figure 3-22 illustrates the proportion of Small Scale Hydropower in each sub-region.

Figure 3-23: Potential accessible small scale hydropower resource by sub-region



Source: SQW and Land Use Consultants

Conclusion

3.110 The Northwest region has a potential accessible resource of Small Scale Hydropower of 77MW.

Microgeneration

DEFINITION AND SCOPE

Microgeneration typically refers to renewable energy systems that can be integrated into buildings to primarily serve the on-site energy demand. They are applicable to both domestic and non-domestic buildings and can be connected to the grid although this is not required as most of the output is used on-site. Thus microgeneration systems are typically designed and sized either in relation to the on-site demand or in proportion to the physical constraints on-site such as available space, which ever is more appropriate.

Microgeneration technologies cover the full range of renewable energy categories: wind, solar, biomass, hydropower and heat pumps. Technologies that directly depend on the built environment capacity to take microgeneration systems are solar – solar water heating (thermal) and solar photovoltaics (electric) – and heat pumps – grounds source heat pumps and air source heat pumps.

In terms of assessing the regional opportunities and constraints for deployment, the microgeneration wind, biomass and hydropower categories are captured elsewhere in this report.

Source: DECC/CLG, 2010

Microgeneration - solar

Main Assumptions

3.111 The assumptions made for Solar Microgeneration were consistent with the DECC/CLG methodology. However, the DECC/CLG methodology was unclear as to what assumption should be made for the average unit capacity for Industrial properties. In this case it was assumed that the average size for Solar was 10kW for industrial properties. More details on the assumptions can be found in Annex A.

Results

3.112 Table 3-21 details the electrical potential of Solar Photovoltaics (PV) and the heat potential of Solar Thermal technology. It can be seen that according to the DECC methodology; the Northwest region has a potential of 1,158MW of Solar PV and 1,158MW of Solar Thermal. The greatest potential can be found in the built environments of sub-regions with a greater urban characteristic.

Table 3-21: Potential accessible solar microgeneration resource

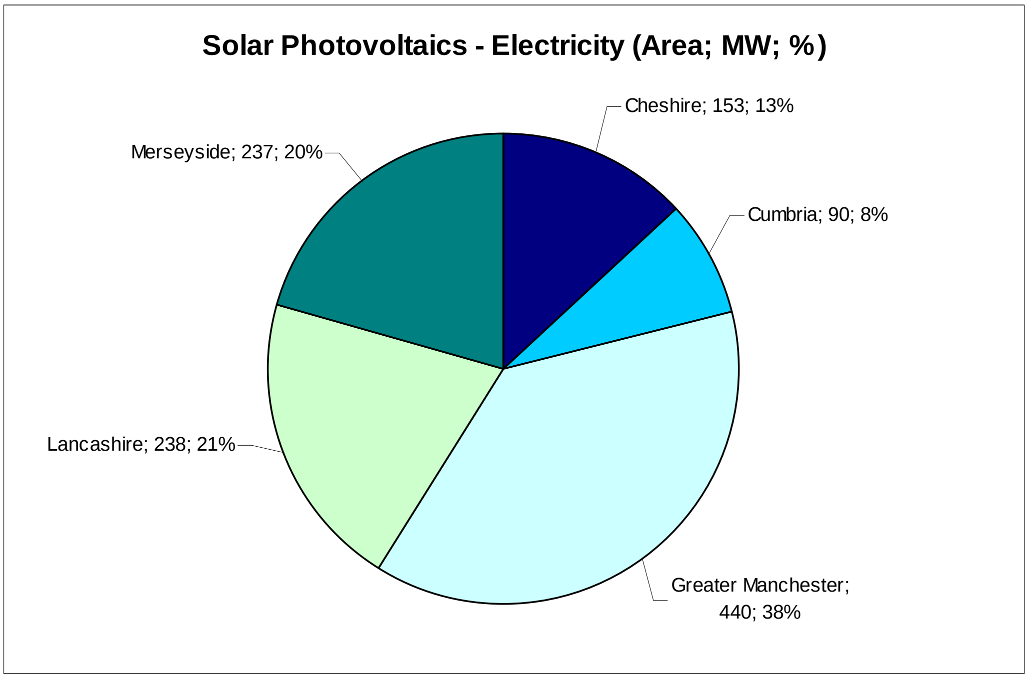
Sub-region	Electricity (MW Capacity)	Percentage of Elec. Total (%)	Heat (MW Capacity)	Percentage of Heat Total (%)
Cheshire	152.7	13%	152.7	13%
Cumbria	90.4	8%	90.4	8%
Greater Manchester	440.4	38%	440.4	38%
Lancashire	237.8	21%	237.8	21%

Sub-region	Electricity (MW Capacity)	Percentage of Elec. Total (%)	Heat (MW Capacity)	Percentage of Heat Total (%)
Merseyside	236.8	20%	236.8	20%
Total NW Region	**1,158.0**	**100%**	**1,158.0**	**100%**

Source: SQW and Land Use Consultants

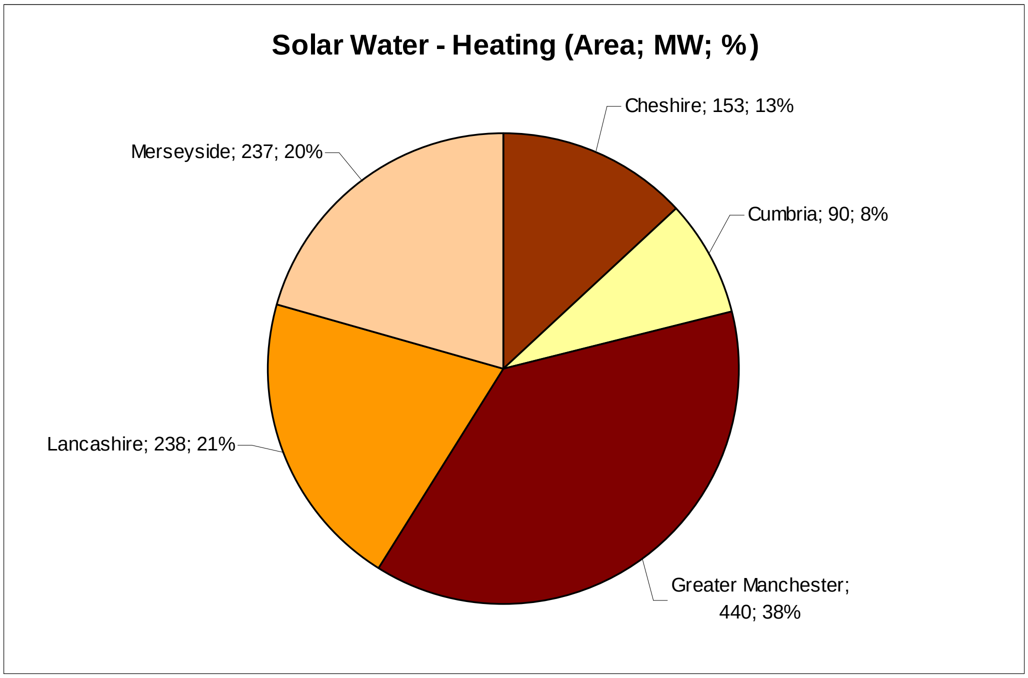
3.113 Figures 3-23 and 3-24 show the proportion of PV and Thermal Solar Microgeneration in each of the sub-regions.

Figure 3-24: Potential accessible microgeneration solar resource (for electricity production) by sub-region



Source: SQW and Land Use Consultants

Figure 3-25: Potential accessible microgeneration solar resource (for heat production) by sub-region



Source: SQW and Land Use Consultants

Conclusion

3.114 The northwest has a potential resource 1,158MW for PV Microgeneration and 1,158MW for Solar Water Heating.

Microgeneration – heat pumps

Main Assumptions

3.115 The potential renewable resources in the Microgeneration Heat Pumps category of the DECC methodology consist of Ground Source Heat Pumps (GSHP) and Air Source Heat Pumps (ASHP). Each of these resources is detailed individually under its own heading in the following sections.

3.116 Some of the data for this assessment were not readily available (i.e. current information on property type) and it was necessary to make some assumptions regarding connection to the gas grid and property type. The assumptions made for Microgeneration Heat Pumps are largely consistent with the DECC methodology and a detailed list of the assumptions made for each of the technologies can be found in Annex A.

Results

3.117 Table 3-22 details the potential accessible Microgeneration Heat Pump resource for the Northwest and its sub-regions. It can be seen that the Northwest has potential resource of 12,355MW of heat.

3.118 Greater Manchester has the largest resource, consistent with its more urban characteristics.

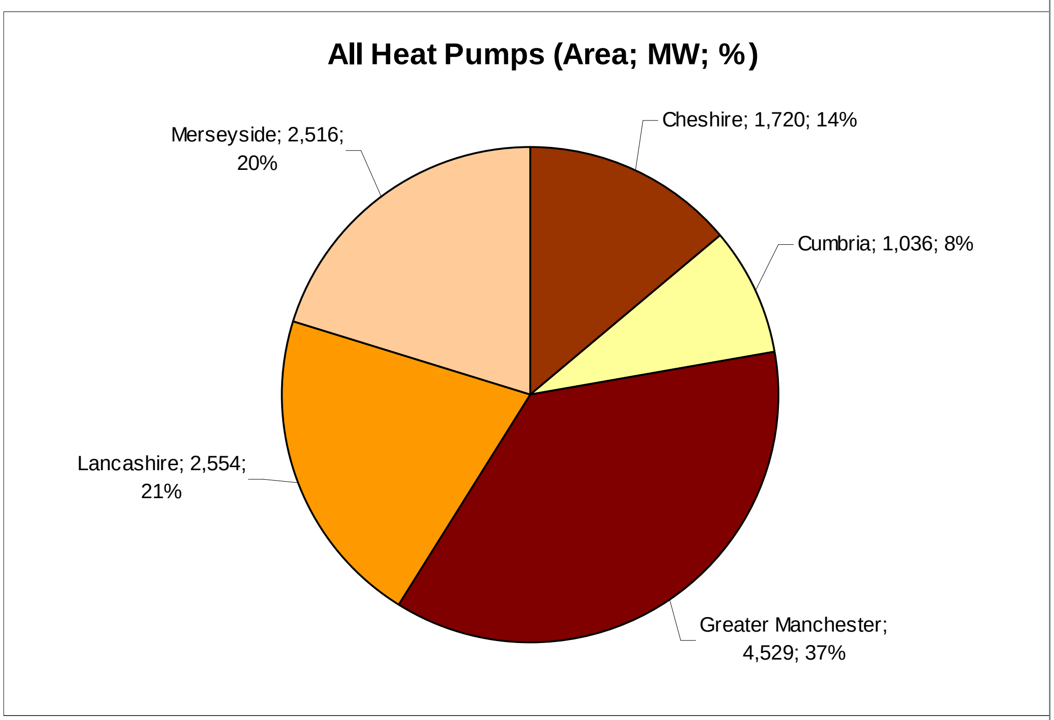
Table 3-22: Potential accessible microgeneration heat pump resource

Sub-region	Heat (MW Capacity)	Percentage of Total (%)
Cheshire	1,720	14%
Cumbria	1,036	8%
Greater Manchester	4,529	37%
Lancashire	2,554	21%
Merseyside	2,516	20%
Total NW Region	**12,355**	**100%**

Source: SQW and Land Use Consultants

3.119 Figure 3-25 illustrates the proportion of the Heat Pump resource in each of the sub-regions.

Figure 3-26: Potential accessible microgeneration heat pump resource (for heat production) by sub-region



Source: SQW and Land Use Consultants

Conclusion

3.120 The Northwest has a potential accessible Microgeneration Heat Pump resource of 12,355MW.

Ground Source Heat Pumps

Main Assumptions

3.121 The assumptions made for Microgeneration GSHPs are consistent with the DECC methodology. However, the DECC/CLG methodology was unclear as to what assumption should be made for the percentage of commercial properties with potential for heat pumps. In this case it was assumed that 10% of commercial properties were suitable. The split between GSHPs and ASHPs was assumed to be 80% ASHP and 20% GSHP. The reasons for this are that ASHPs are suitable for installation in more properties and cause less disruption when installing; hence making them more attractive to potential customers. A detailed list of the assumptions made for each of the technologies can be found in Annex A.

Results

3.122 Table 3-23 details the potential accessible heat resource form Microgeneration GSHPs. The potential capacity for the Northwest region is 2,471MW with Greater Manchester being the single biggest potential resource with over one third of the total.

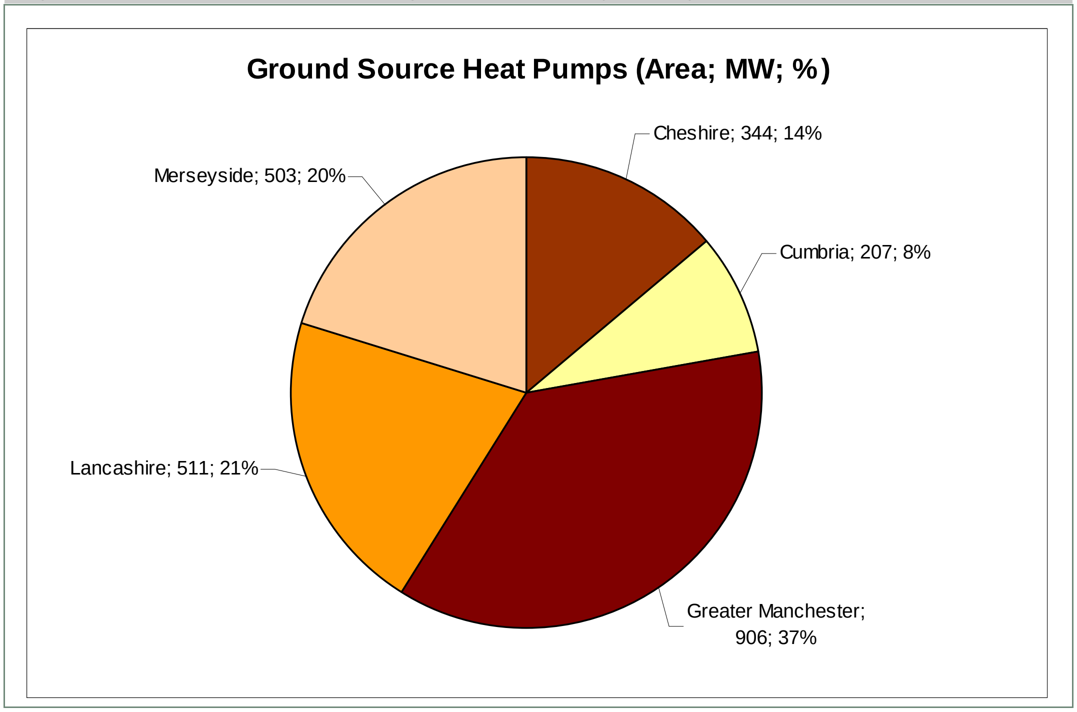
Table 3-23: Potential accessible microgeneration GSHPs resource

Sub-region	Heat (MW Capacity)	Percentage of Total (%)
Cheshire	344.1	14%
Cumbria	207.2	8%
Greater Manchester	905.7	37%
Lancashire	510.8	21%
Merseyside	503.2	20%
Total NW Region	**2471.0**	**100%**

Source: SQW and Land Use Consultants

3.123 Figure 3-26 illustrates the share of the GSHP potential of each of the sub-regions.

Figure 3-27: Potential accessible microgeneration GSHP by sub-region



Source: SQW and Land Use Consultants

Conclusion

3.124 The Northwest has a potential accessible GSHP resource of 2,471MW.

Air Source Heat Pumps

Main Assumptions

3.125 The assumptions made for Microgeneration ASHPs are consistent with the DECC methodology. However, the DECC/CLG methodology was unclear as to what assumption should be made for the percentage of commercial properties with potential for heat pumps. In this case it was assumed that 10% of commercial properties were suitable. The split between GSHPs and ASHPs was assumed to be 80% ASHP and 20% GSHP. The reasons for this are that ASHPs are suitable for installation in more properties and cause less disruption when installing, hence they are more attractive to potential customers. A detailed list of the assumptions made for each of the technologies can be found in Annex A.

Results

3.126 Table 3-24 details the potential accessible Microgeneration ASHP resource for the Northwest and its sub-regions. The potential heat resource is 9,884MW for the region.

Table 3-24: Potential accessible microgeneration ASHP resource

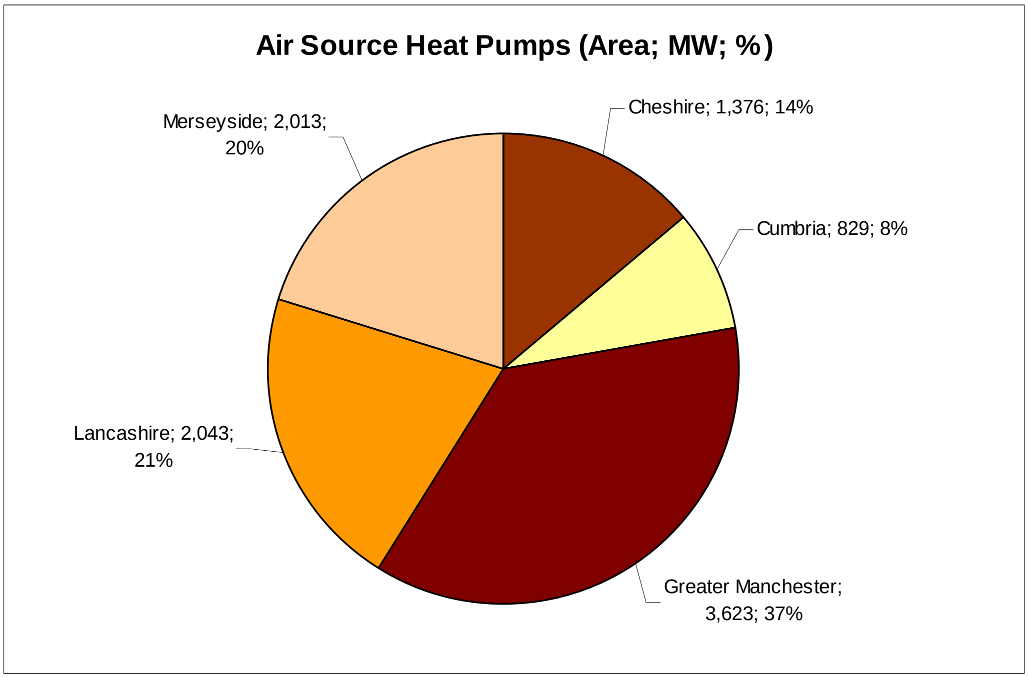
Sub-region	Heat (MW Capacity)	Percentage of Total (%)

Sub-region	Heat (MW Capacity)	Percentage of Total (%)
Cheshire	1.376.2	14%
Cumbria	828.7	8%
Greater Manchester	3,622.9	37%
Lancashire	2,043.4	21%
Merseyside	2,012.8	20%
Total NW Region	**9,884.0**	**100%**

Source: SQW and Land Use Consultants

3.127 Figure 3-27 illustrates the share of the ASHP potential of each of the sub-regions. Greater Manchester has the largest potential resource with over one-third of the region's potential.

Figure 3-28: Potential accessible microgeneration ASHP resource by sub-region



Source: SQW and Land Use Consultants

Conclusion

3.128 The Northwest has a potential accessible GSHP resource of 9,884MW.

4: Low carbon energy potential

Introduction

4.1 Low carbon energy is defined for the purposes of the DECC methodology as Combined Heat and Power (CHP) or tri-generation (to include cooling), and district heating schemes. Whilst not directly fulfilling commitments under the UK Renewable Energy Strategy, low carbon sources of energy supply will be an important part of the mix of technologies that the Northwest can employ to reduce carbon emissions. In the long term, out to 2050, it will be increasingly necessary to decarbonise our energy supply; in the mean time, low carbon technologies represent potentially cost effective alternative solutions.

4.2 At a national level, energy policy is being developed to help meet the significant heat and low-carbon energy requirement of the UK. For example, DECC is currently developing the Renewable Heat Incentive (RHI)[11], aimed at encouraging the use of renewable and low carbon heat sources.

4.3 Although heat is not part of any legislative commitment placed on the Northwest region, the NWDA has been pro-active in this area and has specified the preliminary analysis of the heat capacity as part of this project in support of the updated assessment of renewable energy capacity to 2020.

Methodology

4.4 Unlike most of the renewable energy categories which are assessed on the basis of the supply side (i.e. resource availability), low carbon opportunities referred to in the DECC/CLG methodology are a function of available heat demand.

4.5 Studies have been carried out to develop appropriate evidence bases (such as heat maps) in different regions of the UK. Recognising the need for a consistent approach to assessing the heat and low carbon potential across the UK, DECC commissioned the UK Heat Map[12]. The ground breaking initiative is part of the Government's strategy to help promote CHP and low carbon decentralised technologies and inform capacity studies such as this.

4.6 The low carbon capacity of a region cannot be calculated solely by assessing the heat demand of its properties, since the viability of CHP or district heating is dependent not only on the viability of heat, but the density of that heat demand. This is because the cost of pipe required to transport heat is very high, which also means that the plant used for generating the low carbon energy is likely to need to be close to its demand.

[11] DECC Renewable Heat Incentive (RHI) http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/policy/renewable_heat/incentive/incentive.aspx

[12] DECC UK Heat Map. http://chp.decc.gov.uk/heatmap/

4.7 In order to make evaluations about the viability of an area for CHP or district heating, the DECC methodology introduces the concept of 'heat density'. This is defined as the annual heat demand, divided by the number of hours in a year, which is then divided by area in km^2.

4.8 Higher density urban areas will have a higher heat demand per km^2 and hence would be expected to have lower district heating costs and greater potential for a cost-effective scheme.

4.9 The DECC methodology states that if the heat density exceeds $3{,}000kW/km^2$, the heat density is considered to be high and economically speaking, district heating will likely suit a high proportion of building, such as flats.

Northwest low carbon energy potential

4.10 To assess the low carbon potential for the Northwest region and it sub-regions, the UK Heat Map was consulted. Each kilometre square in the region was examined and where the total heat density exceeded $3{,}000\ kW/km^2$, that kilometre square was judged to be a candidate for one of the low carbon technologies such as district heating or CHP. The heat density for all the candidate areas were then aggregated together to give a total low carbon energy potential for the sub-region and the region.

4.11 Table 4-1 details the results of the low carbon energy potential for each of the sub-regions and the total for the Northwest region.

Table 4 -1: Low carbon energy potential for the Northwest by sub-region

Sub-region	Low Carbon Energy Potential (MW)	Percentage of Total (%)
Cheshire	4,388	18
Cumbria	1,523	6
Greater Manchester	9,016	37
Lancashire	4,970	20
Merseyside	4,716	19
Northwest Region Total	**24,613**	**100**

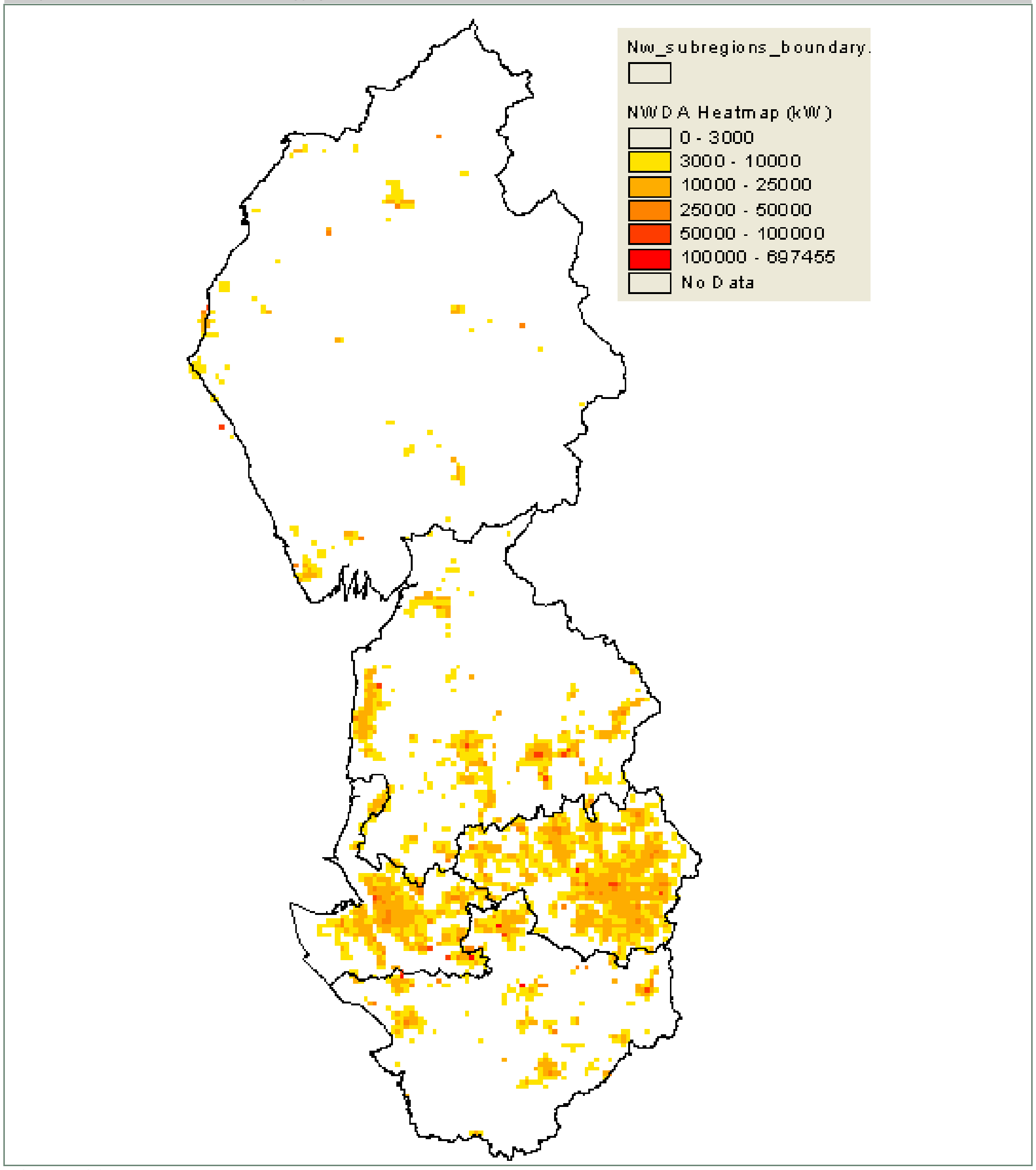
Source: SQW

4.12 It can be see than the theoretical potential for low carbon energy technologies in the Northwest is 24.6GW with the more densely built environment of Greater Manchester accounting for over one third of this.

4.13 It is worth noting that this reflects a theoretical potential for low carbon energy development. The actual amount that could be harnessed would be dependent on a more detailed assessment of the candidate sites with economic and engineering surveys carried out to evaluate individual site suitability.

4.14 Figure 4-1 illustrates the candidate areas in the Northwest where the greatest potential for low carbon energy potential exists.

Figure 4-1: Low carbon energy potential for the Northwest



Source: SQW

Conclusion

4.15 The Northwest region has a low carbon energy potential of 24,613MW (i.e. 24.6GW). This is a very large, untapped energy source for potential exploitation. To give context to the size of the low carbon energy potential, it is greater than the entire commercial wind accessible resource in the Northwest. As such, this is an energy source that clearly warrants further detailed investigation.

5: Renewable energy constraints and deployment scenarios to 2020

Introduction

5.1 This chapter builds on the results of the potential accessible resource assessment (chapter 4), describes the potential impact of various key constraints and describes two deployment scenarios to 2020.

Constraints and deployment scenarios methodology

5.2 The purpose of this part of the project was to investigate the most significant areas of constraint on the expansion of different renewable energy technologies and to use the results to forecast possible deployment scenarios to 2020. The focus of the analysis is upon constraints that are likely to have a material impact on the potential deployment of renewable energy sources at 2020 rather than minor constraints that might have temporary and/or localised effects but little overall impact.

5.3 As indicated in Figure 3-1, the analysis of such constraints goes beyond the first four stages outlined in the DECC methodology (DECC/CLG, 2010). The methodology for this work has therefore been developed specifically for this project by SQW and Land Use Consultants in consultation with the Project Steering Group.

5.4 Four types of constraints have been taken investigated as explained below:

- Economic viability
- Transmission constraints
- Supply chain constraints
- Planning constraints

Economic viability

5.5 Taking the potential accessible renewable energy resource in the region as the starting point, the proportion and sequencing of what is realised on the ground will be driven strongly by the relative economic productivity. The main factors associated with the economic viability of renewable installations in the region are:

- the costs of generation i.e. the cost of generation from renewables will be compared to fossil fuel competitors. Cost estimates were published by the government, as part of the 2006 Energy Review. The costs are 'levelised' which is where the capital costs (purchase, construction and installation) and operation and maintenance costs are spread over the lifetime of the expected output.
- financial help from support mechanisms, the most important of which being:

    - the Renewable Obligation (commercial – scale renewables),
    - Feed-In Tariff (micro-generation of electricity) and the
    - renewable heat incentive (renewable heat)

- the Carbon Price from the EU ETS, which operators of fossil fuel plants must pay for every tonne of CO2 they emit
- benchmarked rates of return demanded by investors in renewable schemes

Transmission constraints

5.6 The electricity transmission system can constrain the deployment of large scale (transmission connected) new renewable energy capacity. This is most likely to occur if a proposed site for a renewable energy project is a long distance from the existing electricity transmission grid or if the grid is already at or near full capacity. In these situations, access to the grid will be granted and in the context of the period 2010-2020, time delays to provide the connection can be seen as temporary. However, significant investment may also be required to provide connection to the grid. Under the agreed charging schemes[13] these up front investments can render particular renewable energy projects as uneconomic. The investigation of transmission constraints has been conducted in consultation with the electricity supply industry.

Supply chain constraints

5.7 Given that many renewable energy technologies are relatively new and still undergoing significant innovation, supply chains for producing and installing some technologies may be constrained. Given the global nature of the supply chains for some of the renewable technologies, consideration is needed of what is happening outside of the UK as well as any likely regional variations. Clearly the picture will also change over time with new supply chains established in response to committed demand and as regional/national/international support initiatives help to tackle initial bottlenecks. The investigation of supply chain constraints has utilised the findings from a number of recent studies conducted in this area, in particular a study on 'Supply Chain Constraints on the Deployment of Renewable Electricity Technologies' (BERR, 2008).

Planning constraints

5.8 The planning system can have a major influence on the deployment rate of new renewable energy projects where planning consent is required. The key parameters are the approval rate for planning applications and the duration/delays to planning decisions for different technologies/types of project. Recent historic data has been used as the starting point for the analysis of planning constraints, largely drawing

[13] http://www.nationalgrid.com/uk/Electricity/Charges/

upon a study of planning approvals for renewable energy projects in the Northwest region between 2004 and 2009 (Envirolink Northwest, 2010).

Steering group and stakeholder involvement in analysing the constraints and scenarios

5.9 The project Steering Group and other stakeholders played an active role to ensure that the investigations and analysis of constraints and potential deployment scenarios were informed and tested against detailed local experiences, knowledge and insight into the progress of renewable energy across the Northwest.

5.10 A stakeholder workshop was held in Liverpool on 26 May 2010 to bring together representatives from the energy sector, local authorities, regional bodies and environmental organisations. One of the focal points of the workshop was to seek views on the constraints and scenario analysis. The workshop provided an opportunity for stakeholders to:

- Understand the scope and methodology applied to assess the regional resource base
- Engage with the interim results of the scenario analysis to investigate the effects of key constraints (planning, transmission, supply chains) on the deployable energy resource
- Understand how the regional renewable and low carbon energy targets will need to be implemented and monitored

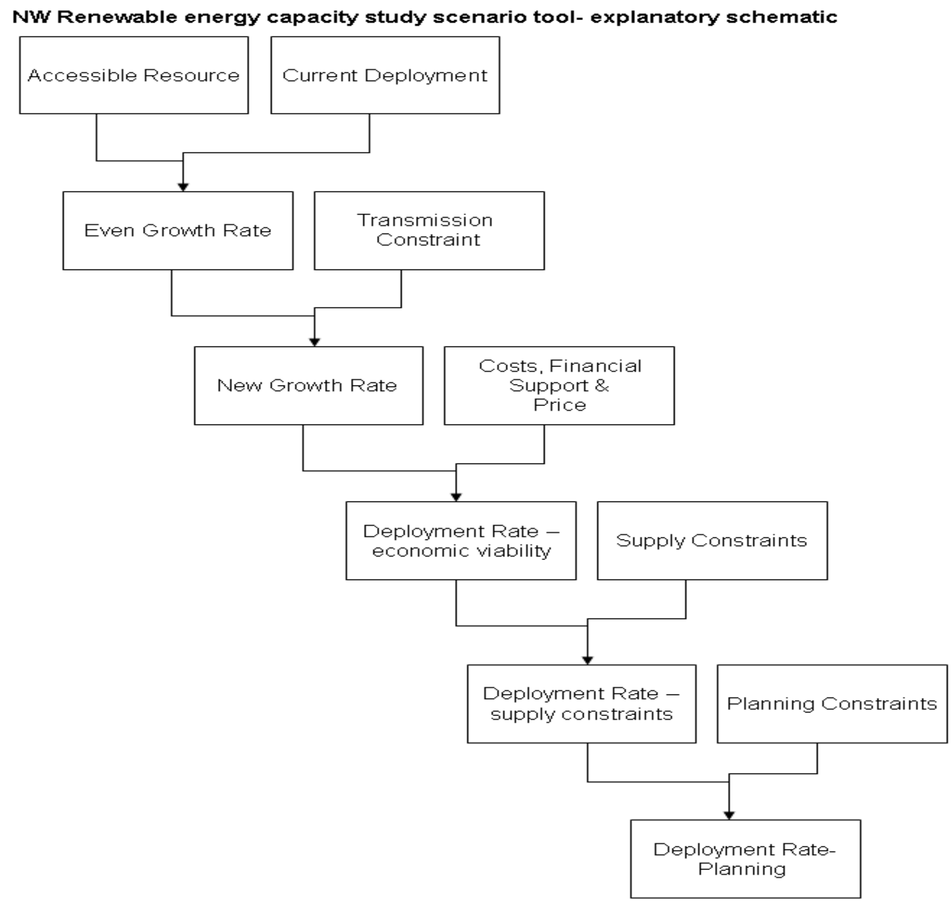
5.11 Further details of the stakeholder workshop are given in the workshop briefing note which is provided as Annex B.

5.12 The project Steering Group helped to guide the investigation of constraints and development of the deployment scenarios throughout the project. In particular the Steering Group participated in a scenario development workshop on 16 June 2010 during which the scenario modelling tool was used to explore, select and refine the scenarios.

Scenario modelling tool

5.13 The scenario development was supported by a tool (developed in Microsoft Excel). A schematic of design of the tool is provided in Figure 5-1 showing how the four constraints (economic viability, transmission, supply chain and planning) were applied to illustrate different assumptions and scenarios for the deployment/growth of each renewable energy technology. Further information regarding the characteristics of the two scenarios is presented in the following sections.

Figure 5-1: Schematic for the scenario development tool



Source: SQW

Renewable energy scenarios to 2020

5.14 Two scenarios for the region (A & B) were selected and developed based on the decisions at the scenario development workshop. The main features of the scenarios and the differences between them are described below.

5.15 Both of the scenarios represent a rapid acceleration of renewable deployment in the region and the emergence of some technologies that make little or no contribution to energy supplies currently. For the second scenario the Steering Group considered what might be possible to accelerate progress further where it would make a difference to do so for that technology. The scenario results are provided in Tables 5-1 and 5-2. Due to the uncertainties involved in modelling and forecasting out to 2020 the data in the results tables is provided for different groups of renewable energy resource i.e. sub-category level 1 as indicated in the methodology (DECC/CLG, 2010).

Scenario A detailed results - Northwest scenario for 2020

5.16 The main characteristics of this scenario are:

- The potential accessible resource has been assessed in accordance with the DECC methodology (2010) with additional assumptions/alternative data sources used where required
- Current deployment of different technologies has been identified from various sources (e.g. DECC's *Quarterly Energy Trends*, September 2009). Annualised growth rates for the periods 2010-2015 and 2015-2020 have been modelled using the current deployment as a starting point. Current deployment figures have not been available for the breakdown of all of the technology sub-categories in the DECC methodology and have therefore been estimated in some cases (e.g. for some of the biomass categories).
- Potential from energy from waste (MSW and C&I waste) has been adjusted to reflect built/planned schemes in the region which is found to equate closely to the full potential accessible resource. There are a number of existing energy from waste (EfW) plants in the region and several more have been consented but not yet commissioned. Those consented but not yet fully operational EfW plants include Energos (14MW), Mersey Green Solution (40MW) and Ineos Chlor (50MW). Further EfW applications are currently going through the planning process, however it should be noted that some of the consented or proposed capacity may not materialise. Anaerobic Digestion (AD) currently also plays a part, particularly for MSW. It is expected that its role will increase for other waste streams including C&I waste as the economics and efficiencies of the process improve and as the technology matures.
- A transmission constraint has been applied in accordance with advice from Electricity Northwest such that commercial scale renewable projects may not be economically viable to connect to the grid in the Cumbria sub-region up to 2020. In practice this does not impose a significant constraint because most technologies/sources are not limited vis a vis the potential accessible resource in other sub-regions.
- The economic viability of individual technologies has been used to modify the modelled growth rates based on the UK's policies and incentive structure to 2020 as described in the Low Carbon Transition Plan/Renewable Energy Strategy. For the micro-generation technologies, including small wind, a specific detailed study has been used to derive growth rates (BERR, The Growth Potential of Microgeneration in England, Wales and Scotland, 2008)
- Supply chain constraints have been taken into account in so far as they are expected to cause a significant impact on deployment of technologies through to 2020 as opposed to short term delays which would not affect the overall growth. The supply chain constraints are based on the findings of a recent detailed study (BERR, Supply Chain Constraints on the Deployment of Renewable Electricity Technologies, 2008).

- Planning constraints have been taken into account based on the acceptance rates and timeframes for specific technologies from an analysis of renewable energy planning applications between 2004 and 2009 (Envirolink, 2010).

Table 5-1: Results for scenario A: Northwest scenario for 2020

	Generation (GWh)				Capacity (MW)		
Resource (sub-category level 1)	**Current deployed resource generation (GWh, 2007/8 figures/ estimates)**	**Accessible resource 2020 – generation (GWh)**	**Scenario A 2015 - generation (GWh)**	**Scenario A 2020 - generation (GWh)**	**Accessible resource 2020 – capacity (MW)**	**Scenario A 2015 - capacity (MW)**	**Scenario A 2020 - capacity (MW)**
Wind – commercial scale	836.7	53,721.8	1,709.8	2,509.4	23,587.0	750.7	1101.8
Wind – small scale	0.2	293.0	1.2	5.4	669.0	2.7	12.4
Plant biomass	84.1	353.4	113.6	140.1	80.7	25.9	32
Plant biomass (heat)	11.3	1,355.2	90.2	289.3	182.0	12.1	38.9
Animal biomass	56.0	940.4	74.1	79.5	214.7	16.9	18.1
MSW & C&I waste	0.7	2,727.1	1,028.0	1,655.7	345.9	130.4	210
Biogas	799.2	757.6	724.9	700.0	96.1	91.9	88.8
Co-firing of biomass (with a fossil fuel)	788.1	1,561.0	788.1	788.1	198.0	100	100
Small scale hydropower	0.2	539.6	1.1	8.6	77.0	0.2	15
Solar	53.3	5,072.3	650.2	1,188.4	2,316.2	188.9	655.3
Heat pumps	2.8	27,057.5	65.0	144.8	12,355.0	29.7	66.1
Total	**2,632.6**	**94,378.9**	**5,246.2**	**7,509.3**	**40,121.6**	**1349.4**	**2338.4**
Electricity only	**2,565.9**	**61,908.4**	**4,444.6**	**6,256.0**	**26,426.5**	**1123.1**	**1999.6**
Heat only	**66.7**	**32,470.5**	**801.6**	**1,253.3**	**13,695.1**	**226.3**	**338.8**

Source: SQW and Land Use Consultants

Scenario B detailed results - aspirational/stretch Northwest scenario for 2020

5.17 Scenario B is the same as the scenario A for the majority of technologies/constraints. The differences are:

- For the commercial wind technology category, the planning acceptance rate derived from the 2004-2009 data of 55% is increased to 65% reflecting a more optimistic view on an improving planning policy and appeals climate for renewable energy
- For the wet organic waste technology category, the planning constraint derived from the 2004-2009 data of 33% is increased to 65% reflecting a more optimistic view on

an improving planning policy and appeals climate for renewable energy and because the original acceptance rate figure from the Envirolink study (2010) is only based on small sample (six projects)

- For the small hydro technology category, half of the capacity from the potential hydropower sites identified in the Environment Agency's 2010 study have been included. This is in light of the fact that scenario A may be an underestimate because of the large number of viable sites identified for this relatively "new" technology.

Table 5-2: Results for scenario B: aspirational/stretch Northwest scenario for 2020

	Generation (GWh)				Capacity (MW)		
Resource (sub-category level 1)	**Current deployed resource generation (GWh, 2007/8 figures/ estimates)**	**Accessible resource 2020 – generation (GWh)**	**Scenario B 2015 - generation (GWh)**	**Scenario B 2020 - generation (GWh)**	**Accessible resource 2020 – capacity (MW)**	**Scenario B 2015 - capacity (MW)**	**Scenario B 2020 - capacity (MW)**
Wind – commercial scale	836.7	53,721.8	1,930.3	3,028.4	23,587.0	847.5	1329.6
Wind – small scale	0.2	293.0	1.2	5.4	669.0	2.7	12.4
Plant biomass	84.1	353.4	113.6	140.1	80.7	25.9	32
Plant biomass (heat)	11.3	1,355.2	90.2	289.3	182.0	12.1	38.9
Animal biomass	56.0	940.4	99.1	115.2	214.7	22.6	26.3
MSW & C&I waste	0.7	2,727.1	1,028.0	1,655.7	345.9	130.4	210
Biogas	799.2	757.6	724.9	700.0	96.1	91.9	88.8
Co-firing of biomass (with a fossil fuel)	788.1	1,561.0	788.1	788.1	198.0	100	100
Small scale hydropower	0.2	539.6	36.5	276.8	77.0	5.2	39.5
Solar	53.3	5,072.3	650.2	1,188.4	2,316.2	188.9	655.3
Heat pumps	2.8	27,057.5	65.0	144.8	12,355.0	29.7	66.1
Total	**2,632.6**	**94,378.9**	**5,527.1**	**8,332.2**	**40,121.6**	**1456.9**	**2598.9**
Electricity only	**2,565.9**	**61,908.4**	**4,725.5**	**7,078.9**	**26,426.5**	**1230.6**	**2260.1**
Heat only	**66.7**	**32,470.5**	**801.6**	**1,253.3**	**13,695.1**	**226.3**	**338.8**

Source: SQW

Summary

5.18 The total **electricity capacity and electricity generation** results of scenarios A and B are summarised Table 5-4. The table also provides data to enable benchmarking of the potential renewable electricity generation capacity in the region against national targets for renewable deployment by 2020. Firstly the table states the current (2008) electricity consumption in the region based on DECC statistics (DECC, 2010). Secondly the expected regional share of the national contribution of offshore wind and wave and tidal technologies by 2020 has been included based on information from DECC (including DECC,2009).

Table 5-3: Summary of regional onshore renewable energy scenario results and benchmarks

Result/Benchmark (and source)	**Electricity Generation (GWh/year)**	**Electricity Capacity (MW)**
2008 regional electricity consumption (DECC statistics)	34,569	-
Scenario A results – Northwest onshore renewable scenario for 2020 (this study)	**4,900**	**2,000**
Scenario A results – Northwest onshore scenario for 2020 as a percentage of 2008 electricity demand	14%	15%
Scenario A results – Northwest onshore scenario plus expected minimum national contribution of offshore wind and wave/tidal for 2020	9,567	3,844
Scenario A results – Northwest onshore scenario plus expected minimum national contribution of offshore wind and wave/tidal for 2020 as a percentage of 2008 electricity demand	28%	29%
Scenario B results – aspirational/stretch Northwest onshore renewable scenario for 2020 (this study)	**5,723**	**2,260**
Scenario B results – Northwest onshore scenario for 2020 as a percentage of 2008 electricity demand	17%	17%
Scenario B results – Northwest onshore scenario plus expected minimum national contribution of offshore wind and wave/tidal for 2020	10,390	4,104
Scenario B results – Northwest onshore scenario plus expected minimum national contribution of offshore wind and wave/tidal for 2020 as a percentage of 2008 electricity demand	30%	31%

Source: SQW; DECC 2009; DECC 2010; UK Government, 2009.

6: Conclusions and next steps

Introduction

6.1 The project has produced a comprehensive assessment of the potential accessible renewable energy resources in Northwest England and explored the constraints and deployment scenarios for significantly growing their contribution to 2020. It has also provided an initial assessment of low carbon energy potential (i.e. Combined Heat and Power or tri-generation (to include cooling), and district heating schemes).

6.2 The focus of the project has been to present the results at the regional and sub-regional scales with technologies assessed. The project's evidence base is also highly relevant for use at the local scale in response to the requirements of national planning policy to consider the contribution of renewable energy and low carbon initiatives and opportunities for climate change mitigation and adaptation and noting that energy consumption is a material planning consideration. The evidence base from this project has the specific advantages of being based on up to date data, being informed by numerous other local/sub-national studies and being consistent with the national capacity assessment methodology (DECC/CLG, 2010).

6.3 This chapter presents the strategic conclusions from the project and outlines some suggested next steps for managing and monitoring the deployment of renewable and low carbon energy resources to 2020.

Strategic conclusions

6.4 The primary conclusion arising from the project is that:

- **There is a very large potential accessible onshore renewable energy resource in the Northwest region (40GW) and a significant proportion of it is considered viable. Two deployment scenarios are presented to provide more than 2GW of electricity generating capacity. This is equivalent to generating at least 15% of regional electricity demand from onshore renewable sources[14]. Taken in combination with the anticipated minimum contributions from offshore wind and marine renewable energy sources nationally, the 15% generating capacity from onshore renewables would put the Northwest in line with the Renewable Energy Strategy target of 30% of electricity by 2020. However there are considerable challenges, constraints and uncertainties associated with scaling up the deployment of renewable energy projects to this level across the Northwest in time for the 2020 UK and EU targets.**

6.5 Three supporting conclusions are that:

[14] This is based on regional electricity demand in 2020 being at or below 2008 levels i.e. within national projections which forecast a reduction in electricity demand of 2.8% over that period, DECC, 2010a.

- **The successful deployment of commercial scale onshore wind and microgeneration technologies are critical to the overall growth in renewable capacity, together accounting for approximately 75% of the capacity at 2020 under the deployment scenarios presented.** For commercial wind the issues surrounding aviation, environmental and other planning constraints will need to be successfully dealt with through the planning processes and the site specific investigations and consultations with relevant parties. Potential constraints associated with the cumulative impact of commercial wind and potentially other renewable energy developments may also need to be examined. Microgeneration technologies offer exciting opportunities for local economic development and employment as well as their renewable energy supply potential. However there is relatively little experience in the UK with many of these technologies to use to predict the uptake in the context of the new Feed in Tariffs as well as local policy measures.

- **The Northwest region has a theoretical capacity potential of approximately 25GW for low carbon sources (i.e. Combined Heat and Power or tri-generation (to include cooling), and district heating schemes) warranting further, more detailed consideration.** The more densely built environment of Greater Manchester accounts for over one third of the potential.

- **The renewable energy capacity evidence base has been significantly strengthened and updated through this project. However, inevitably for this rapidly developing sector there are still gaps and uncertainties to fill to improve the robustness of growth aspirations, plans and monitoring mechanisms.** For example early insights need to be drawn from the current round of proposals for small scale hydropower projects. Also the information base for regional/sub-regional electricity and heat demand is currently weak but will be increasingly important to understand in light of potential shifts across different fuel types (e.g. due to the electrification of road transport).

Potential next steps

6.6 The data assembled within this project provides an extensive evidence base for sub-national/local policy making and action. Next steps for consideration by local authorities, sub-regions, MAA areas and other stakeholders could include:

- **Dissemination of the results and extended evidence base from the project to local authorities to assist with plan development and related activities. For example the evidence base can support local assessments of deployable resource scenarios, identifying renewable energy deployment targets and establishing delivery mechanisms.** The evidence base includes the assessment of the majority of renewable energy technologies using local source data and all but one using sub-regional source data. The project also provides supplementary useful information in terms of the review of data sources, methodological assumptions and references to other studies.

- **Reviewing and refining initiatives/interventions to facilitate the roll out of appropriate microgeneration technologies in support of economic development goals as well as renewable energy targets.**

- **Preparation of a monitoring process in order that the progress to accelerate the deployment of renewable energy capacity can be tracked, reviewed and actions taken**. The development of monitoring processes will need to take account of ongoing planning and energy policy developments and associated research such as DECC's recent scoping study on *Options for a Local Authority Renewable Energy National Indicator* (DECC, 2010c).

Annex A: Accessible resource methodology and assumptions (by technology)

Table A-1: Assumptions for commercial scale wind

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Commercial scale wind							
Table 3-1	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)	Include area with wind speed 5 m/s at 45m above ground level (agl)	Regional, Sub-regional and LA Can be broken down by any scale	Very small area excluded due to this constraint. Readings over water are often zero.
Table 3-1	Turbine size	Use 2.5MW turbine (tip height 135m, rotor diameter 100m, hub height 85m	Turbine 2.5MW	Use 2.5MW turbine (tip height 135m, rotor diameter 100m, hub height 85m	Use 2.5MW turbine (tip height 135m, rotor diameter 100m, hub height 85m	Regional, Sub-regional and LA Can be broken down by any scale	5 rotor widths will always be greater than 9MW/ square km
Table 3-1	Turbine density	Use greater of 9MW/km square or distance of 5 rotor diameters between turbines (500m), whichever is larger	Use 500m theoretical spacing between turbines	Use greater of 9MW/km square or distance of 5 rotor diameters between turbines (500m), whichever is larger	Use 500m theoretical spacing between turbines	Regional, Sub-regional and LA Can be broken down by any scale	This equates to 4 turbines per square km which is greater than 9MW/square km for the turbine dimensions provided
Table 3-1	Roads (A Roads, B Roads, Motorways)	OS Strategi data	OS Strategi data	Exclude areas within roads and within 150m of roads	Applied buffers to approximate footprint of road and additional topple distance buffer	Regional, Sub-regional and LA Can be broken down by any scale	Used information from Highways Agency to convert road centrelines to polygons

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Commercial scale wind							
Table 3-1	Railways	OS Strategi data	OS Meridian data	Exclude areas within railways and within 150m of railways	Applied buffers to approximate footprint of Railways and additional topple distance buffer	Regional, Sub-regional and LA Can be broken down by any scale	Used own assumption to generate approximate polygons for railway widths
Table 3-1	Inland waters (rivers, canals, lakes, reservoirs)	OS Strategi data	OS Meridian data	Exclude areas within rivers, canals, lakes and reservoirs	Rivers, canals with buffer to approximate footprint. Meridian lakes.	Regional, Sub-regional and LA Can be broken down by any scale	Used own assumption to generate approximate polygons for railway widths
Table 3-1	Built up areas	OS Strategi data	OS Strategi Urban Areas	Exclude areas within Urban areas and within 600m of urban areas	Excluded areas within 600m of O Urban Areas	Regional, Sub-regional and LA Can be broken down by any scale	NWDA happy to use OS Strategi data (instead of ONS urban areas)
Table 3-1	Airports	OS Strategi data	CAA centrepoints for airports and additional internet search for military airports	Exclude areas within 5km of airports	Excluded areas within 5km of civil airports, aerodromes and military airports	Regional, Sub-regional and LA Can be broken down by any scale	Included small aerodromes
Table 3-1	Ancient semi-natural woodland	MAGIC	Natural England	Exclude areas within Ancient sei-natural woodland	Excluded areas within all Ancient woodland (including PAWS)	Regional, Sub-regional and LA Can be broken down by any scale	Forestry Commission (Peter Fox) advised that FC would object to wind development within PAWS land

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Commercial scale wind							
Table 3-1	Sites of historic interest	MAGIC	English Heritage	Exclude areas within heritage boundaries with no buffer	No information on Conservation areas. Applied 15m buffer to Listed Building points to approximate boundary. Excluded land within World heritage Sites (include site specific buffer zone), Battlefields, Scheduled Monuments, Parks and gardens and Listed Buildings	Regional, Sub-regional and LA Can be broken down by any scale	No regional information on Conservation Areas, so this has not been accounted for. Most CAs are within urban areas, so this land will mostly be accounted for in the exclusion of urban areas with 600m buffer
Table 3-1	Civil air traffic control constraints	None	Met office Zones and MOD Low fly zones	None	Exclude high priority low fly zones and two inner rings of Met Office Zones	Regional, Sub-regional and LA Can be broken down by any scale	No further data
Table 3-1	MOD constraints	MOD	N/A	Exclude training sites, explosive safeguarded areas, danger areas near ranges, MOD sites (other operational and unused land), air defence and air traffic control radar, other safeguarded areas, MOD byelaws	None	Regional, Sub-regional and LA Can be broken down by any scale	No data provided, therefore not taken into account
Table 3-1	International and national nature conservation designations	MAGIC	Natural England	Do separate assessment	Excluded all these designations (SPA, SAC, Ramsar, NNR, SSSI)	Regional, Sub-regional and LA. Can be broken down by any scale	

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Commercial scale wind							
Table 3-1	Landscape designations (National Parks and AONB's) and Heritage Coast	MAGIC	Natural England	Do separate assessment	Assume zero deployment	Landscape Designation	Assume zero deployment within landscape designations and within 2km of the designations
Table 3-1	Within 2km of landscape designations	N/A	Natural England	N/A	Assume zero deployment	Landscape Designation	Assume zero deployment within landscape designations and within 2km of the designations
Table 3-1	Within potential national park extensions	N/A	Natural England	N/A	Test a scenario with zero deployment	Landscape Designation	Assume zero deployment within landscape designations and within 2km of the designations
Table 3-1	Bird sensitive areas	N/A	Natural England/RSPB England sensitivity map	N/A	Assume 50% deployment in high and medium sensitivity areas	1km grid covering whole of England	Further guidance from NE suggests that it should be 25% deployment in areas with high sensitivity and 50% deployment in medium sensitivity
Table 3-1	Peat designations	N/A	Natural England/BGS	N/A	Assume 50% deployment	No data supplied	No data provided, therefore not taken into account

Source: SQW

Table A-2: Assumptions for small scale wind

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Small scale wind							
Table 3-2	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)	Regional, Sub-regional and LA Can be broken down by any scale	Very small area excluded due to this constraint. Readings over water are often zero.
Table 3-2	Scaled wind speed	NOABL/Address data/wards	NOABL/Address data/wards	Include address points where scaled wind speed 4.5m/s at 10m above ground level (agl). Assume scaling factor of 56% for urban, 67% for suburban, 100% for rural	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	Regional, Sub-regional and LA Can be broken down by any scale	Each address point assigned a wind speed and a ward type, and wind speed scaled according to ward classification
Table 3-2	Address points	OS Address Point	OS Mastermap Address Layer 2	Estimate total number of residential and non-residential buildings	Use NLUD classification within address data to classify as residential, commercial and industrial. Others excluded. Unless categorised in NLUD as dwelling, address point must be postal/multi-occupancy and permanent building	Regional, Sub-regional and LA Can be broken down by any scale	See NLUD group table for classification
Table 3-2	Turbine size	6kW per address point	6kW per address point	6kW per address point	6kW per address point	Regional, Sub-regional and LA. Can be broken down by any scale	

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Small scale wind							
Table 3-2	Ward classification	DEFRA Rural Definition dataset	DEFRA Rural Definition dataset	Classify wards as urban, suburban or rural	Classified as Urban, semi-urban or rural	Regional, Sub-regional and LA Can be broken down by any scale	DEFRA classifies wards as Urban >10k (urban), Town and Fringe (semi-urban) and Village, hamlet and isolated dwellings (rural)

Source: SQW

Table A-3: Assumptions for managed woodland

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Managed Woodland							
Table 3-3a	Amount of biomass available in the region in odt	1) Woodfuel Resource Tool or 2) National Inventory of Woodlands and Trees	Peter Fox (FC) provided woodland data for North West region split by broad type and management. Peter recommended not using Resource tool data, and starting with raw data to build up sub-regional picture. Resource Tool data not available at sub-regional level	N/A	Use Forestry Commission managed woodland, Non-FC managed and undermanaged woodland as well as Grants and Licensing Activity woodland. Yield classes of 4 (Broadleaved), 12 (conifers) and 6 (mixed woodland). Do not use non-productive woodland. 1 cubic metre = 1 green tonne. Loss of 50% when converting from green tonnes to oven dried tonnes.	Regional, Sub-regional and Local Authority	Agreed parameters with Peter Fox.
Table 3-3a	Exclude woodfuel uneconomic to harvest	None given	No actual data to calculate this. Peter Fox would prefer to see total theoretical figure of all woodland and follow this up with a caveat that states an estimate of 50% may be unavailable due to constraints such as access, owner objectives and economics. Woodfuel Strategy's 2 million tonnes figure by 2020 represents an aspirational target of 50% of what is available.	None	Followed Peter Fox suggestions, but will need to present this very carefully in the reporting. Table shows 50% reduction	Regional, Sub-regional and Local Authority	Agreed parameters with Peter Fox.

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Table 3-3a	Exclude wood that could go to alternative markets	Forestry Commission Deliveries of UK grown softwood	For Forestry Commission managed woodland, assume constant percentage = 3.7% of total (in 2008). For unmanaged and other woodland, cannot make assumptions, so assume 100%. Could caveat with potential 50% figure to estimate alternative markets.	None	For FC managed woodland, 3.7% and for other, 100% , then apply 50% reduction	Regional, Sub-regional and Local Authority	
Table 3-4	Calorific values	Biomass Energy Centre	Peter Fox suggests 18GJ/odt to represent stemwood.	Various figures for different woodfuel categories. N/A as not using woodfuel resource tool	18GJ/odt	Regional, Sub-regional and Local Authority	

Source: SQW

Table A-4: Assumptions for energy crops

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Energy crops							
Table 3-3b	Existing areas of established SRC and Miscanthus Existing areas of established SRC and Miscanthus	Woodland Grant Scheme, Natural England, National Non-food crops centre	Natural England	Use all schemes Use all schemes	Used all Energy Crop Schemes data Natural England provided	Sub-regional	No schemes for 2009 or 2010 (confirmed by NE)
Table 3-3b	Amount of land available for growing energy crops (ha) - HIGH scenario Assume all available arable land and pasture will be planted with energy crops	Rural Payments Agency with DEFRA agricultural land classification	DEFRA agricultural land classification	Use Grades 3 and 4	Use Grades 3 and 4	Sub-regional	This data is very coarse and will likely include some areas which are not suitable such as roads/railways/inland waters
Table 3-3b	Amount of land available for growing energy crops (ha) - HIGH scenario. Assume all available arable land and pasture will be planted with energy	Rural Payments Agency with DEFRA agricultural land classification	DEFRA energy crop opportunity maps	Use highest yield where SRC and Miscanthus overlap	Combined SRC and Miscanthus and took highest yield for each square. Where equal, assume miscanthus because DECC method assumes miscanhus 15GJ/odt and SRC 10GJ/odt	Sub-regional	

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
	crops						
Table 3-3b	Amount of land available for growing energy crops (ha) -MEDIUM scenario All abandoned land and pasture	None	DEFRA Agricultural and horticultural survey GAEC12 land	None	DEFRA Agricultural and horticultural survey GAEC12 land	County/Sub-regional	Not spatial data, cannot remove exclusion areas
Table 3-3b	Amount of land available for growing energy crops (ha) - LOW scenario new crops planted to extent of Energy Crop Scheme for 2010	2010 applications	None	2010 applications	No applications for 2009 or 2010, therefore no low scenario	N/A	No low scenario possible
Table 3-3b	Required amount of biomass per MW capacity	Electricity: 6000odt/MW	Electricity: 6000odt/MW	Electricity: 6000odt/MW	Electricity: 6000odt/MW	N/A	
Table 3-3b	Required amount of biomass per MW capacity	Heat: varied assumptions based on diameter	Heat: 18GJ/odt	Heat: varied assumptions based on diameter	Heat: 18GJ/odt	N/A	Used same conversion factors as managed woodland

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Energy crops							
Table 3-3b	Exclusion areas: Permanent grassland/pasture	MAGIC	IACS database	Exclude	Select all permanent grassland IACS points within remaining opportunity areas and subtract total area	County/Sub-regional	Not ideal, but no spatial dataset. Could only be done for high scenario
Table 3-3b	Exclusion areas: Public rights of way and buffers	MAGIC	None	exclude PROW and buffers (3m RC, 5m Miscanthus)	None - no data available	N/A	Tried to obtain data from local authorities, but very low response, so was included as a percentage reduction from total are
Table 3-3b	Common land	MAGIC	Natural England	Exclude	Exclude	County/Sub-regional	Could only be done for high scenario
Table 3-3b	Exclusion areas: SPS Cross-compliance buffers	MAGIC	Percentage reduction on total land area	None	15% reduction to account for buffers and other non cropped areas. Based on average field size from IACS database	County/Sub-regional	Applied to high and medium scenarios
Table 3-3b	Exclusion areas: Nature conservation	MAGIC	Natural England	Exclude	Exclude	County/Sub-regional	Could only be done for high scenario
Table 3-3b	Exclusion areas: Heritage	MAGIC	English Heritage	Exclude	Exclude	County/Sub-regional	Could only be done for high scenario
Table 3-3b	Environmental impacts: water stressed areas	Consult EA	None	Consult EA	None	County/Sub-regional	No further information obtained - may already be included in opportunity maps.

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Table 3-3b	Environmental impacts: biodiversity impacts	Consult NE	Consult NE	Consult NE	Consult NE: response too late to be included in assessment	Consult NE: response too late to be included in assessment	Consult NE: response too late to be included in assessment
Table 3-3b	Environmental impacts: protected landscapes	Consult NE	Consult NE	Consult NE	Consult NE: response too late to be included in assessment	Consult NE: response too late to be included in assessment	Consult NE: response too late to be included in assessment

Source: SQW

Table A-5: Assumptions for plant biomass - waste wood

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Plant biomass – waste wood							
Table 3-3	Existing and potential new feedstock	Forestry Commission/WRAP	WRAP Report " Wood Waste Market in the UK" August 2009	For sawmill - 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-apply and increase of the existing feedstock of 1% per year	All wood waste used except for MSW which has already been accounted for within other technologies. Future additional feedstock as per DECC methodology.	Regional	Sawmill report no longer published. No bottom up data for sub-regional breakdown
Table 3-3	Fuel requirement	Biomass Energy Centre	Biomass Energy Centre	Benchmark of 6,000 odt/year per 1MW for electricity. For heat apply standard calorific values	Benchmark of 6,000 odt/year per 1MW for electricity. For heat apply standard calorific values and that wood is of poorer odt quality. It is also assumed that for heat generation, the plant is available 45% of the time and has an efficiency of 80%.	Regional	No bottom up data for sub-regional breakdown
Table 3-3	Available feedstock	No data required	No data required	Assume 50% of resource is available	Assume 50% of resource is available	Regional	No bottom up data for sub-regional breakdown

Source: SQW

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

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Plant Biomass - Agricultural Arisings (Straw)							
Table 3-3	Existing feedstock	Defra-Agricultural and Horticultural Survey-England	Defra-Agricultural and Horticultural Survey-England	Use data of existing feedstock of all wheat and oil seed rape straw only	Use data of existing feedstock of all wheat and oil seed rape straw only. Assume 3.5 tonnes per ha of wheat and 1.5 tonnes per ha of oil seed rape	Regional, Sub-regional and Local Authority	
Table 3-3	Fuel requirement	N/A	N/A	Apply benchmark of 6,000 odt of baled straw per 1MW capacity	Apply benchmark of 6,000 odt of baled straw per 1MW capacity	Regional, Sub-regional and Local Authority	
Table 3-3	Available feedstock	Defra-Agricultural and Horticultural Survey-England	Defra-Agricultural and Horticultural Survey-England	Apply 1.5 tonnes of straw per annum per head of cattle in the region	Apply 1.5 tonnes of straw per annum per head of cattle in the region. Assume 3.5 tonnes per ha of wheat and 1.5 tonnes per ha of oil seed rape	Regional, Sub-regional and Local Authority	

Source: SQW

Table A-7: Assumptions for animal biomass – wet organic waste

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Animal Biomass-Wet Organic Waste							
Table 3-4	Existing feedstock	ADAS Manure Management Database, Defra Agricultural and Horticultural Survey-England and Food and Drink Federation	For livestock data- Defra Agricultural and Horticultural Survey-England For manure factor -biomass energy centre For food and drink waste used EA Report "North West Commercial and Industrial Waste Survey 2009", March 2010	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 -use data on number of livestock multiplied by a manure factor For food and drink waste use data for food, (drink and tobacco plus data for retail and wholesale) from the North West Commercial and Industrial Waste Survey 2009 report	Regional, County LA - partially	ADAs manure management database unavailable. Use breeder and fattener pigs to derive total slurry produced by pigs.
Table 3-4	Biogas yield	UK National Non-Food Crops Centre (NNFCC)		Use following assumptions: cattle's 25m3/t, Pigs 26m3/t , food and drink 46m3/t	Use following assumptions: cattle's 25m3/t, Pigs 26m3/t , food and drink 46m3/t	Regional, County LA - partially	
Table 3-4	Feedstock requirements	N/A	N/A	Apply benchmark of 37,000 tonnes of wet organic waste required per 1MW capacity per year	Apply benchmark of 37,000 tonnes of wet organic waste required per 1MW capacity per year	Regional, County LA - partially	
Table 3-4	Limits to extraction	N/A	N/A	Assume 80% of the resources can be collected	Assume 80% of the resources can be collected	Regional, County LA - partially	
Table 3-4	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	For manure and slurry- assume 100% of total resource is available for energy For food and drink - assume 50% of total	Regional, County LA - partially	

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
				available for energy	resources is available for energy		

Source: SQW

Table A-8: Assumptions for animal biomass - poultry

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Animal biomass – poultry							
Table 3-4	Existing and potential new feedstock	Defra-Agricultural and Horticultural Survey-England	Defra-Agricultural and Horticultural Survey-England	Use data on poultry numbers and excreta factor per head of poultry	Use data on poultry numbers and excreta factor per head of poultry. Use assumption that broilers typically produce 16.5 tonnes per annum per 1000 hens	Regional, County LA - partially	
Table 3-4	Feedstock requirements	N/A	N/A	Apply benchmark of 11,000 tonnes of poultry litter required for 1MW capacity per annum	Apply benchmark of 11,000 tonnes of poultry litter required for 1MW capacity per annum	Regional, county LA - partially	
Table 3-4	Available feedstock	N/A	N/A	Assume 100% of the resource is available for energy	Assume 100% of the resource is available for energy		

Source: SQW

Table A-9: Assumptions for municipal solid waste

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Municipal Solid Waste							
Table 3-5	Existing and potential new feedstock	Defra's quarterly MSW Statistics	Defra WasteDataFlow	Collate information from all local waste management plans	Use Local authority municipal and household waste statistics 2008/09 data derived from WasteDataFlow - waste collection only then assume Biodegradeable Municipal Waste is 68% of total MSW	Regional County LA	Assumes BMW component of MSW is 68%.
Table 3-5	Feedstock requirement	N/A	N/A	Apply a benchmark of 10 kilo tonnes of MSW required for 1 MW capacity per annum.	Apply a benchmark of 10 kilo tonnes of MSW required for 1 MW capacity per annum.	Regional County LA	

Source: SQW

Table A-10: Assumptions for commercial and industrial waste

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Commercial and industrial waste							
Table 3-5	Existing and potential new feedstock	No specific source provided.	Collate information from all local waste management plans	Collate information from all local waste management plans	Use data on estimate of North West England C &I Waste Arisings, by sector from North West of England Commercial and Industrial Waste Survey 2009 report produced by Environment Agency. Includes animal and vegetable waste and non - metallic waste only	Regional County	
Table 3-5	Feedstock requirement	No specific source provided.	North West of England Commercial and Industrial Waste Survey 2009 Report - for the Environment Agency (Urban Mines)	Apply a benchmark of 10 kilo tonnes of MSW required for 1 MW capacity per annum.	Apply a benchmark of 10 kilo tonnes required for 1 MW capacity per annum.	Regional County	

Source: SQW

Table A-11: Assumptions for Biogas - landfill gas

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Biogas - landfill gas							
Table 3-6	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 'live' landfill sites in the NW from the OFGEM RO register	Regional County	
Table 3-6	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	Assume that the present day capacity will continue flat for 5 years to 2015, then straight line reduction until the capacity in 2030 is 20% of today's capacity	Regional County	

Source: SQW

Table A-12: Assumptions for Biogas – sewage gas

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Biogas – sewage gas							
Table 3-6	Available resource	Water Utilities	OFGEM RO Register	Refer to inventory of sewage treatment sites and their size and capacity	Assume 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.	Regional County	
Table 3-6	Potential new resource	Water Utilities	OFGEM RO Register	Refer to water utility business plans and forecast	As above - assumes growth comes from smaller more efficient treatment works that give greater coverage.	Regional County	

Source: SQW

Table A-13: Assumptions for Biogas co-firing

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Biogas co-firing							
Table 3-7	Available plant	DUKES inventory of coal and oil-fired plants	DUKES inventory of coal and oil-fired plants	Estimate total coal and oil-fired plant capacity (MW) in 2015. Take into account plants scheduled for closure as a result of the LCPD	Estimate total coal and oil-fired plant capacity (MW) in 2015. Take into account plants scheduled for closure as a result of the LCPD	Regional County - Applies to Cheshire only	
Table 3-7	Co-firing threshold	N/A	N/A	Apply benchmark of 10% of combusted fuel to be from biomass	Apply benchmark of 10% of combusted fuel to be from biomass	Regional County - Applies to Cheshire only	
Table 3-7	Policy framework	N/A	N/A	N/A	N/A	N/A	

Source: SQW

Table A-14: Assumptions for Small Scale Hydropower

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Small scale hydropower							
N/A	Number of barriers identified in EA study 'Mapping Hydropower Opportunities in England and Wales' (2009)	GIS data from EA study 'Mapping Hydropower Opportunities in England and Wales' (2009)	GIS data from EA study 'Mapping Hydropower Opportunities in England and Wales' (2009)	Identify total resource available and the proportion that is accessible and viable for development	Total resource calculated using all barriers. Accessible and viable resource calculated using potential hydropower sites as defined in the EA study.	Regional	Data is intended for use at national and regional level.

Source: SQW

Table A-15: Assumptions for Microgeneration - solar

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Microgeneration - solar							
Table 3-8	Existing building stock	CLG Statistics, English Housing Survey and ONS data	RSS new housing provisions	Apply for domestic properties- 25% of all properties (including flats) For commercial properties - 40% of all hereditaments For industrial buildings - 80% of the stock	Apply for domestic properties- 25% of all properties (including flats) For commercial properties - 40% of all hereditaments For industrial buildings - 80% of the stock	Regional County	
Table 3-8	New developments	RSS new housing provisions	RSS new housing provisions	Assume 50% of all new domestic roofs will be suitable for solar systems	Assume 50% of all new domestic roofs will be suitable for solar systems	Regional County	
Table 3-8	System capacity	N/A	N/A	For domestic - 2kW (thermal or electric) For commercial - 5kW (electric only) For industrial - each region use their own assumptions	For domestic - 2kW (thermal or electric) For commercial - 5kW (electric only) For industrial - 10kW (electric only)	Regional County	

Source: SQW

Table A-16: Assumptions for Microgeneration – heat pumps

DECC Methodology ref	Parameters	DECC suggested data source	Actual data source used	DECC suggested assumptions	Final assumptions made	Coverage/scale (e.g. regional, county, LA)	Additional Comments
Microgeneration – heat pumps							
Table 3-9	Existing building stock	CLG Statistics, English Housing Survey and ONS data	RSS new housing provisions	For domestic 100% of all off-grid properties, for the remaining stock 75% of detached and semi-detached properties, 50% of terraced properties and 25% of flats	For domestic 100% of all off-grid properties, for the remaining stock 75% of detached and semi-detached properties, 50% of terraced properties and 25% of flat	Regional County	
Table 3-9	New developments	RSS new housing provisions	RSS new housing provisions	50% of all new build domestic properties	50% of all new build domestic properties	Regional County	
Table 3-9	System capacity	N/A	N/A	Domestic -5kw and Commercial -100kW	Domestic -5kw and Commercial -100kW	Regional County	

Source: SQW

Annex B: Evidence base previous/ongoing studies

Table B-1: Evidence base of previous and ongoing studies identified

- 4NW, 2006*. Renewable Energy Targets for the North West - Technical Briefing Note.*
- 4NW, 2008. *Nationally, Regionally and Sub-Regionally Significant Waste Management Facilities.*
- 4NW, 2008. *Towards Broad Areas for Renewable Energy Development*.
- 4NW, 2010. *The Updated Renewable Waste Strategy for England's North West.*
- 4NW, 2010. *5th Waste Management Annual Monitoring Report.*
- Advantage West Midlands, 2010*. The West Midlands Approach to Landfill Diversion.*
- Allerdale Borough Council, 2010. *Evidence Base for the Provision of Renewable Energy in Allerdale.*
- BERR, 2008. *The Growth Potential for Microgeneration in England, Wales and Scotland - Final Report*.
- BERR, 2008. *Numbers of Microgeneration Units Installed in England, Wales, Scotland, and Northern Ireland: Final Report.*
- Cheshire West and Chester Council, 2010. *Establishment of a New Renewable Energy Policy*.
- Cumbria County Council, 2001. *Cumbria & Lake District Joint Structure Plan 2010 – 2016: Technical Paper No 6 - Planning for Renewable Energy Development*.
- England's Northwest, 2001. *Rising to the Challenge: A Climate Change Action Plan for England's North West*.
- Envirolink Northwest, 2008. *Life Cycle Costs & Impacts of Energy from Waste Technologies*.
- Envirolink Northwest, 2009. *Baseline Benchmarking against Biomass Interventions in other English Regions.*
- Envirolink Northwest, 2009. *Biomass Strategy for North West England- Draft Report.*
- Envirolink Northwest, 2009. *Survey of Industrial Process Heat in England's Northwest*.
- Envirolink Northwest, 2010. *Supply Chain Directories - various, including "Wind Energy 2010".*
- Envirolink Northwest, 2010. *Survey of Planning Applications for Renewable Energy Projects in the Northwest: Results and Analysis.*
- Environment Agency, 2010. *North West of England Commercial and Industrial Waste Strategy 2009 - Final Report.*
- Forestry Commission, 2010. *Scoping the Potential for Renewable Energy Generation on Public Lands in Northwest England – Draft Report*.
- Government Office North West, 2001*. Renewable Energy in North West England: Investigating the Potential and Developing the Targets - Final Report*.
- Greater Manchester Energy Group, 2010*. Shaping Partnership Priorities Energy Report for Greater Manchester.*
- Inter Hydro Technology, 2009. *Scoping Study for the Lake District National Park Authority into Potential Hydro Electric Generating Sites within the Park - Part 1-3.*
- Knowsley Metropolitan Borough Council, 2009. *Knowsley Renewable and Low Carbon Energy Options.*
- Liverpool City Region, 2009*. Renewable Energy Capacity Study: Liverpool City Region - Stage 1 Report.*
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Source: SQW

Annex C: Stakeholder workshop details

C.1 The briefing note describing the stakeholder workshop on 26 May 2010 is presented below.

North West Renewable and Low Carbon Energy Capacity and Deployment

Briefing note for the stakeholder event

To be held on Wednesday 26th May 2010 at 13.45 to 17.00

Liverpool 1 Suite, The Holiday Inn, Liverpool (opposite Liverpool Lime Street Station)

Background to the project

1. The North West Development Agency (NWDA) has commissioned SQW and Land Use Consultants to undertake the "Northwest Renewable and Low Carbon Energy Capacity and Deployment" study. The project aims to provide analysis and decision support to ensure that the Northwest region is able to deploy renewable energy in time to meet the UK's 2020 targets[15].

2. The project will provide the essential evidence base required for renewable energy deployment to input to the North West Regional Strategy (RS2010) process currently underway. The project has a specific emphasis on ensuring that this evidence base is consistent with national guidance and other regional activities. It will do this by building on previous/ongoing studies in the region and then applying the methodology recently published by the Department of Energy and Climate Change (DECC) and the Department for Communities and Local Government (CLG)[16].

3. The project focuses on land-based renewable electricity and heat, including both commercial scale renewables and microgeneration (on-site and building-integrated renewables). It also provides a high level assessment of low-carbon energy categories which are defined by DECC as being combined heat and power (CHP) generation (and tri-generation to include cooling) and district (community) heating schemes.

4. The project does not cover offshore wind or marine (wave and tidal) renewable energy sources because those technologies are not controlled by the spatial planning regime within the region as they are governed by other frameworks (e.g. the Crown Estate's

[15] The Renewable Energy Strategy (RES) published in July 2009 sets out the measures that the Government will pursue to achieve the target to source 15% of the UK's energy needs from renewables by 2020.
[16] DECC/CLG, 2010: "Renewable and Low-carbon Energy Capacity Methodology: Methodology for the English Regions". http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/ored/ored.aspx

licensing arrangements). Other energy sources including nuclear and fossil fuel sources are also excluded from this project. It is fully recognised that in implementing the Regional Strategy there are various relationships between the technologies covered by the project and those that are excluded. For example, energy industry and supply chain opportunities in the region may cross over these markets.

5. It is also important to note that this project is intended to provide a regional assessment with sub-regional assessments where feasible. It is not intended to provide guidance for the assessment and development of specific sites.

Purpose of the stakeholder event

6. The event will bring together a range of key stakeholders including representatives from the energy sector, local authorities, regional bodies and environmental organisations. It will provide an opportunity to:

   - ➢ Understand the scope and methodology applied to assess the regional resource base
   - ➢ Engage with the interim results of the scenario analysis to investigate the effects of key constraints (planning, transmission, supply chains) on the deployable energy resource
   - ➢ Understand how the regional renewable and low carbon energy targets will need to be implemented and monitored

Detailed agenda

7. The proposed agenda for the event is as follows:

   13.45: Arrival and refreshments

   14.00: Welcome and introduction to the RS2010 process (NWDA)

   14.15: Overview of the study methodology and schedule for the rest of the afternoon (SQW). Followed by Q&A.

   14.45: Study results to date – total potential renewable energy resource (SQW). Followed by Q&A.

   15.15: Break.

   15.30: Constraints parameters and implications (SQW). With breakout discussions on the key planning and supply chain constraints in the region.

   16.30: Wrap up and next steps in the process (NWDA). With final Q&A.

   17.00: Close.

Annex D: GIS output maps

D.1 The following supporting GIS data maps are available separately:

Map C-1: Context

Map C-2: Commercial-scale wind considerations

Map C-3: Commercial-scale wind opportunities and constraints

Map C-4: Commercial-scale wind constraints

Map C-5: Results of commercial-scale wind assessment

Map C-6: Small-scale wind assessment

Map C-7: DEFRA energy crop opportunity maps

Map C-8: Energy crop opportunity analysis (high scenario)

Map C-9: Energy crop opportunity and constraints analysis (high scenario)

Map C-10: Environment Agency study hydropower barriers

Map C-11: Environment Agency study potential hydropower sites

Annex E: Bibliography

Table E-1: Bibliography

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