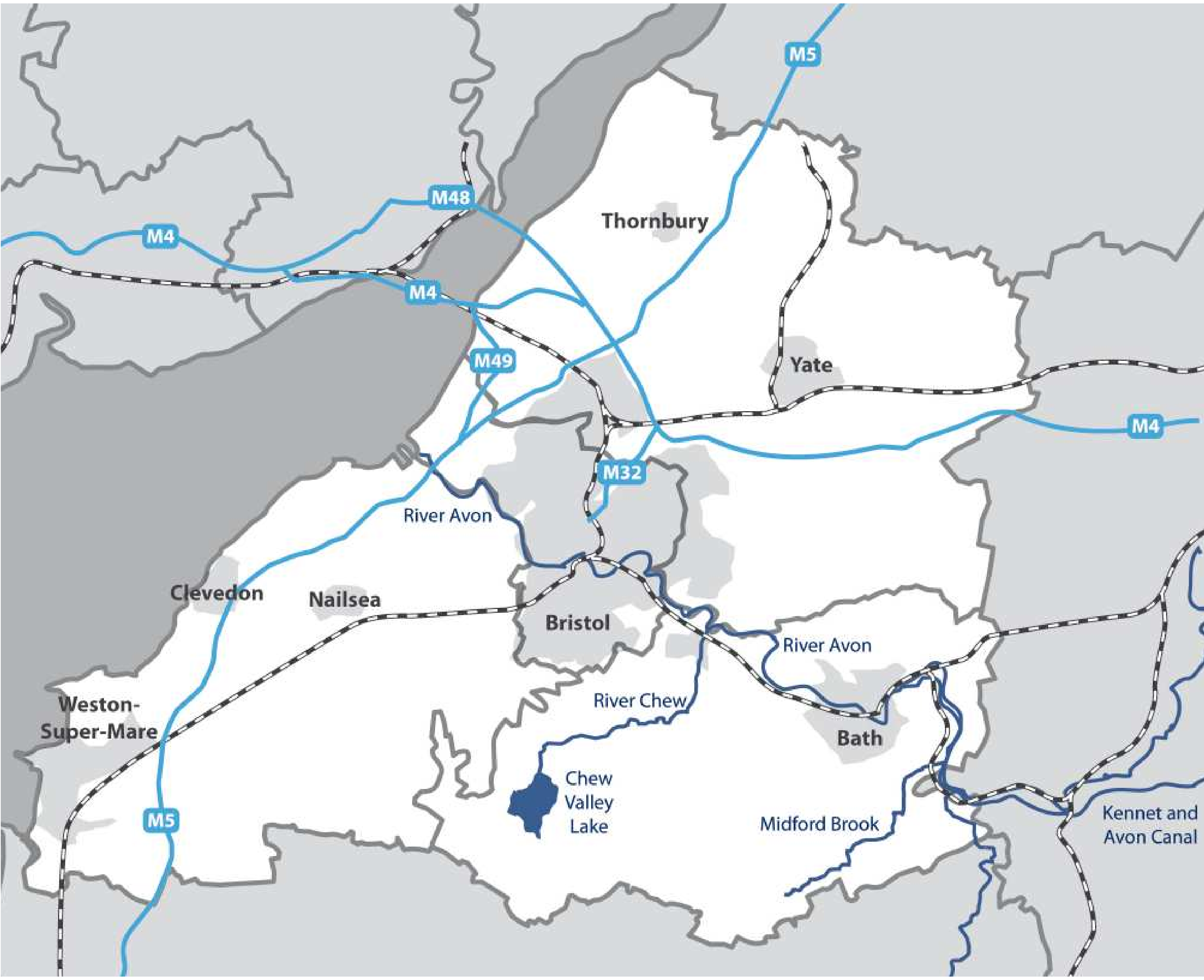

West of England Low Carbon Initiative Project 2 Lot 4

Renewables and Low Carbon Energy in the West of England

Final Report Revision 03

24th February 2012

Buro Happold

Contents

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Glossary

West of England: The counties formerly known as Avon. These are the Unitary Authorities of: Bath and North East Somerset, North Somerset, South Gloucestershire and Bristol City.

Unitary Authority: is responsible for all local government within its area. It is a type of local authority that forms a single tier of local government as opposed to two tier systems where functions are divided between county councils and district councils.

Sustainable energy: used to describe both renewable energy and low carbon energy technologies, including combined heat and power. Low carbon energy produces less carbon than traditional forms of energy production. If energy production can be carried out closer to demand through smaller decentralised power plants, then energy which would otherwise be wasted can be used and distributed to these buildings.

Renewable energy: energy that comes from sources which are not used up faster than they are generated. Renewable energy sources include sunlight, wind, tide, wave, geothermal and biomass power. Renewable sources of energy are generally less concentrated than non-renewable energy, and require a distributed energy system.

DECC methodology: This is the standard methodology for assessment of the potential for sustainable energy in the English regions. It was published by DECC in 2010, so studies carried out prior to that date were not able to follow it.

Technical potential: This is the total energy that can be obtained from a resource using today's technology. This is equivalent to 'stage 2' of the DECC methodology, 'technically available resource'.

Practical potential: This is the total energy that can be obtained from a resource, taking into account technical, economic and supply chain constraints. The exact definition of these constraints will vary depending on regulatory requirements as well as political and community will. These constraints are negotiable, as they depend on the social choices that are made, and so the practical potential is difficult to quantify.

Constrained potential: the amount of renewable energy available is constrained by a number of factors, from land use to regulatory, planning and financing issues. The amount of constraint and number of constraints applied to a resource increases as the analysis moves through the stages of the DECC methodology.

Anchor load: a single large heat demand, such as a swimming pool or a hospital, which can form a stable demand and customer for a district heating system. The presence of anchor loads can significantly increase the viability of a district heating network in a particular location.

Merton Rule: the Merton Rule was first implemented in the London Borough of Merton in 2003, as a requirement that new developments generate at least 10% of their energy needs from on-site renewables. Since then, the Planning and Energy Act 2008 has enabled all councils in England and Wales to implement similar policies, with the threshold of percentage of renewable energy generated at the discretion of the council.

Combined Heat and Power: Simultaneous generation of both electricity and heat, which saves energy by making use of heat which would otherwise be wasted.

Planning Policy Statement 1: Delivering Sustainable Development, first implemented in January 2005.

Area of Outstanding Natural Beauty: a landscape conservation status which reduces the likelihood of wind turbines being permitted in the area, although it does not prohibit wind turbine development entirely.

Section 106: The section of the Town and Country Planning Act which relates to the payment of monies from developers to the local council towards the external costs of the development. These include impacts on transport and other infrastructure and services which the council will have to pay for.

Abbreviations

AONB - Area of Outstanding Natural Beauty

B&NES - the Unitary Authority of Bath and North East Somerset

BCC - the Unitary Authority of Bristol City Council

CHP - Combined Heat and Power

CIL - Community Infrastructure Levy

CSE - Centre for Sustainable Energy

DECC - Department for Energy and Climate Change

ESCo - Energy Service Company

GIS - Geographical Information Service

LEAF - Local Energy Assessment Fund

LEP - Local Enterprise Partnership

NS - the Unitary Authority of North Somerset

odt/ha - oven dried tonnes per hectare (unit used for biomass resource assessment)

PPS1 - Planning Policy Statement 1

S106 - Section 106

SAC - Special Area of Conservation

SG - the Unitary Authority of South Gloucestershire

SSSI - Site of Special Scientific Interest

UA - Unitary Authority

WoE - West of England

1 Executive Summary

1.1 Introduction

This report builds on the other West of England Low Carbon Initiative projects commissioned by the four Unitary Authorities (UAs) that make up the West of England (WoE), and other relevant studies across the UAs, to identify opportunities for developing regional sustainable energy infrastructure and to help build capacity to facilitate this. This report summarises Stage One and Stage Two of Project 2, Lot 4 "Renewables and Low Carbon Energy in the West of England". Stage One of this project focused on the existing evidence base around the WoE's capacity for deployment of sustainable energy. Stage Two used this evidence base to build capacity by presenting the findings of this report in a series of workshops with appropriate stakeholders. The workshops concluded with next step actions to set out clear ways forward for realising sustainable energy opportunities for the WoE. The outcomes of the workshops informed the recommendations for WoE wide action by the UAs.

The study has found that there is significant potential for sustainable energy in the WoE, with the largest potential for sustainable energy in rural areas being wind power and biomass, whereas in urban areas the largest potential is for heat networks, energy from waste, heat pumps, and solar PV.

Through the case studies and workshops, this study showed the importance of leadership from the UAs in order to achieve policy objectives and advance the agenda of sustainable energy.

'Technical Potential'

This study brought together existing data to assess the overall technical potential for sustainable energy in the WoE. The technical potential is the maximum amount of energy which could be supplied using today's technology; assuming that economic, social and deployment factors were not an issue.

If all the technical potential for sustainable energy in the WoE were implemented, it would be possible to achieve approximately a 44% reduction in carbon dioxide emissions from heat and electricity (not including carbon dioxide emissions associated with transport, agriculture or aviation), compared to meeting current demand through conventional energy generation and supply methods. This would require an extremely challenging level of activity and acceptance of new infrastructure. Even if it is possible to achieve the full 44% reduction in carbon dioxide emissions, there is a significant shortfall to achieve the overall 80% reduction in carbon dioxide emissions required by the 2008 UK Climate Act, which includes transport agriculture and aviation emissions. This demonstrates the importance of demand reduction through energy efficiency and other measures, as well as the need for additional sustainable energy from outside the WoE, such as offshore wind turbines, tidal power or nuclear power.

Previous studies and 'Practical Potential'

During 2009 and 2010, studies were carried out by external consultants for the UAs of Bristol City, South Gloucestershire and Bath and North East Somerset (B&NES) to provide an evidence base for spatial planning of sustainable energy in response to Planning Policy Statement 1 (PPS1). These are referred to as 'Previous Studies' in this report. North Somerset has not to date commissioned any local studies assessing sustainable energy capacity, although data exists at the regional and the national level. The previous studies each used different methodologies to estimate the potential for deployment of sustainable energy, so they are not directly comparable, but they give a useful indication of the 'Practical Potential' and illustrate the variability between the different methodologies used to estimate the technical potential. Practical potential is the potential for deployment of sustainable energy once planning, economics, supply chain and social factors have been taken into account. The previous studies also illustrate the gap between 'practical potential' and 'technical potential'.

Workshops

Key themes were identified as part of the Stage One work as critical for realising sustainable energy capacity in the WoE. These themes were 'Building Capacity for Heat Networks', 'Building Community Capacity' and 'Strategic Energy Planning'.

Executive Summary

Three workshops were organised as part of Stage Two of this project in order to connect with necessary stakeholders to build capacity and help realise potential through developing action plans for these themes. The outcomes from these workshops inform the conclusions of this study, and are summarised at the end of this report.

1.2 Gap analysis and methodology

Assessment of the methodologies used and the data presented in the previous studies was carried out, in order to determine the comparability of data, and to identify gaps. Data from other sources was used to provide a comparable and complete set of data across the WoE. This comparable data included data from: Regen South West (AEA 2010, CSE and Geofutures 2010, Wardell-Armstrong, 2010), the Joint Waste Core Strategy (WoE Partnership, 2011), the Environment Agency (2010) and the Centre for Sustainable Energy (CSE, 2009):

Wind power: Different methodologies were used to assess capacity in each of the previous studies, so the data was not directly comparable. The Regen South West wind map data was therefore used to provide WoE wide technical potential information and also fill gaps for North Somerset.

Biomass: There are gaps relating to potential animal waste source streams that should be filled to complete a WoE wide picture, particularly given the number of farms in the WoE. There were also inconsistencies relating to the assessments of woody, plant and waste biomass resources within the previous studies. Therefore the CSE assessment of woodland and energy crop areas has been used to provide a comparable set of data for assessment of the WoE's technical potential.

Solar PV and hot water: The previous studies for each UA used different methodologies for assessement of the potential for solar technologies. Regen South West data was therefore used to provide a comparable set of data and assess the technical potential for the WoE.

Hydro power: There is a complete national dataset provided by the Environment Agency, and this was therefore used for the assessment of technical potential.

Heat pumps: There was no data available for Bristol in the previous study as this was not considered a suitable technology to adopt for older house types. This gap was filled using Regen South West data for consistency in assessing the WoE wide technical potential.

Heat networks: A significant amount of work has been carried out by the UA's to develop an evidence base for heat networks with B&NES providing significant cases for deployment within their UA, and a Heat Priority Area identified in Bristol. The Regen South West heat map has been used to fill gaps for North Somerset.

1.3 Summary of WoE Technical Potential

The WoE's technical potential is summarised below in Table 1.1.

Where:

Total demand: is the total annual energy demand by UA calculated from DECC 2009 sub-national energy consumption data, and relates to energy associated with buildings only. Gas and electricity data is split into demand from the domestic sector and demand from the commercial and industrial sector. It is worth noting that these figures exclude other energy use, for example, that associated with transport, agriculture, and aviation.

Overall technical potential percentage: is the total percentage of the UA's energy demand that can be met through sustainable energy from within that UA.

Technology: is the technology to which the technical potential figures relate. Clarifications are presented in brackets.

Technical potential for sustainable energy: is the total amount of sustainable energy, split into heat and electricity, which can be delivered by each technology.

Percentage of energy demand met through sustainable energy: is the percentage of energy demand which can be met by the amount of sustainable energy which can be delivered. The percentage met relates to that of the UA's demand and not the total for WoE.

Table 1.1 Sustainable energy "technical potential' for the WoE

	Total Demand - DECC sub-national gas and electricity data, 2009		Overall technical potential percentage	Technology	Technical potential for sustainable energy		Percentage of energy demand met through sustainable energy	
	Heat	Electricity			Heat	Electricity	Heat	Electricity
	GWh/year	GWh/year			GWh/year	GWh/year	Percentage	
South Gloucestershire	1,886	1,250	57%	Potential for biomass (wood)	18	6	0.90%	0.50%
				Potential for biomass (energy crops)	490	167	26.00%	13.30%
				Potential for energy from waste (Joint Waste Core Strategy)	237	79	12.50%	6.30%
				Solar water heating (Regen Microgeneration)	67	-	3.60%	-
				Heat pumps (Regen Microgeneration)	455	-162	24.10%	-13.00%
				Wind (Regen South West wind map)	-	351	-	28.10%
				Solar PV (Regen Microgeneration)	-	92	-	7.40%
				Hydro power (Environment Agency data, win-win scenarios)	-	1	-	0.10%
				Total technical potential	1,267	534		
Bristol	3,070	1,895	43%	Potential for biomass (wood)	5	2	0.20%	0.10%
				Potential for biomass (energy crops)	3	1	0.10%	0.00%
				Potential for energy from waste (Joint Waste Core Strategy)	1,064	355	34.70%	18.70%
				Solar water heating (Regen Microgeneration)	97	-	3.20%	-
				Heat pumps (Regen Microgeneration)	726	-259	23.70%	-13.70%
				Wind (Regen South West wind map)	-	0	-	0.00%
				Solar PV (Regen Microgeneration)	-	138	-	7.30%
				Hydro power (Environment Agency data, win-win scenarios)	-	7	-	0.40%
				Total technical potential	1,896	243		

Executive Summary

	Total Demand - DECC sub-national gas and electricity data, 2009		Overall technical potential percentage	Technology	Technical potential for sustainable energy		Percentage of energy demand met through sustainable energy	
	Heat	Electricity			Heat	Electricity	Heat	Electricity
	GWh/year	GWh/year			GWh/year	GWh/year	Percentage	
B&NES	1,300	733	75%	Potential for biomass (wood)	16	5	1.20%	0.70%
				Potential for biomass (energy crops)	322	109	24.70%	14.90%
				Potential for energy from waste (Joint Waste Core Strategy)	355	118	27.30%	16.10%
				Solar water heating (Regen Microgeneration)	47	-	3.60%	-
				Heat pumps (Regen Microgeneration)	344	-123	26.40%	-16.70%
				Wind (Regen South West wind map)	-	239	-	32.60%
				Solar PV (Regen Microgeneration)	-	67	-	9.10%
				Hydro power (Environment Agency data, win-win scenarios)	-	20	-	2.70%
				Total technical potential	1,082	435		
North Somerset	1,676	784	61%	Potential for biomass (wood)	26	9	1.50%	1.10%
				Potential for biomass (energy crops)	340	116	20.30%	14.80%
				Potential for energy from waste (Joint Waste Core Strategy)	237	79	14.10%	10.10%
				Solar water heating (Regen Microgeneration)	62	-	3.70%	-
				Heat pumps (Regen Microgeneration)	420	-150	25.00%	-19.10%
				Wind (Regen South West wind map)	-	277	-	35.30%
				Solar PV (Regen Microgeneration)	-	86	-	10.90%
				Hydro power (Environment Agency data, win-win scenarios)	-	1	-	-
				Total technical potential	1,085	417		
Total	7932	4661	55%	All technologies	5,329	1,629		

1.4 Strategic energy maps

A series of geographical energy maps of the potential for sustainable energy in the WoE have been developed as part of this study. These have been used in particular to identify potential cross-boundary opportunities between the UAs. Energy maps have been developed at the WoE wide, UA and cross-boundary levels to provide a complete picture of where sustainable energy can be deployed and also where demand for energy is highest. These maps highlight opportunities where demand and supply could be aligned for strategic sites.

1.5 Cross boundary energy maps

As well as mapping data for the whole of the WoE, cross boundary energy maps have been developed to identify specific strategic energy areas and locations from previous studies. It should be noted that these maps indicate opportunities that would be subject to new planning frameworks and a 'duty to co-operate' in the Localism Act 2011. A map of the UA boundaries in the WoE and the locations of the detailed maps is shown in Figure 1.1. Three WoE boundaries have been shown in more detail, with a description of key opportunities for sustainable energy for:

- South Gloucestershire boundary with Bristol (1).
- Bristol boundary with North Somerset (2).
- Bristol boundary with B&NES and North Somerset (3).

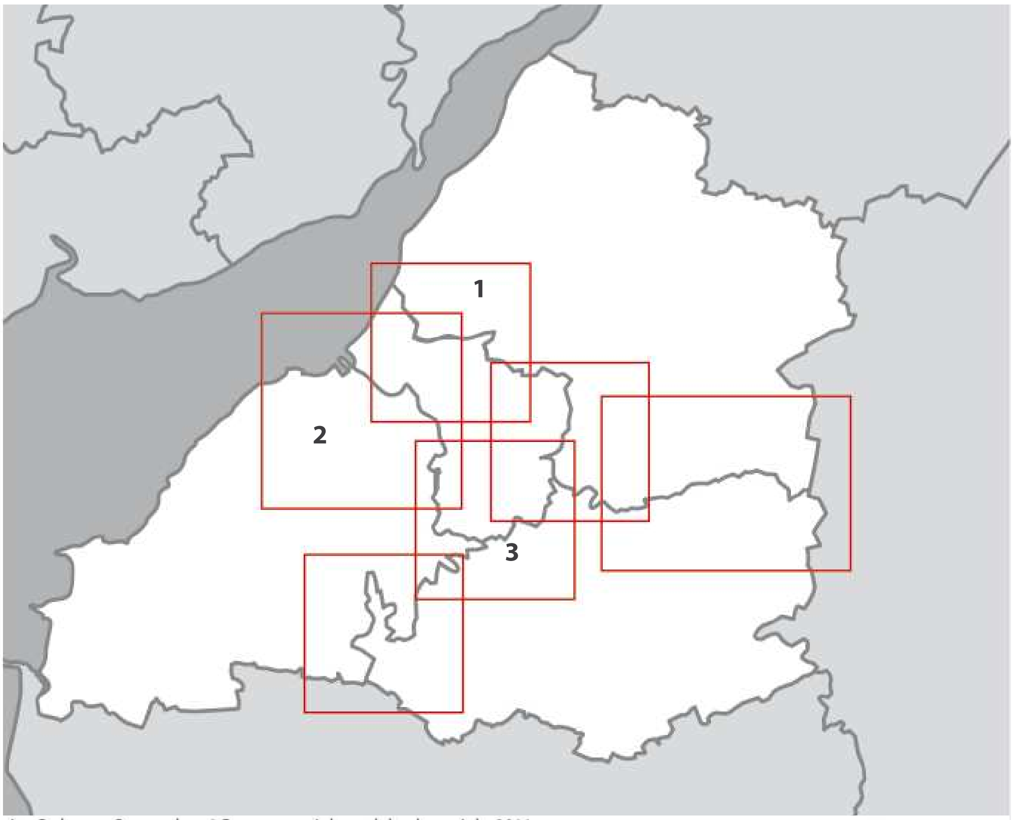


Figure 1.1: Map of WoE UA boundaries and key to locations of detailed maps

Executive Summary

1.5.1 Map of all sustainable energy potential in the West of England

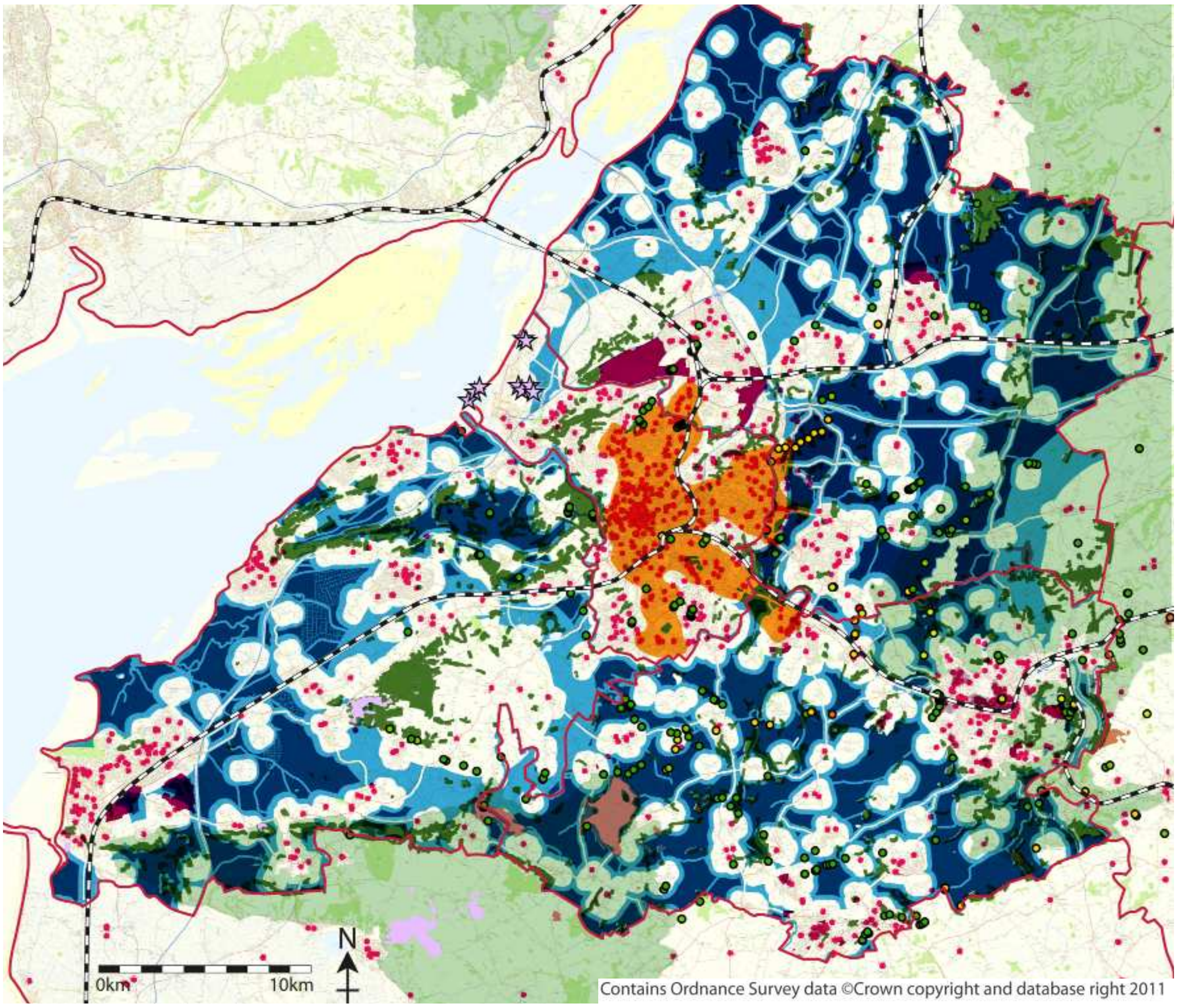
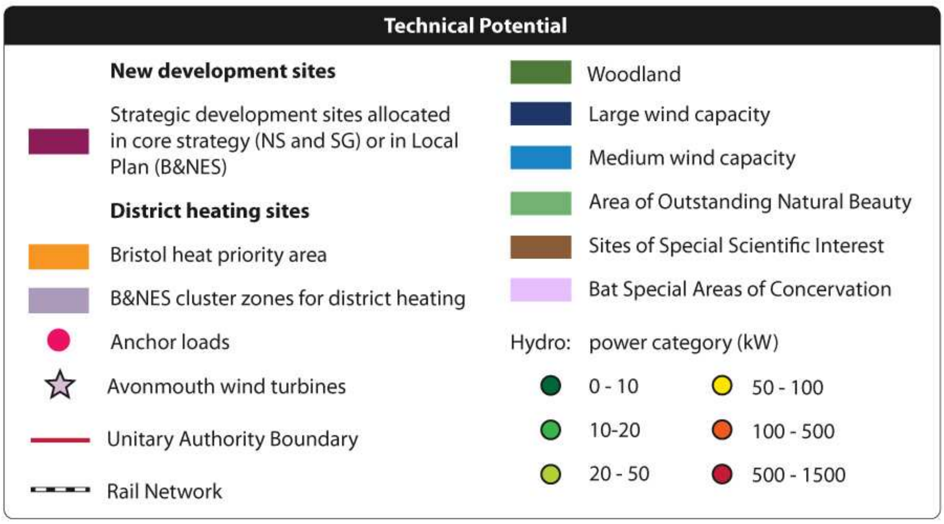


Figure 1.2: Map of all sustainable energy opportunities in the West of England



Executive Summary

1.5.2 South Gloucestershire boundary with Bristol

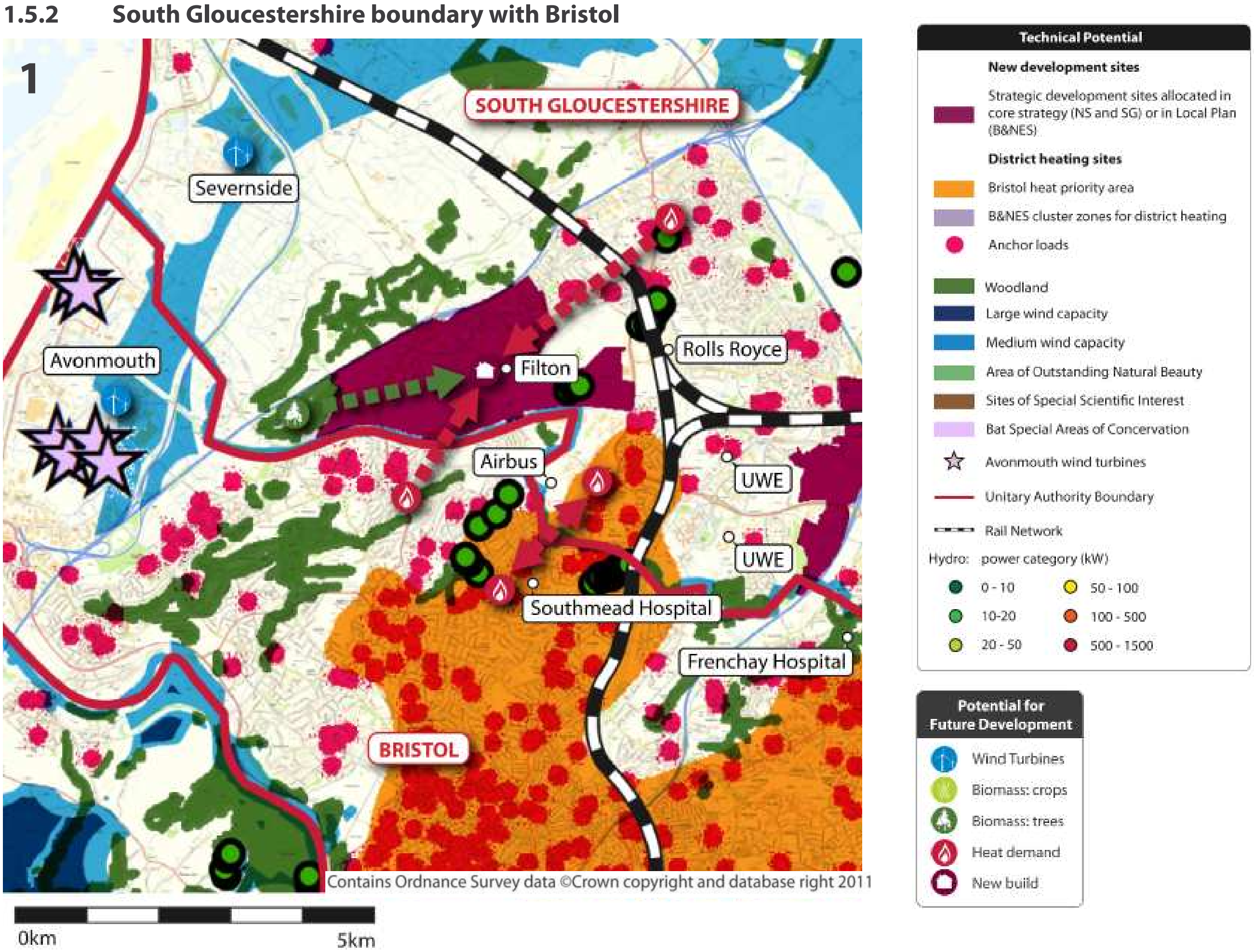


Figure 1.3: Sustainable energy map of the South Gloucestershire boundary with Bristol

There are the following cross boundary opportunities:

- Strategic sites exist at Patchway and Cribbs Causeway for heat networks and CHP that adjoin the Bristol City border. There are a number of key anchor loads that could be used for triggering local heat networks here such as Rolls Royce, Airbus, UWE, Frenchay Hospital, Filton Airfield.
- There is potential for wind power across the South Gloucestershire and Bristol boundary at Avonmouth, and for heat networks from industrial sites at Avonmouth connecting with possible heat networks in Bristol and South Gloucestershire. The distances between Avonmouth and residential heat load centres mean that this is not likely to be currently economically viable, but it is technically possible, and may become economically viable in the future. A study into an industrial heat grid is currently being carried out by Low Carbon South West.

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1.5.3 Bristol Boundary with North Somerset

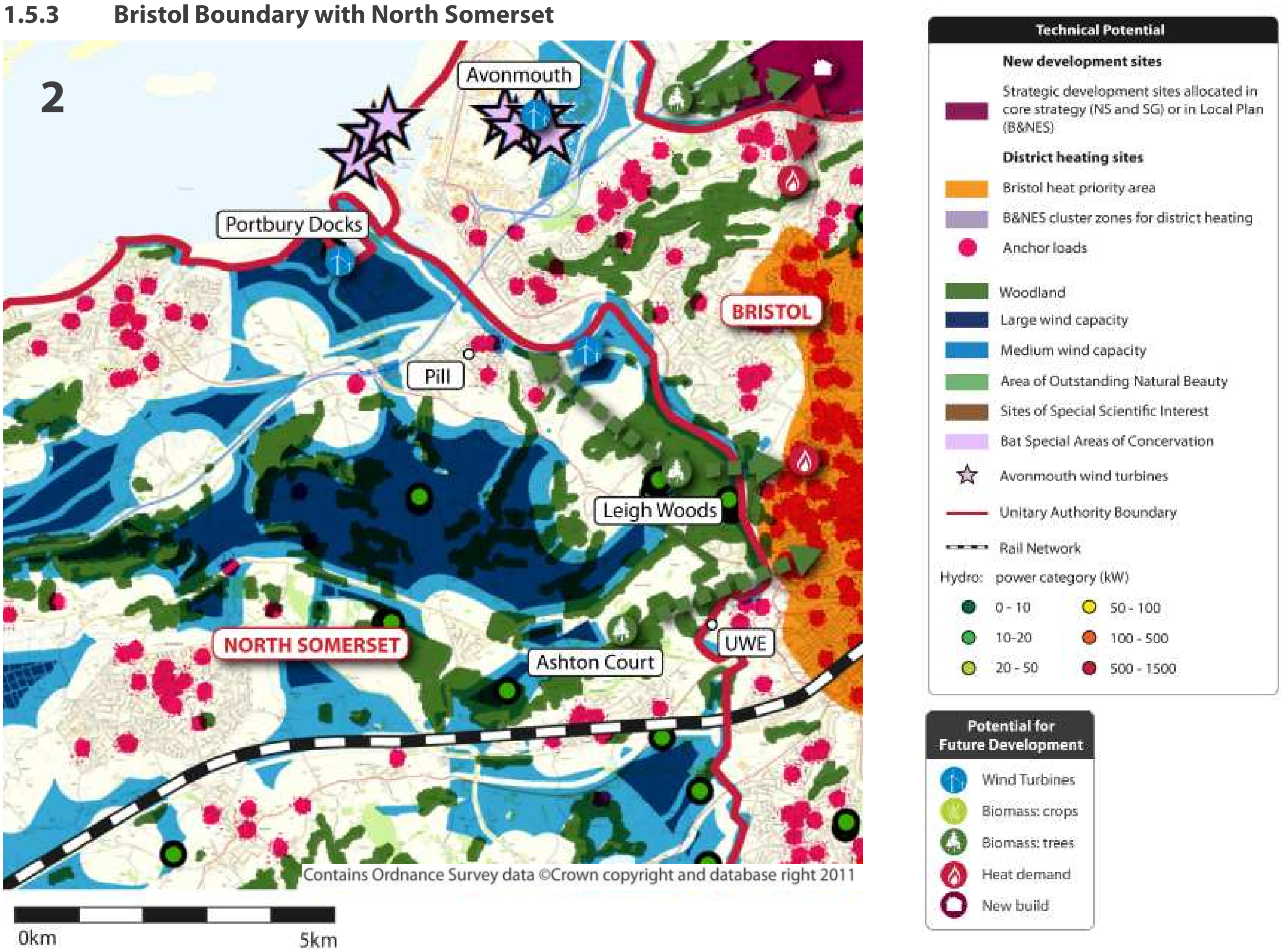


Figure 1.4: Sustainable energy map of the Bristol boundary with North Somerset

There are the following cross boundary opportunities:

- There is potential for large wind power along the border at Portbury Docks, Avonmouth and south east of Pill.
- There is biomass wood resource potential from neighbouring North Somerset (i.e. Ashton Court and Leigh Woods), which could connect to heat demand areas in West Bristol.

Executive Summary

1.5.4 South Gloucestershire, Bristol, B&NES and North Somerset

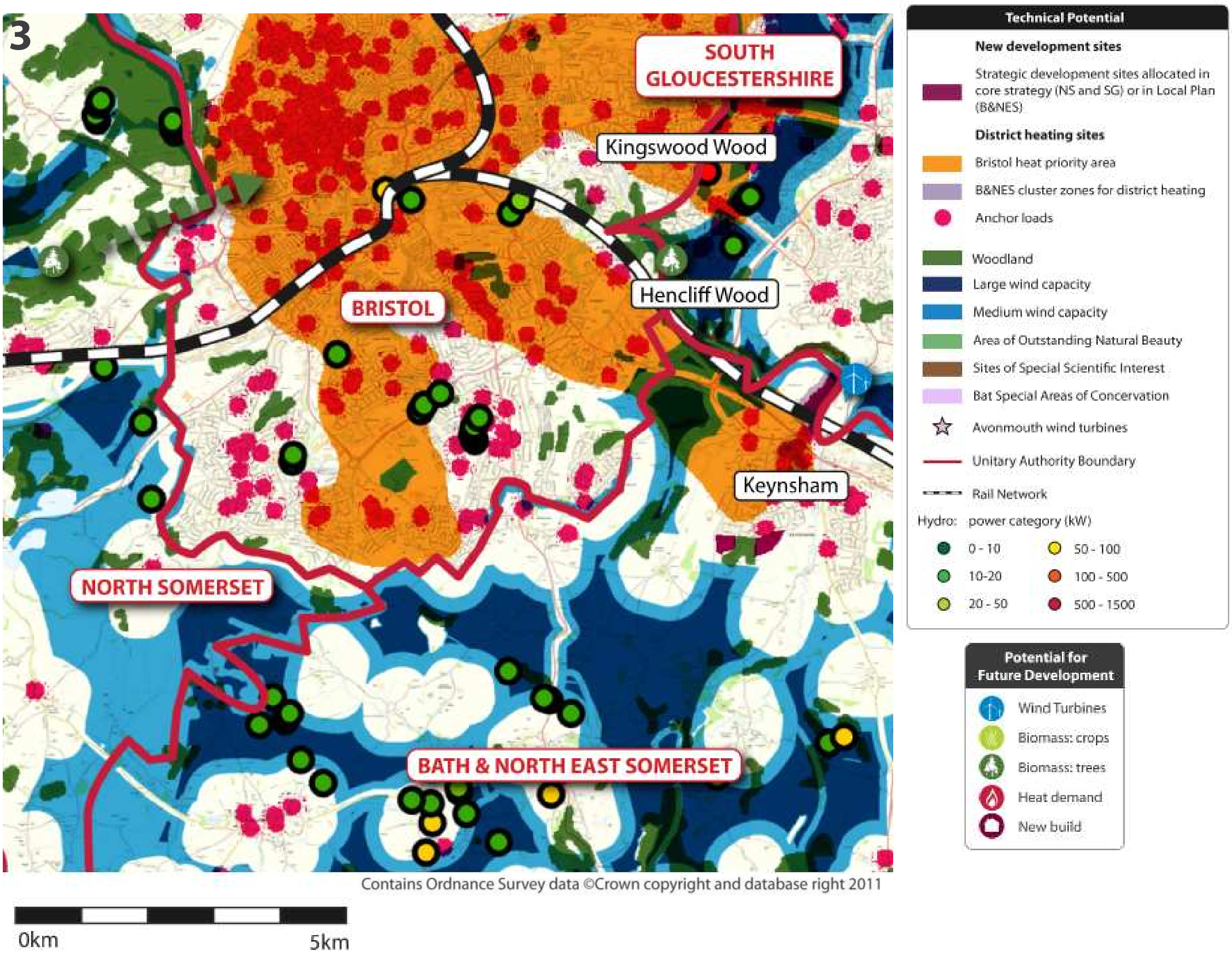


Figure 1.5: Sustainable energy map of the South Gloucestershire, Bristol, B&NES and North Somerset boundaries

There are the following cross-boundary opportunities:

- The Bristol heat priority area crosses the boundary between Bristol and B&NES near Keynsham, and between Bristol and South Gloucestershire in the Kingswood area.
- There is potential for large wind power in B&NES and North Somerset near the boundary with Bristol, which could connect to nearby villages and to south Bristol.
- There is some woodland in Hencliffe Wood along the Avon, which could be used to supply biomass to nearby residential areas.

1.6 Summary of cross-boundary opportunities

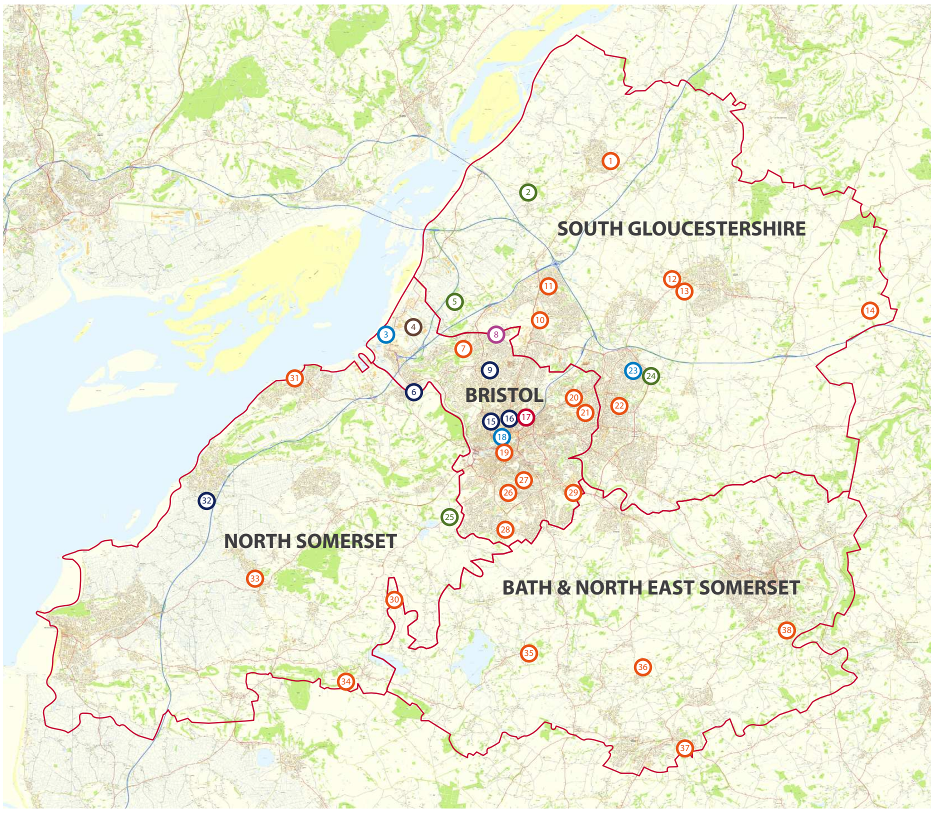
Other detailed cross-boundary opportunities are shown on further maps in the 'opportunities' chapter of this report. A full summary of potential cross boundary sustainable energy opportunities from the mapping is listed in Table 1.2.

Executive Summary

Table 1.2 Cross boundary opportunities summary

Boundary	Technology mix	Opportunity
South Glouces-tershire/Bristol	Wind power	There is potential for wind power at **Avonmouth** and on the north side of the M32.
South Glouces-tershire/Bristol	CHP and heat network - new development	There are planned development sites with potential for South Gloucestershire/ Bristol cross boundary district heat networks in: **Patchway/Cribbs Causeway**, **Filton/Brentry** and in **Harry Stoke** with potential for a heat network connecting **UWE** and adjacent residential development.
South Glouces-tershire/Bristol	CHP and heat network - new development	There are several areas where the Bristol heat priority area goes across the boundary with South Gloucestershire. This includes the boundary between **Horfield** and **Filton**, and **Fishponds**, **Hillfield** and **Two Mile Hill** on the Bristol side and **Staple Hill**, **Soundwell** and **Kingswood** on the South Gloucestershire side.
South Glouces-tershire/Bristol	Hydro power	There is potential for hydro power on the river **Frome** near **Snuff Mills**.
South Glouces-tershire/Bristol	Biomass	There is potential for biomass energy crops in South Gloucestershire and west Bristol, and woody biomass from woodland north west of the M5.
South Glouces-tershire/ B&NES	Wind power	There are potential wind power sites shown within the AONB around the cots-wolds in B&NES. Wind potential within the AONB was excluded from the South Gloucestershire mapping, although the DECC methodology states that this should be addressed on a case by case basis. There may be potential for a cross-boundary wind farm near **Hanging Hill** in South Gloucesterhsire, although planning permission may prove to be difficult as this is in an AONB.
Bristol/B&NES	CHP and heat network	The Bristol heat priority area from Bristol through the boundary with B&NES to Keynsham, indicating that there are cross boundary district heat opportunities. This also coincides with projected new residential development on the urban fringe of Bristol along the A4.
Bristol/North Somerset	Biomass	The woody biomass potential from **Leigh Woods** and **Ashton Court** in North Somerset could supply some biomass fuel to Bristol and North Somerset. CSE conducted a study into existing wood waste streams within Bristol in 2003, which would supply **Blaize nursery** and potentially up to two or three tower blocks. More intensive management could lead to a greater supply.
Bristol/North Somerset	Wind power	There are potential wind sites in North Somerset near the boundary with Bristol and near **Bishopsworth**, **Portbury docks** and **Ham Green**. However, the presence of the River Avon between Bristol and North Somerset restricts the potential for cross-boundary wind farms.
North Somerset/ B&NES	Wind power	There is potential for wind power in North Somerset and in B&NES on the boundary between **Dundry** and **North Wick** (next to **Hartcliffe** in Bristol), and near **Nempnett Thrubwell**.
North Somerset/ B&NES	Hydro power	There are potential hydroelectric sites along the river between **Winford** in North Somerset and **Chew Magna** in B&NES, and between **Regil** in North Somerset and **Chew Stoke** in B&NES. If several of these sites were to be developed, there could be potential collaboration or unification of development between the two UAs.

1.7 Existing sustainable energy projects



Existing Sustainable Energy Projects

- Biomass
- Onshore wind
- Landfill gas
- Sewage gas
- Solar PV
- Solar thermal
- Advanced Treatment of Waste

Project		Capacity	
1	Gillingstead School	0.15	MW
2	Harnhill Quarry Landfill	2.7	MW
3	Avonmouth Dock	6	MW
4	Avonmouth STW	6	MW
5	Berwick Farm	0.6	MW
6	Myrtle Drive	5	kW
7	Blaise Nursery	0.4	MW
8	Compact Power Pilot Scheme	0.2	MW
9	Westbury-on-Trym Primary Care Centre	unknown	
10	Filton Hill Primary School	0.2	MW
11	Stoke Lodge Primary School	0.2	MW
12	South Glos Council Offices	0.4	MW
13	Abbotswood Primary School	0.2	MW
14	Trinity Primary School	0.1	MW
15	Redland Friends Meeting House	unknown	
16	Colston Girls School	unknown	
17	The Children's Scrapstore	unknown	
18	Colston Hall	unknown	
19	Bristol Museum	0.5	MW
20	Whitefield Fishponds Community School	0.36	MW
21	BSF Speedwell / BSF	0.4	MW
22	Kings Forest Primary School	0.2	MW
23	Sainsbury's Emersons Green	15	kW
24	Shortwood Quarry	1.14	MW
25	Yanley 1	1.56	MW
26	Florence Brown School	0.2	MW
27	The Park Community Centre	0.5	MW
28	BSF Hartcliffe Skanska	0.6	MW
29	BSF Brislington Enterprise College	0.65	MW
30	Winford Manor	0.3	MW
31	Portishead Swimming	0.4	MW
32	Yeo Bank, 105	40	kW
33	Goblin Combe	55	kW
34	The Mendip Centre	22	kW
35	Folly Farm Environment Centre	0.15	MW
36	St Mary's School	0.11	MW
37	Writhlington School	0.35	MW
38	Midford Castle	0.1	MW

Figure 1.6: Map of existing sustainable energy projects (Regen South West, 2011a)

Figure 1.5 is a map of known large existing sustainable energy projects in the WoE, from the Regen South West Project Map (Regen South West, 2011a). The largest installations are both located at Avonmouth with a 6MW wind farm and a 6MW waste treatment plant. Shortwood Quarry, Harnhill and Yanley Landfill sites are providing landfill gas, delivering 1.14MW, 2.7MW and 1.56MW respectively. The most frequently installed sustainable energy technology is biomass boilers, many of which are in new schools in South Gloucestershire and Bristol. Increased use of technology should help mature supply chains within the WoE. There are no known large heat networks in the WoE and there are only a few large wind farms currently installed (e.g. Avonmouth), although the WoE shows good potential for deployment of this technology.

1.8 Best practice

A number of best practice projects have been identified, which can be used as precedents for delivering sustainable energy within the WoE. Of the seven best practice projects discussed later within this report all those associated with heat networks had significant influence from the Local Authority and public sector in order to drive projects through to delivery. For solar, wind and hydro projects there was a significant community engagement and involvement. Collaboration with the private sector was important for delivery in all cases, in terms of investment, skills and knowledge.

In summary the best practice projects highlighted that:

- Establishing the appropriate financing mechanism and governance structure is crucial for this type of project. This needs to take into account the allocation of responsibility for delivery risk control of the ESCo.
- The Local Authority took the initiative to push the heat networks forward, even when capital funding is by a third party.
- Public-private (and community) partnerships are instrumental in the successful delivery of projects through identifying and aligning skills, investment the supply chain.
- Robust cooperative models have been used for delivery of wind power. A community led energy sector is now emerging in the WoE and is also supported by the national Localism Act 2011.

1.9 Workshop summaries and action plans

Stage Two of this project involved stakeholder workshops to build capacity for sustainable energy in the WoE, and develop next step actions. Three workshops were held in December 2011 and January 2012 as follows:

Workshop 1:	13th December 2011, full day workshop: Building Capacity for Heat Networks
Workshop 2:	14th January 2012, full day workshop: Building Community Capacity
Workshop 3:	25th January 2012, business breakfast: Strategic Energy Planning

Each workshop brought together a different group of participants to build capacity, share the learning and evidence base presented in this report, and to identify next steps to lead to progress on specific projects. The workshops developed the understanding and experience of key players in the UAs, including planning officers and council members. They have also laid the groundwork for progress on specific sites, and collaboration between specific partners.

The delivery framework table in chapter 8 of this report formed the basis for the selection of the workshop themes and design of the workshops, and this was used to ensure that the actions proposed drew on the knowledge and experience of a wide variety of perspectives.

The workshops proposed were site and technology specific, and used detailed discussion of real projects to enable wider learning applicable to a variety of situations.

Detailed summaries and action plans from each of the workshops can be found in chapter nine of this report.

1.10 Conclusions

The following section outlines the study conclusions for Stages One and Two.

1.10.1 Conclusions from Stage One

- There is significant technical potential for sustainable energy in the WoE, which could meet up to 55% of total heat and electricity demand in the WoE. Of the demands that need to be met, the domestic market dominates heating requirements and the industrial/commercial sectors dominate electrical requirements.

- Achieving the full technical potential would be extremely challenging, and moving towards achieving it would require significant policy support, public acceptance, and change the economics of or incentives for sustainable energy. Even if the full technical potential for sustainable energy within the WoE was achieved, additional carbon reductions through demand reduction, energy efficiency and sustainable energy generation and supply from outside the sub-region would be required to meet national carbon targets.
- Biomass energy crops, heat pumps and energy from waste have the greatest technical potential for heat provision. Solar thermal can provide a relatively limited input.
- Wind power, biomass energy crops and energy from waste have the greatest potential for renewable electricity generation. Solar PV can also provide significant input.
- There is a difference in the characteristics of Bristol compared to the less urban UAs, where Bristol has significant potential for CHP and heat networks, as well as energy from waste, and the less urban UAs have more potential for wind power and biomass energy crops. Also there are currently differences in policy between the UAs regarding waste incineration.
- There are differences in catchment area assumed for biomass by the previous studies for each UA, with Bristol counting biomass from within a 40km radius of Bristol, and the other UAs counting biomass from within their own boundaries. Therefore a coordinated WoE approach is required to ensure the most appropriate deployment of biomass is used for each UA.
- Heat pumps have high technical potential in the WoE. However this technology may not perform well when used within older and not very well insulated properties. Heat pumps require grid electricity which currently has quite a high carbon intensity (i.e. in the UK a large portion of electricity is still provided by coal fired power stations).
- There is significant potential for district heating identified in a number of urban areas in the WoE. To facilitate heat networks UAs can:
    - Provide planning policy support,
    - Connect their own buildings,
    - Take responsibility for strategic planning,
    - Advocate the connection of other public sector buildings,
    - Identify sites for energy centres,
    - Undertake feasibility studies and tender viable opportunities.
- A number of strategic new development sites may be appropriate for district heating but this requires financial and policy support to be viable. Options for the UAs to explore include requiring contributions from new developments in the form of Allowable Solutions for Zero Carbon Homes or Section 106 contributions, and incentives such as waivers to a stringent 'Merton Rule' requirement for developers contributing by incorporating district heating in heat priority areas, or allowing for future connection.
- The WoE is very active in terms of interest at a community level; with sustainable energy appearing in many parish plans in South Gloucestershire, many local groups being part of the Transition Town movement, and several community energy social enterprises in existence at various stages of development.

Executive Summary

- The WoE is served by, or home to, a number of professional service organisations and initiatives relating to sustainable energy, including the Centre for Sustainable Energy, Regen South West, Low Carbon South West, the West of England Carbon Challenge, Severn Wye Energy Agency as well as many sustainable design and construction, renewable energy installation, and business networking organisations. This provides an opportunity for the WoE to take leadership in developing sustainable energy at a local level within the UK.

1.10.2 Conclusions from Stage Two

- There is significant interest in sustainable energy from all sectors, including the public sector, private sector and not for profit sector. Workshops were well attended, and participants were enthusiastic and motivated.
- There is an interest in exploring opportunities for a joint WoE energy strategy.
- There is interest in exploring opportunities for collaboration across the WoE, both at a strategic planning level, and at a community level.
- Successful collaboration requires a clearer understanding of mutual benefits and drivers, specific deliverable projects and objectives, and the use of existing partnership structures e.g. LEP or WoE England Partnership Joint Scrutiny Panel.
- Taking projects forward to implementation often requires feasibility work, which the UAs can play a key role in supporting. This can take the form of funding feasibility studies directly, or implementing other finance initiatives.
- The role of the UAs in developing district heat networks is key, and has been significant in all best practice case studies examined.

1.11 Identified further work

This study has brought together previous work from a wide variety of organisations, and collated it in one document. This collation and gap analysis process has made progress towards making sense of the complex and detailed information available on the subject of sustainable energy in the WoE. However, there are still issues which could benefit from further more detailed study, beyond the scope of this report. These include:

- Investigate the impacts of decarbonisation of the national electricity grid, and the role that sustainable energy would play in this within the WoE.
- Whole life carbon and cost comparison of district heating retrofit compared to insulation retrofit on existing buildings, and of combining these approaches. This could include consideration of other drivers such as the heritage value of buildings and the role the Green Deal can play in this.
- Integrate strategic planning for energy efficiency with planning for energy generation, to determine the most effective allocation of resources, and realising efficiencies from a joined-up approach to energy supply and demand.
- Design an interactive web-based tool for maps generated within this report. This could ultimately be managed and kept up to date by UAs to ensure information is current. This would provide an effective screening tool for planners and developers to help better understand 'live' opportunities, similar to the London Heat Map.

1.12 Recommendations

Recommendations from Stages One and Two of the study are summarised below. They are arranged under the following three headings 'Leadership', 'Strategic planning' and 'Delivery' to reflect the level at which change could be effected or delivered. Actions need to be taken at every level in order to build momentum towards sustainable energy delivery.

At the leadership level, council leaders can provide the mandate and context for officers to take action on strategic planning and to work with a variety of stakeholders and partners to enable delivery of projects.

Leadership

- Set an ambitious shared target for sustainable energy in the WoE.
- Develop a clear shared policy direction between the four UAs and their stakeholders about how this target should be delivered.
- Enable policy officers, development control and building control officers to provide coordination and facilitation to build momentum towards a shared target.

Strategic planning

- Plan for long term targets e.g. the 2050 target of 80% reduction in carbon dioxide emissions, to ensure progress is made towards this long term goal rather than locking into technology which will not be able to deliver this. For example, ensuring that high levels of fabric energy efficiency and 'district ready' systems are installed in new buildings from the outset, avoiding the need for future retrofitting. The long term availability of fuel such as biomass and waste should also be taken into account strategically, to ensure best use is made of limited resources.
- Identify the interdependencies for energy strategy between the UAs in the WoE, in order to identify areas with a case for joint strategic planning, with the potential to develop a joint strategic energy plan for the WoE, similar to the Joint Waste Core Strategy. This could begin with a joint strategy on specific technologies, for example developing district heating capacity at a strategic planning level in the UAs of the Woe.
- Develop a list of potential sustainable energy projects in the WoE, to enable strategic allocation of resources. Establish, for each project, its state of readiness.
- Develop a WoE approach to strategic planning for biomass to ensure double-counting is avoided. This could include developing a hierarchy for the most appropriate use of this limited resource.
- Develop a strategic WoE wide approach to maximising the benefits of energy from waste i.e. using heat as well as electricity generation, whilst continuing to incentivise reduction in generation of waste. Acknowledge the different policies on energy from waste in each of the UAs, whilst keeping dialogue open to achieve a coherent implementation of the Joint Waste Core Strategy.
- Embed commitment to supporting community energy projects in strategic energy planning, and involve community stakeholders in policy development discussions. In discussion with community energy stakeholders, set an ambitious target for the percentage of sustainable energy to be delivered by the community over the next five years.

Delivery

- Develop local wood fuel supply chains through contracts and direct procurement, business development support for startups and startup loans for social enterprise and SMEs. Use biomass primarily in rural areas where there are hard to heat properties which are off the gas grid, as this can minimise air quality issues, transport distances and be more economically viable when the incumbent heating system is oil tank based rather than gas grid supply.
- Ensure that learning from the Bristol ELENA experience is shared with other UAs. If Bristol projects do not absorb all of the ELENA funds, consider using this to invest in other WoE UAs.

Executive Summary

- Develop masterplans for district heating in strategic development areas and city centre locations, with cross-boundary plans where appropriate. Develop sufficient level of detail to enable individual new developments or segments of district heating systems to be future-proofed.
- Use 'Development Control' to require all new developments to connect to district heating, or be district heating ready and coordinate with the Highways Agency to identify opportunities for district heating networks to be installed with other services and during combined road works packages. Ensure that planners understand the wider strategic aim of significant carbon dioxide emission reductions and that individual decisions on wind farms or other specific developments are consistent with the wider objectives and targets.
- UAs to take a leading role in developing district heating networks, building on the experience of ESCo projects from around the country. Identify and carry out feasibility studies for heat network areas where UAs can act as anchor loads to kick start the deployment of such systems.
- Require contributions to district heating systems from part of the S106 and Community Infrastructure Levy (CIL) contributions of developers in all developments within heat network priority areas. Require developments in heat network priority areas to be 'district ready'.
- Develop wind power on UA owned land, to benefit from the income of generating energy, create precedents for wind power development within the planning process, and take the opportunity where the UA has direct control.
- Encourage wind farm developers to invite participation from, and offer benefits to, the local community at an early stage, to ensure wider buy in.
- Host joint events and workshops with stakeholders, to provide opportunities for cross-boundary networking for community groups and the private sector, and gain an understanding of stakeholder perspectives. e.g. through site specific workshops, talks and training events.
- Measure performance on a WoE level, with joint performance indicators and targets, to focus on collaborative purpose.
- Continue to work with a number of organisations to support community energy projects, and share experience and best practice between UAs. Support can include: coordination, policy support, clear and accessible communications and regulation through permissions and planning for community groups, and the provision of startup loan finance where possible.
- Continue to use the sustainable energy maps and information contained in this report as a basis for informed public debate on sustainable energy strategies.
- Make the information contained in this report publicly accessible, and set up a public awareness initiative showing people the maps and the role that each technology could potentially play in delivering sustainable energy in the WoE. Link in to CSE's Plan Local.
- Build on the workshops and action plans undertaken as part of Stage Two of this study and commit to helping workshop participants and other stakeholders to implement and share this understanding and develop action plans.

2 Introduction

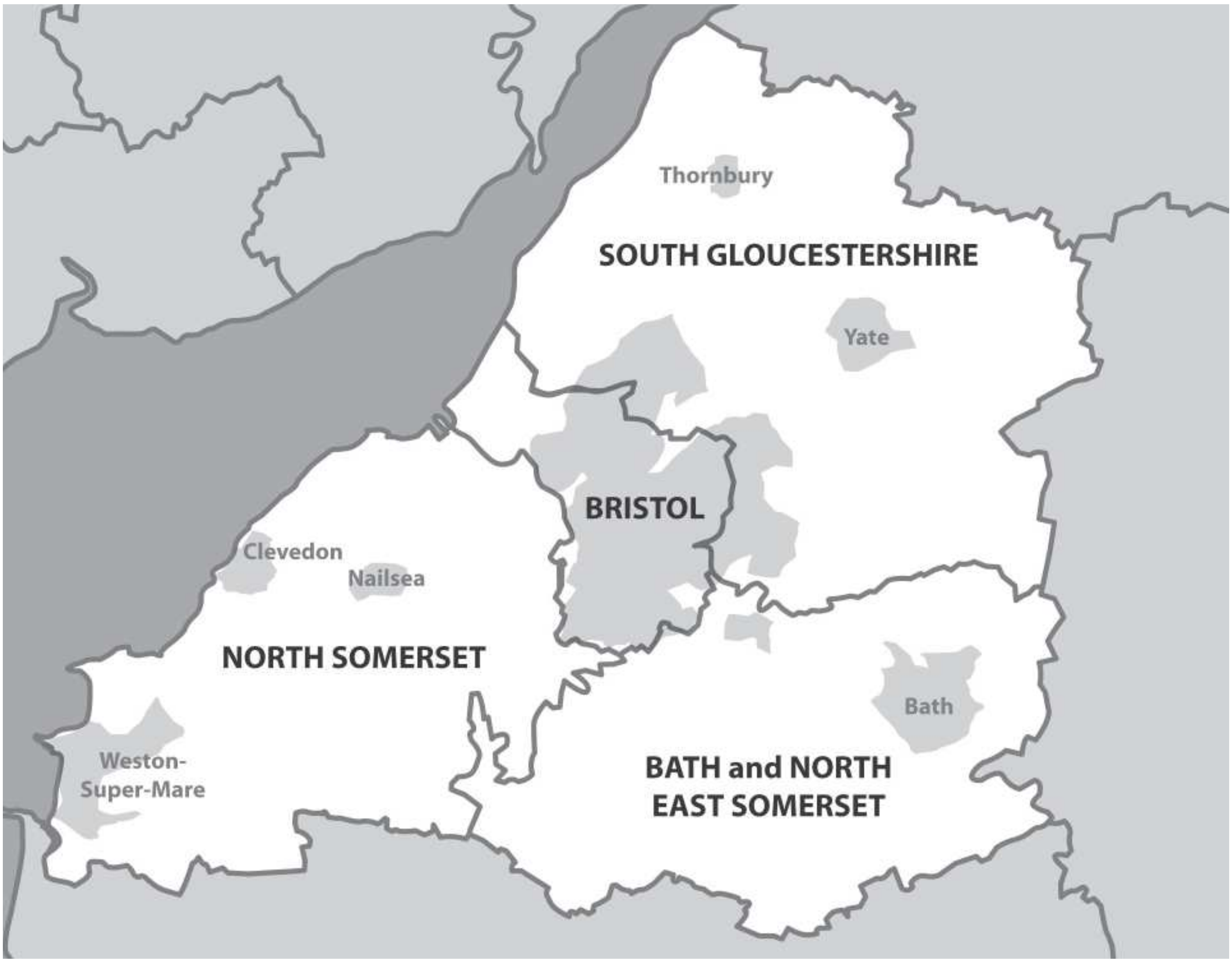


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Figure 2.1: Map of the Unitary Authorities of the West of England

The West of England (WoE) defines an area previously known as the county of Avon and includes the four Unitary Authorities (UAs) of Bath & North East Somerset (B&NES), Bristol City, North Somerset and South Gloucestershire. It is an area of over 130,000 hectares and is diverse in land use, ranging from the metropolitan area of inner city Bristol to the large areas of rural farmland that make up the North Somerset plains. Similarly the Woe's 1,070,900 population is diverse both in the density of its spread and in its areas of employment. These four UAs have a history of collaboration including the development of a Joint Waste Core Strategy and a Joint Local Transport Plan. As required for local planning, each UA is in the process of producing their own Core Strategy for local development, some of which have been adopted and others are about to be adopted.

The four UAs are further united by the formation of a Local Enterprise Partnership (LEP) for the WoE, which will play a central role in determining local economic priorities and undertaking activities to drive economic growth and the creation of local jobs.

Previous studies into the capacity for sustainable energy in the WoE have been carried out in response to the requirement for evidence based spatial planning outlined in PPS1 (Planning Policy Statement 1, 2005, Delivering Sustainable Development). These studies were carried out separately by each UA, at different times, and by different

Introduction

consultants, which has resulted in differing methodologies being used in each case, and the resulting data being incomparable between the studies. During this period, in early 2010, DECC published a unifying methodology for carrying out this type of work, with the aim of aiding comparability between regional renewable energy potential assessments. The experience of the CSE study for Bristol City Council and the CAMCO study for B&NES contributed to the development of this national methodology, whereas the later studies followed the methodology. This further contributed to the incomparability of the reports.

This report is one of five studies being carried out by Buro Happold for the WoE as part of the WoE Low Carbon Initiative. These include:

- Project 1 — Public Sector Carbon Reduction.
- Project 2 — Lots 1-4
  - Lot 1 — Existing economic activity and the local energy economy.
  - Lot 2 — Innovation and growth of low carbon technologies and services and the environmental industries sector.
  - Lot 3 — Existing economic activity and the wider energy economy.
  - Lot 4 — Building Sustainable Energy Capacity.
    - Stage 1: Evidence Base
    - Stage 2: Building Capacity

This report summarises Stage One and Stage Two of Project 2, Lot 4 "Renewables and Low Carbon Energy in the West of England". The report builds on the work of other WoE Low Carbon Initiative projects and other relevant studies in the WoE to identify opportunities for developing regional sustainable energy infrastructure and help build capacity to facilitate this.

Stage One focused on the existing evidence base around the WoE's capacity for deployment of sustainable energy, and identified:

- Gaps within the existing sustainable energy studies and datasets.
- The technical potential for sustainable energy using comparable data across the WoE.
- Cross UA opportunities for delivery of sustainable energy infrastructure and strategic themes.
- Best practice.

Stage Two of this project used this evidence base to build capacity by presenting the findings of this report in a series of workshops with appropriate stakeholders. The workshops concluded with action plans to set out clear ways forward for realising sustainable energy opportunities for the WoE. Actions need to be taken at every level in order to build momentum towards sustainable energy delivery. At the leadership level, council leaders can provide the mandate and context for officers to take action on strategic planning and tow work with a variety of stakeholders and partners to enable delivery of projects. The outcomes of the workshop informed the recommendations for WoE wide action by the UAs, under the following headings:

- Leadership
- Strategic planning
- Delivery

3 Overview of Technical Potential

3.1 Introduction

This chapter presents an estimate of the 'technical potential' for sustainable energy in the WoE, with a breakdown of the potential for each technology.

The 'technical potential' for sustainable energy is the maximum amount of energy which could be supplied using today's technology, assuming that all of the resource is exploited to the maximum, regardless of economic, social and supply chain factors. This gives a useful indication of the absolute maximum possible, although actually achieving this would be extremely challenging. For the purpose of this analysis we have taken 'technical potential' to mean the amount of sustainable energy that can be harnessed taking into account the limits of the technology and their efficiencies at converting a resource into energy as well as physical constraints such as airports, roads and rivers. The 'technical potential' does not consider planning, policy, public opinion, economics or supply chain constraints.

This study of 'technical potential' was carried out by undertaking a desktop assessment collating available existing information from a variety of sources. Its main purpose was to create a set of data that is comparable across the UAs, to enable meaningful discussion of cross-boundary opportunities. Questions of comparability of methodology between the different technologies, and detailed assessment of the methodologies adopted from other sources for each technology have not been addressed.

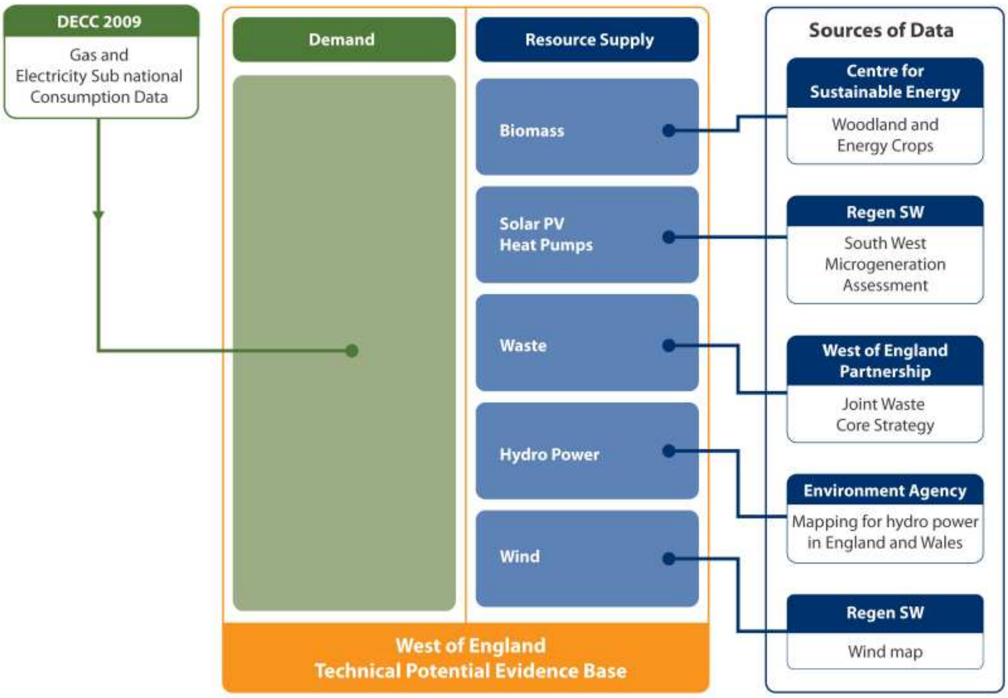


Figure 3.1: Sources used for assessing the technical potential for the WoE

Figure 3.1 illustrates the source of data used to develop a comparable and complete picture of technical potential for the WoE.

Overview of Technical Potential

3.2 Summary of Technical Potential

A summary of the collated information can be seen in Table 3.1.

Where:

Total demand: Is the total annual energy demand by UA calculated from DECC 2009 sub-national energy consumption data and relates to energy associated with buildings only. Gas and electricity data is split into demand from the domestic sector and demand from the commercial and industrial sector. It is worth noting that these figures exclude other energy use, for example, that associated with transport, agriculture, and aviation.

Overall technical potential percentage: Is the total percentage of the UA's energy demand that can be met through sustainable energy from within that UA.

Technology: Lists the technology to which the technical potential figures relate. Clarifications are presented in brackets.

Technical potential for sustainable energy: Is the total amount of sustainable energy, split into heat and electricity, which can be delivered by each technology.

Percentage of energy demand met through sustainable energy: This is the percentage of energy demand which can be met by the amount of sustainable energy which can be delivered. The percentage met relates to that of the UA's demand and not the total for WoE.

Table 3.1 Sustainable energy "technical potential' for the WoE

	Total Demand - DECC sub-national gas and electricity data, 2009		Overall technical potential percentage	Technology	Technical potential for sustainable energy		Percentage of energy demand met through sustainable energy	
	Heat	Electricity			Heat	Electricity	Heat	Electricity
	GWh/year	GWh/year			GWh/year	GWh/year	Percentage	
South Gloucestershire	1,886	1,250	57%	Potential for biomass (wood)	18	6	0.90%	0.50%
				Potential for biomass (energy crops)	490	167	26.00%	13.30%
				Potential for energy from waste (Joint Waste Core Strategy)	237	79	12.50%	6.30%
				Solar water heating (Regen Microgeneration)	67	-	3.60%	-
				Heat pumps (Regen Microgeneration)	455	-162	24.10%	-13.00%
				Wind (Regen South West wind map)	-	351	-	28.10%
				Solar PV (Regen Microgeneration)	-	92	-	7.40%
				Hydro power (Environment Agency data, win-win scenarios)	-	1	-	0.10%
				Total technical potential	1,267	534		
Bristol	3,070	1,895	43%	Potential for biomass (wood)	5	2	0.20%	0.10%
				Potential for biomass (energy crops)	3	1	0.10%	0.00%
				Potential for energy from waste (Joint Waste Core Strategy)	1,064	355	34.70%	18.70%
				Solar water heating (Regen Microgeneration)	97	-	3.20%	-
				Heat pumps (Regen Microgeneration)	726	-259	23.70%	-13.70%
				Wind (Regen South West wind map)	-	0	-	0.00%
				Solar PV (Regen Microgeneration)	-	138	-	7.30%
				Hydro power (Environment Agency data, win-win scenarios)	-	7	-	0.40%
				Total technical potential	1,896	243		

Overview of Technical Potential

	Total Demand - DECC sub-national gas and electricity data, 2009		Overall technical potential percentage	Technology	Technical potential for sustainable energy		Percentage of energy demand met through sustainable energy	
	Heat	Electricity			Heat	Electricity	Heat	Electricity
	GWh/year	GWh/year			GWh/year	GWh/year	Percentage	
B&NES	1,300	733	75%	Potential for biomass (wood)	16	5	1.20%	0.70%
				Potential for biomass (energy crops)	322	109	24.70%	14.90%
				Potential for energy from waste (Joint Waste Core Strategy)	355	118	27.30%	16.10%
				Solar water heating (Regen Microgeneration)	47	-	3.60%	-
				Heat pumps (Regen Microgeneration)	344	-123	26.40%	-16.70%
				Wind (Regen South West wind map)	-	239	-	32.60%
				Solar PV (Regen Microgeneration)	-	67	-	9.10%
				Hydro power (Environment Agency data, win-win scenarios)	-	20	-	2.70%
				Total technical potential	1,082	435		
North Somerset	1,676	784	61%	Potential for biomass (wood)	26	9	1.50%	1.10%
				Potential for biomass (energy crops)	340	116	20.30%	14.80%
				Potential for energy from waste (Joint Waste Core Strategy)	237	79	14.10%	10.10%
				Solar water heating (Regen Microgeneration)	62	-	3.70%	-
				Heat pumps (Regen Microgeneration)	420	-150	25.00%	-19.10%
				Wind (Regen South West wind map)	-	277	-	35.30%
				Solar PV (Regen Microgeneration)	-	86	-	10.90%
				Hydro power (Environment Agency data, win-win scenarios)	-	1	-	-
				Total technical potential	1,085	417		
Total	7932	4661	55%	All technologies	5,329	1,629		

The assessment indicates that 55% of the heat and electricity demands in the WoE could be met through deployment of sustainable energy. This is a 'technical potential', and represents the maximum that is physically possible with today's technology. This does not take into account economic, social, planning or supply chain constraints.

The technical potential summarised in Table 3.1 is broken down into the following Figures 3.2 and 3.3.

Figures 3.2 and 3.3 show the maximum technical potential for renewable and low carbon energy alongside the current demand for energy. There are separate graphs for heat and electricity. They illustrate that there is a greater demand for heat in the domestic context and a greater demand for electricity in the commercial and industrial sector.

There is good potential within the WoE to generate heat and electricity through energy from waste and biomass (energy crops). Wind and solar PV also show significant potential. It should be noted that heat pumps have the potential to provide significant renewable heat for the WoE but are shown as a negative value in Figure 3.2 due to their electricity demand.

However even if all technical potential can be realised, there would be a shortfall relative to current demand. This demonstrates the importance of demand reduction, energy efficiency, and the use of energy from outside the WoE such as offshore wind turbines, tidal power, or nuclear power. Not all of these factors are within the control of the WoE.

Overview of Technical Potential

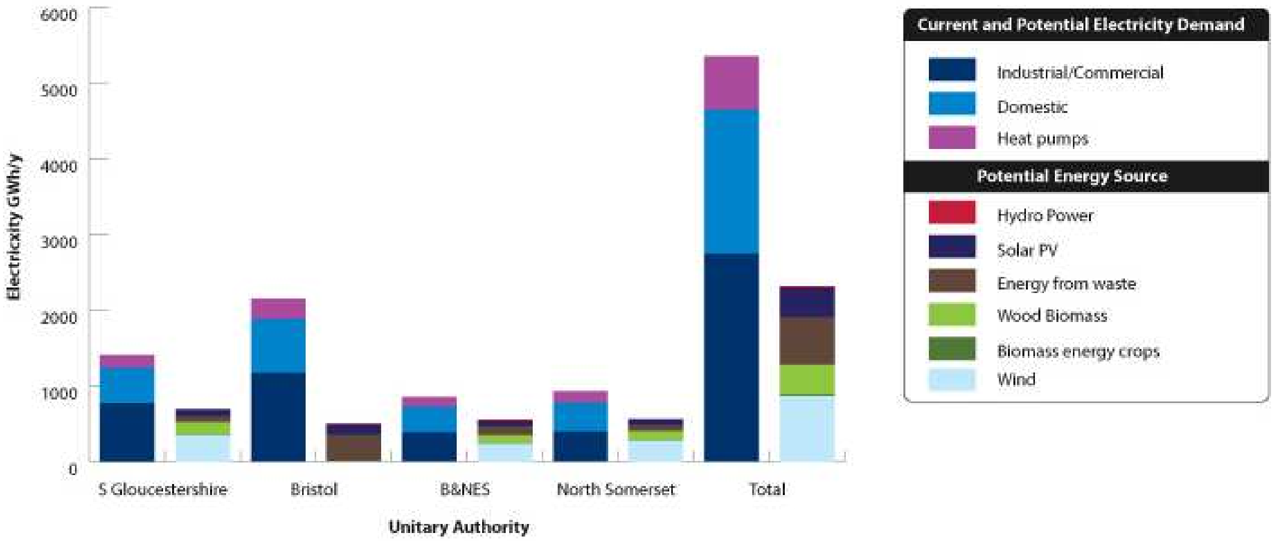


Figure 3.2: Electricity demand and supply in the WoE, technical potential

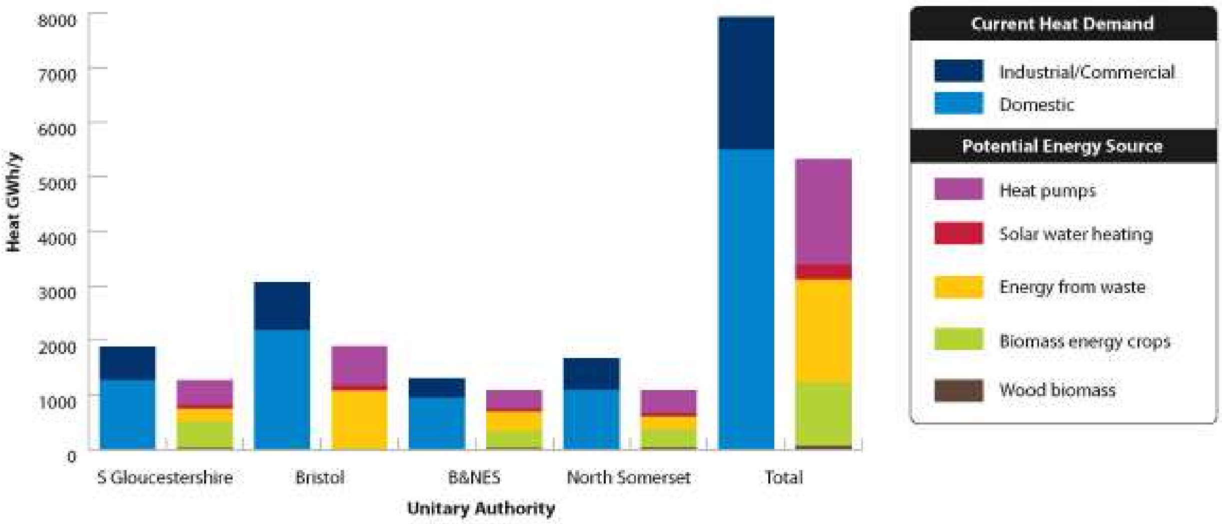


Figure 3.3: Heat demand and supply in the WoE, technical potential

The charts in Figures 3.4 to 3.7 show the contributions of each technology to the technical potential for sustainable energy broken down for each UA. This demonstrates the significant technical potential of biomass (energy crops), energy from waste and wind power for B&NES, North Somerset and South Gloucestershire. Bristol has a significant potential for energy from waste. These charts show the maximum technical potential for each resource, and do not take into account policy, social or planning constraints. For example, B&NES has a policy against energy from waste, so the full technical potential for this resource would not be implemented.

Note that this does not show the percentage of energy demand which can be met, nor the relative potential for energy supply between the different UAs, only the relative potential fore each resource within each UA.

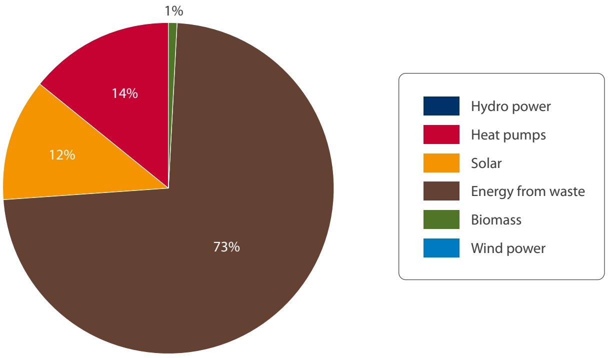


Figure 3.4: Bristol Technical Potential

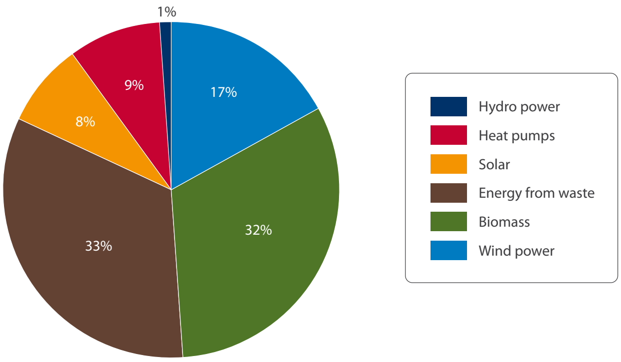


Figure 3.5: B&NES Technical Potential

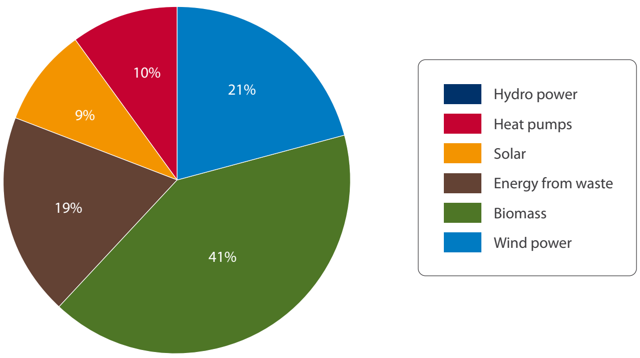


Figure 3.6: South Gloucestershire Technical Potential

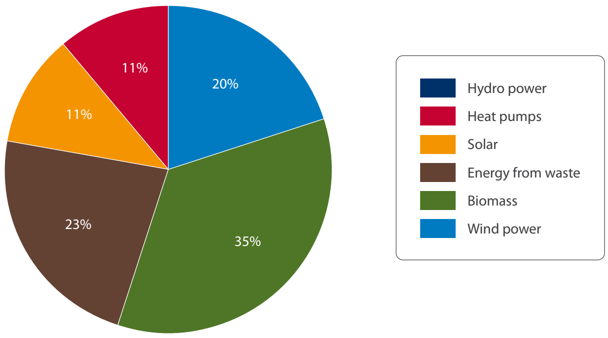


Figure 3.7: North Somerset Technical Potential

Overview of Technical Potential

3.3 Technical potential - Carbon

The graph in Figure 3.8 shows the contribution that sustainable energy can make towards reducing the WoE's carbon dioxide emissions.

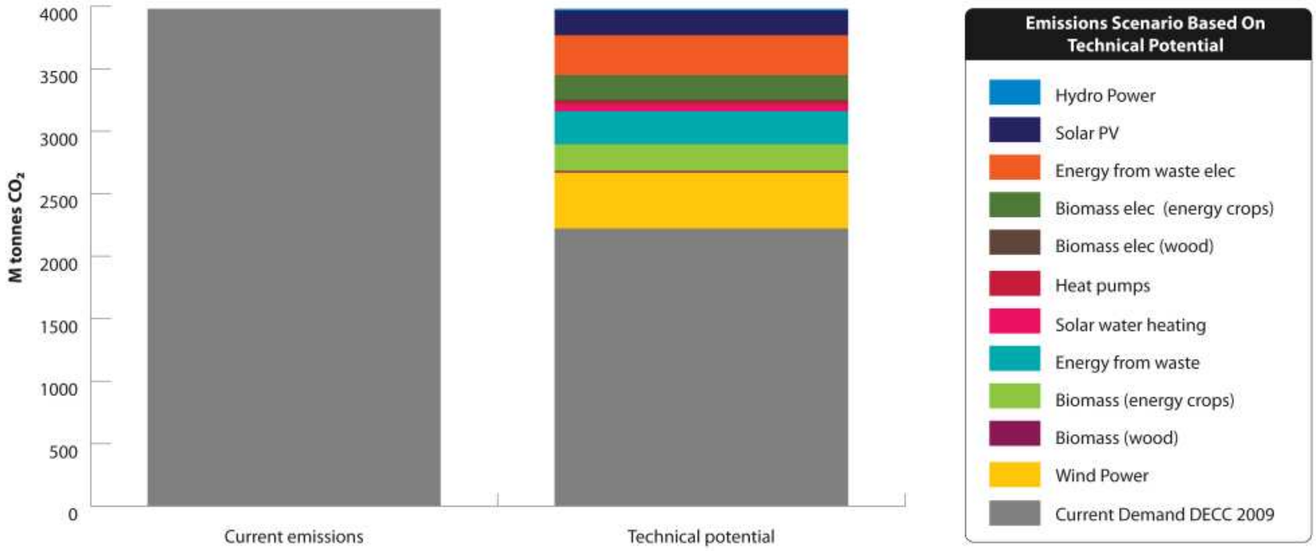


Figure 3.8: 2009 carbon emissions and technical potential of sustainable energy supply in the WoE

The national policy context for carbon is a legally binding commitment to reduce national carbon dioxide emissions by 80% by 2050, and the carbon budget for 2027 commits to a reduction of 50% by 2027, from a 1990 baseline.

For the WoE, if all the technical potential for sustainable energy were implemented, it would be possible to achieve approximately a 44% reduction in carbon dioxide emissions from heat and electricity (not including transport, agriculture or aviation), compared to meeting current demand through conventional energy generation and supply methods. This would require an extremely challenging level of activity and acceptance of new infrastructure. Even if it is possible to achieve the full 44% reduction in heat and electricity carbon dioxide emissions, this assessment demonstrates the importance of demand reduction through energy efficiency and other measures, as well as the need for additional sustainable energy from outside the WoE, such as offshore wind turbines, tidal power or nuclear power, to achieve the 80% overall carbon emissions reduction target by 2050, as set in the UK Climate Act.

3.4 Methodology for estimation of technical potential

The following methodology was used to calculate the technical potential for each resource:

Large scale wind

The data is taken from the Regen South West wind map.

Biomass (woody)

The area of woodland was assessed using the data mapped by CSE as presented within the previous study for Bristol. This provided an estimated area of woodland in km^2 from the GIS data.

Overview of Technical Potential

This was then converted into MWh using the following methodology:

- 2odt/ha (oven dried tonnes per hectare, the benchmark used in the previous studies for both South Gloucestershire and Bristol).
- 5,000 kWh/odt based on 18GJ/odt for low grade timber.
- 75% plant efficiency.
- 2:1 heat: electricity ratio for CHP.

Biomass (energy crops)

The area of agricultural land grades 1-3 within each UA, as mapped by CSE in the previous study for Bristol, was calculated from the GIS data. This was then converted into MWh using the DECC methodology as follows:

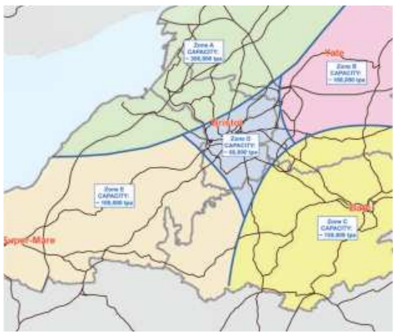
- 15odt/ha (miscanthus).
- 30% of total agricultural land area planted for energy crops.
- 3,600 kWh/odt taking 13GJ/odt for baled miscanthus.
- 75% plant efficiency.
- 2:1 heat: electricity ratio for CHP.

Energy from waste

The Joint Waste Core Strategy estimates the quantity of waste to be processed in each of five locations, from five different zones. The waste capacity allocated to each UA is taken as the waste due to be processed in each location, rather than the quantity of waste produced in the area. This involves some cross-boundary transportation of waste, as per the Joint Waste Core Strategy.

Waste is allocated to the UAs in the following way:

Location	Joint Waste Core Strategy Zone	UA waste is allocated to
North West Bristol	A	Bristol
Yate	B	South Gloucestershire
Keynsham	C	B&NES
Inner, east or south Bristol	D	Bristol
Weston-Super-Mare	E	North Somerset



To convert from tonnes of waste available to energy from CHP, the factors of 0.66MWh/tonne electricity and 1.97MWh/tonne heat were used. These were derived from the waste to energy results reported by CSE in the previous study for Bristol.

Overview of Technical Potential

Hydro power

This was taken from the Environment Agency Hydro Power mapping study, and reflects the potential for energy from hydro power in 'win win' situations, with respect to the wider environmental impact of installing a in hydroelectric system. The total capacity estimate was based on average potential installation sizes.

Solar PV, solar thermal, heat pumps

This data was taken directly from the Regen South West Microgeneration report written by AEA.

For heat pumps, the electricity demand has also been taken into account by assuming a Coefficient of Performance (COP) of 2.8. This has led to a negative value on the electricity supply charts, and that was taken into account when calculating the potential carbon dioxide emissions savings from heat pumps, assuming grid electricity and using 2010 carbon factors.

4 Previous Studies

4.1 Introduction

South Gloucestershire, Bristol and B&NES have all previously commissioned studies into the potential for sustainable energy within the UA. These were intended to provide an evidence base for renewable and low carbon energy targets in the core strategies that each UA was developing, in response to PPS1. They were primarily for the purposes of spatial planning, rather than for detailed development planning. B&NES also commissioned a study into the potential for district heating, which identified fifteen 'cluster zones' with potential for district heating, selecting three of these for detailed feasibility analysis.

4.2 Practical Potential

The 'practical potential' for sustainable energy is the amount of energy supply capacity which can actually be installed, taking into account constraints such as planning, regulatory, economic and social issues and supply chain development. These constraints can be applied progressively, as though filtering the amount of energy available through a series of finer and finer filters.

Figure 4.1 describes the methodology developed by DECC in January 2010, to standardise the assessment of regional sustainable energy resources. The methodology defines seven steps, each time adding further constraints to the resource. At the centre, is the target set, a target based on evidence that it is definitely achievable. The framework defines seven stages, but the methodology only applies to the first four. As one moves further and further towards the centre, the level of uncertainty increases, as the economic and social issues are negotiable and interrelated, rather than being physical fact.

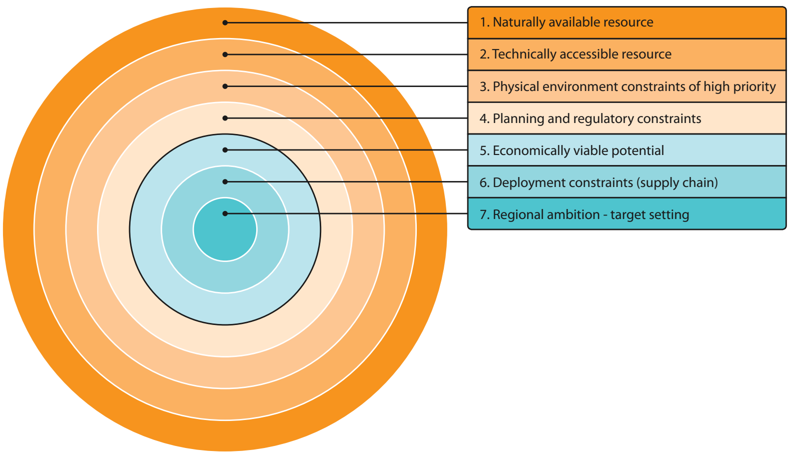


Figure 4.1: DECC methodology for the assessment of regional sustainable energy potential

4.3 Previous studies

The four previous studies for the UAs were published around the same time as the DECC methodology was developed, some before and some after. They followed the DECC methodology, or a similar process, to estimate the potential for sustainable energy in the UA. The previous studies for Bristol and for B&NES were published before the DECC methodology, and the experience from this research fed into the development of this methodology.

Previous Studies

The previous study carried out for Bristol was undertaken before the DECC methodology was published and this assessed the technical potential for sustainable energy. The previous study for South Gloucestershire estimated the accessible resource for sustainable energy and calculated a practical potential for deployment by 2020, and the previous study for B&NES (initially published before the DECC methodology) estimated the practical potential for 2020 and 2026, as well as the technical potential.

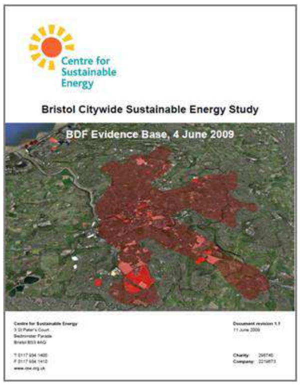
The level of uncertainty and the number of assumptions required in carrying out this type of analysis means that the DECC methodology is a way of standardising the analysis rather than the most true or accurate way of making the estimate. It also leaves space for context specific, professional judgement of the consultants involved, making different studies potentially difficult to compare.

Because of the incomparability of the previous studies, alternative, comparable data was used in this study to directly estimate the technical potential for the whole of the WoE, as outlined in the previous chapter of this report.

However, the previous studies provide detail specific to each of the UAs studied, and go 'further' along the stages of the DECC methodology than has been possible with existing comparable data. The previous studies also provide an opportunity to compare the practical potential with the technical potential, and highlight the challenge of achieving this. This chapter gives a detailed description of the conclusions of the previous studies, how they compare to the technical potential estimate used in this report, and how the practical potential data was derived.

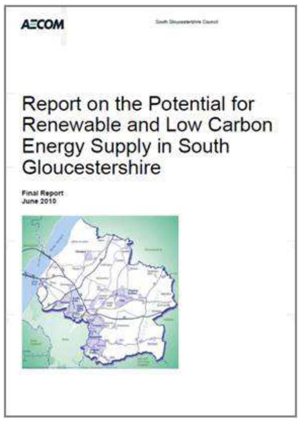
CSE, Bristol - June 2009

The report was produced before the DECC methodology was issued. Carries out renewable assessment for Bristol with additional areas outside the UA considered for the sourcing of biomass and energy crops. Does not consider heat pumps as viable. Provides evidence for waste and biomass fuel for CHP and heat networks.



AECOM, South Gloucestershire - June 2010

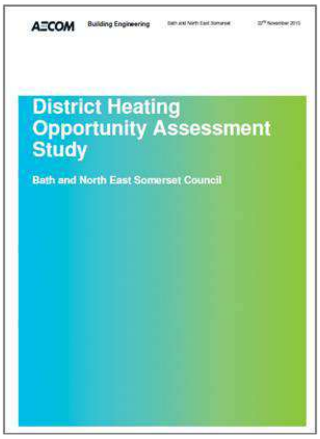
Presents an evidence base for the UA for potential deployment of sustainable energy. Provides assessment of potential based on spatial mapping and provides suggested approaches to be considered for specific sites in terms of policy options, and also possible business or community engagement to take things forward.



AECOM, B&NES - November 2010

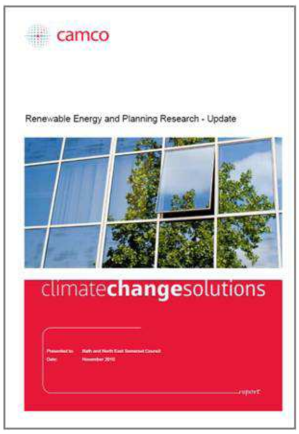
Detailed feasibility of district heating in B&NES, identified 15 cluster zones of which 3 key areas were addressed in more detail.

Includes financial analysis and consideration of deliverability.



CAMCO, B&NES - June 2009, updated November 2010

Provides an overview of renewable energy potential in B&NES with projections for 2020 and 2026. Provides recommendations for a district wide minimum level of renewable energy deployment and potential delivery mechanisms to take forward.



South Gloucestershire

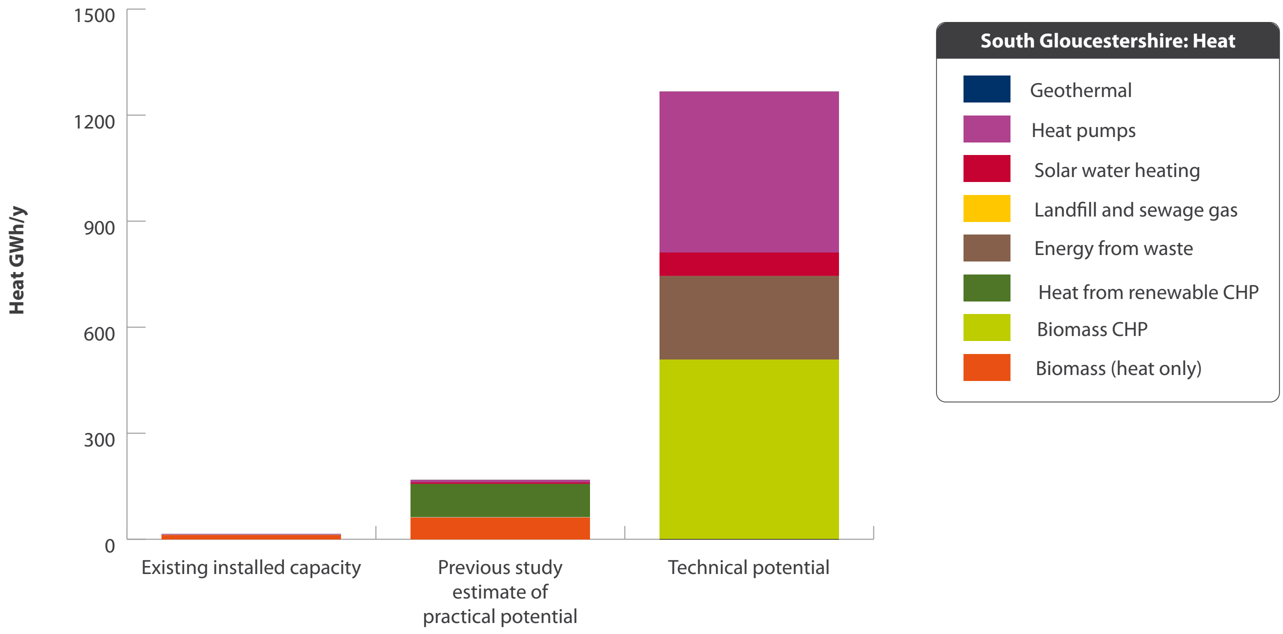


Figure 4.2: South Gloucestershire installed heat capacity, previous study estimates and technical potential

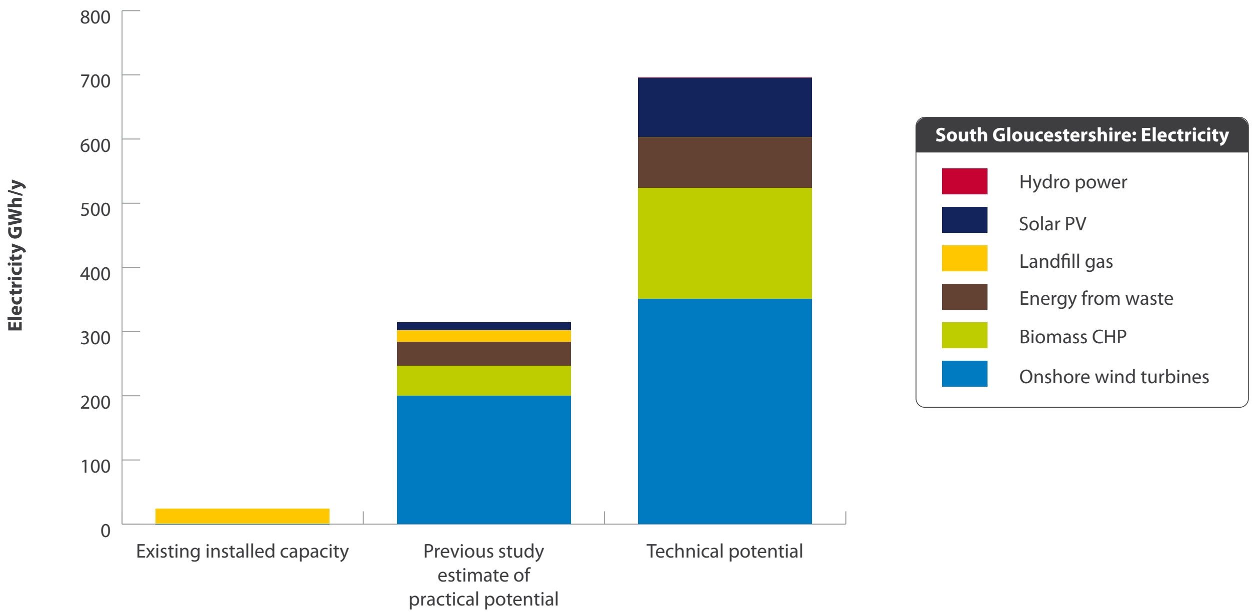


Figure 4.3: South Gloucestershire installed electrical capacity, previous study estimates and technical potential

Previous Studies

The graphs in Figures 4.2 and 4.3 show the existing installed capacity, previous study estimate and the Buro Happold technical potential for sustainable energy in South Gloucestershire. Existing installed capacity is taken from the Regen South West Annual Survey.

The previous study by AECOM presented a practical potential estimated to be achievable by 2020, referred to as 'previous study' in Figures 4.2 and 4.3. This differs significantly from the estimated technical potential for a number of reasons:

- AECOM used an estimate based on their professional judgement to derive a practical potential they thought could be realistically installed by 2020 from a technical potential following the DECC methodology. There is no defined DECC methodology for this estimate. The practical potential for 2020 is significantly lower than the total technical potential, due to the additional constraints.
- Different categories for biomass and energy from waste were used in the AECOM study. The AECOM study categorised 'heat from renewable CHP' and 'heat from biomass', whereas the Buro Happold technical potential estimate assumes all biomass and waste are burned in CHP plant, to generate both heat and electricity, in line with the methodology used for the previous study for Bristol. Biomass and energy from waste form the majority of the potential in both cases.
- The technical potential for heat pumps is significantly higher than the practical potential for 2020. The assumptions used for the technical potential estimate for heat pumps are generous and assume that 75% of detached and semi detached properties and 50% terraced properties can use this technology.
- The technical potential for landfill gas is omitted due to lack of data.
- For the technical potential for electricity, there is a negative electricity value to represent the additional demand for electricity from the use of heat pumps.
- The practical potential for wind power assumed that no wind power is possible in designated areas such as AONB, whereas the technical potential includes development in these areas.

The graphs in Figures 4.2 and 4.3 show the current installed capacity, previous study estimate and the Buro Happold technical potential for sustainable energy in South Gloucestershire. Current installed capacity is taken from the Regen South West Annual Survey.

Previous Studies

Bristol

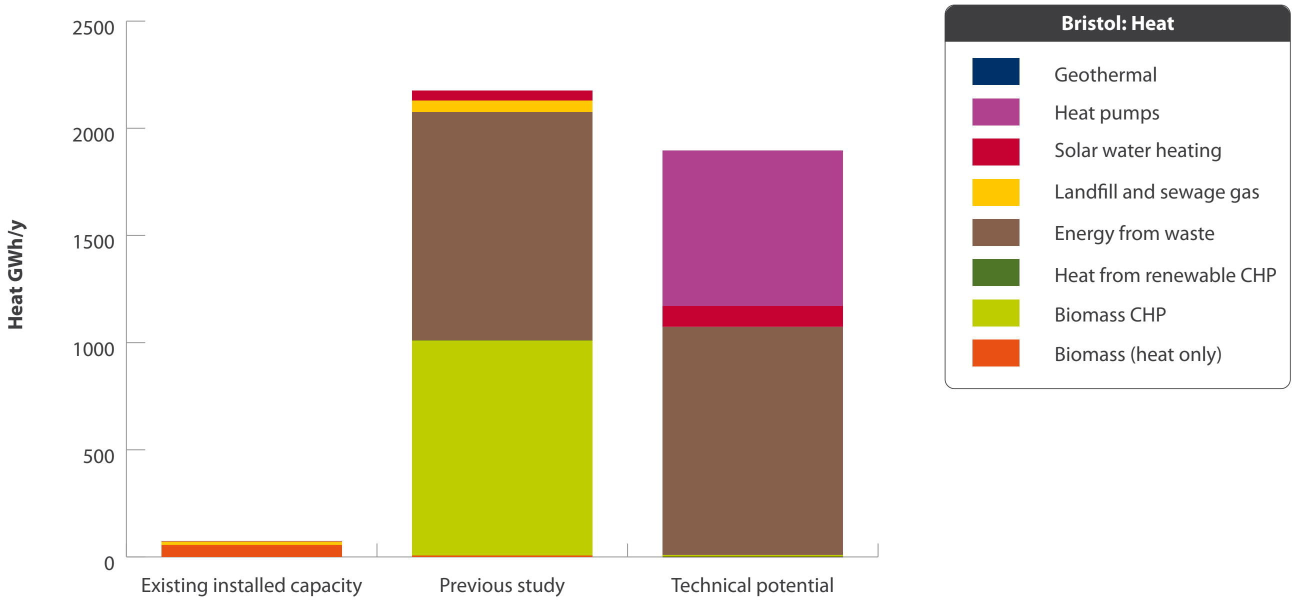


Figure 4.4: Bristol installed heat capacity, previous study estimates and technical potential

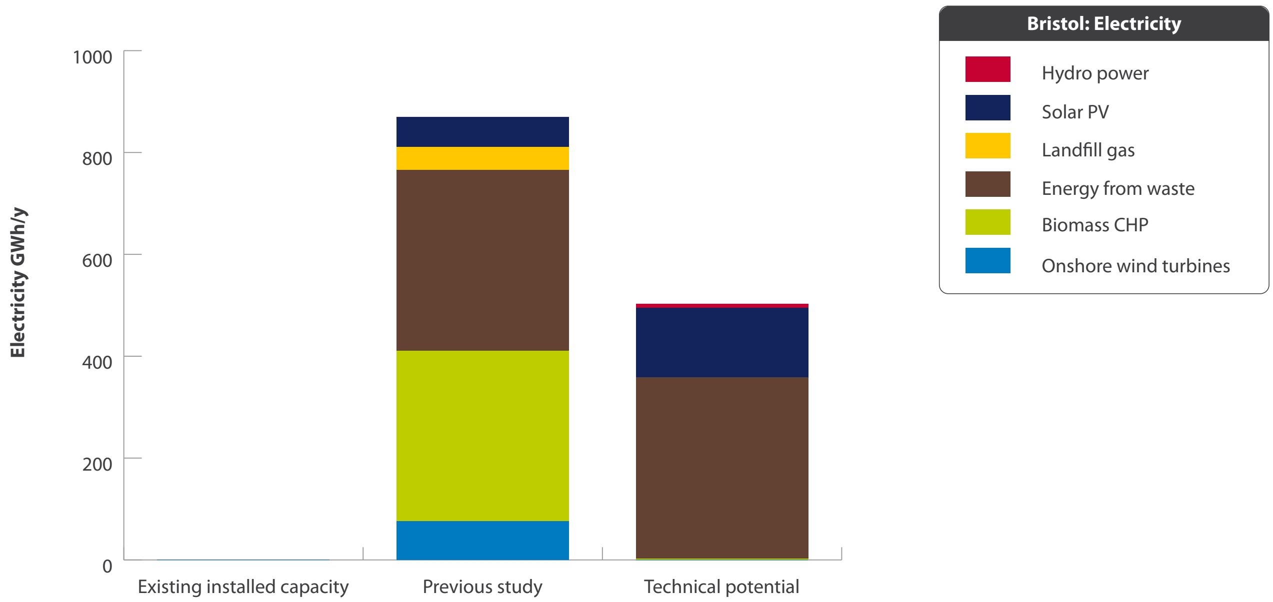


Figure 4.5: Bristol installed electrical capacity, previous study estimates and technical potential

Previous Studies

The graphs in Figures 4.4 and 4.5 show the existing installed capacity, the previous study estimate and the Buro Happold technical potential for sustainable energy in Bristol.

The previous study presented the technical potential for sustainable energy in Bristol, using different assumptions to those used by Buro Happold to derive the 'technical potential' column shown. The methodology used for this 'technical potential' estimate is consistent with the technical potential estimated for other UAs.

Key differences between the methodology used by CSE and that used by Buro Happold are as follows:

- The CSE study took biomass from woodland and agricultural land in a 40km radius around Bristol. In order to avoid double counting and enable comparability between the UAs, the Buro Happold estimate counts only biomass from woodland and agricultural land (not waste wood or trimmings from urban tree surgery) within the UA boundary for Bristol. As Bristol is primarily urban, this leads to a severe reduction. This methodology is necessary for consistency, but this could result in anomalies, as the installed capacity for biomass boilers (consuming biomass) could be higher than the technical potential (for growing biomass fuel).
- As with South Gloucestershire, landfill gas is omitted from the Buro Happold estimate.
- Heat pumps are estimated to provide significant capacity for heat. This technology was deemed not viable and omitted from the CSE study. Buro Happold have used the technical potential estimate for heat pumps following the DECC methodology for consistency.
- The Buro Happold estimate for technical potential takes wind potential to be zero, following the Regen South West wind map data in order to achieve comparability across the UAs. In reality there is some potential for wind, although the previous study technical potential was less constrained than that used in the other UA studies.
- Buro Happold has included a negative electricity value for heat pumps. This technology was omitted entirely from the CSE study.

Previous Studies

B&NES

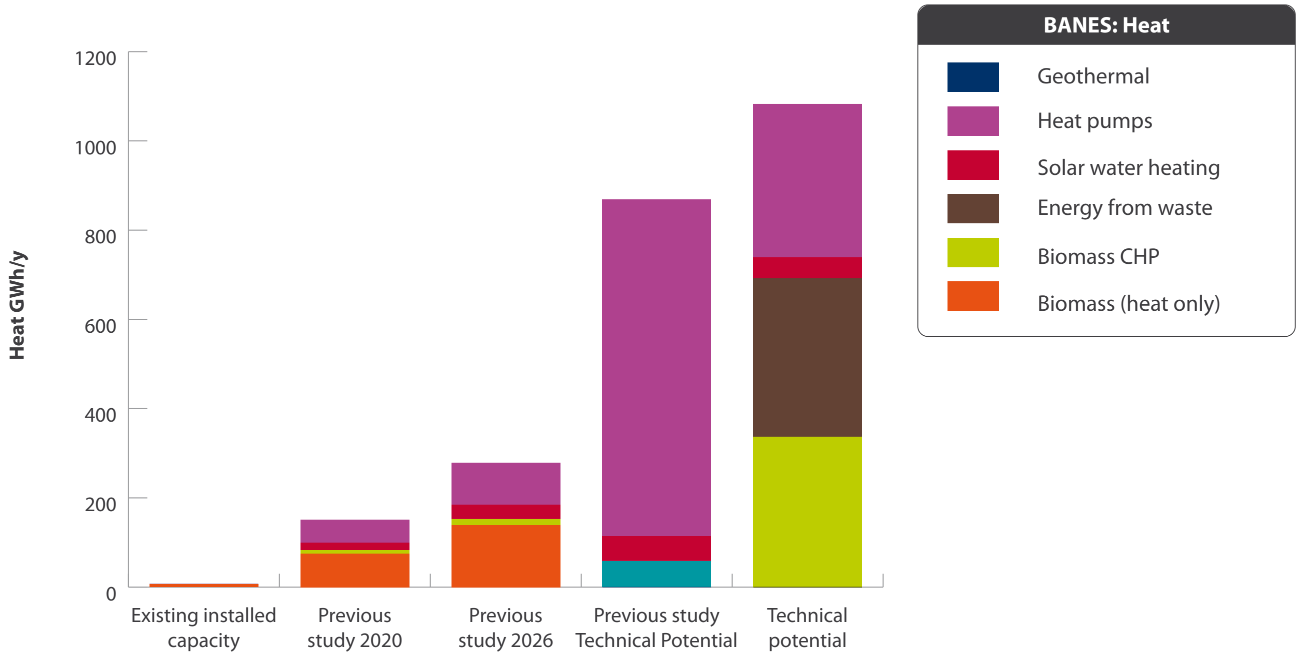


Figure 4.6: B&NES installed heat capacity, previous study estimates and technical potential

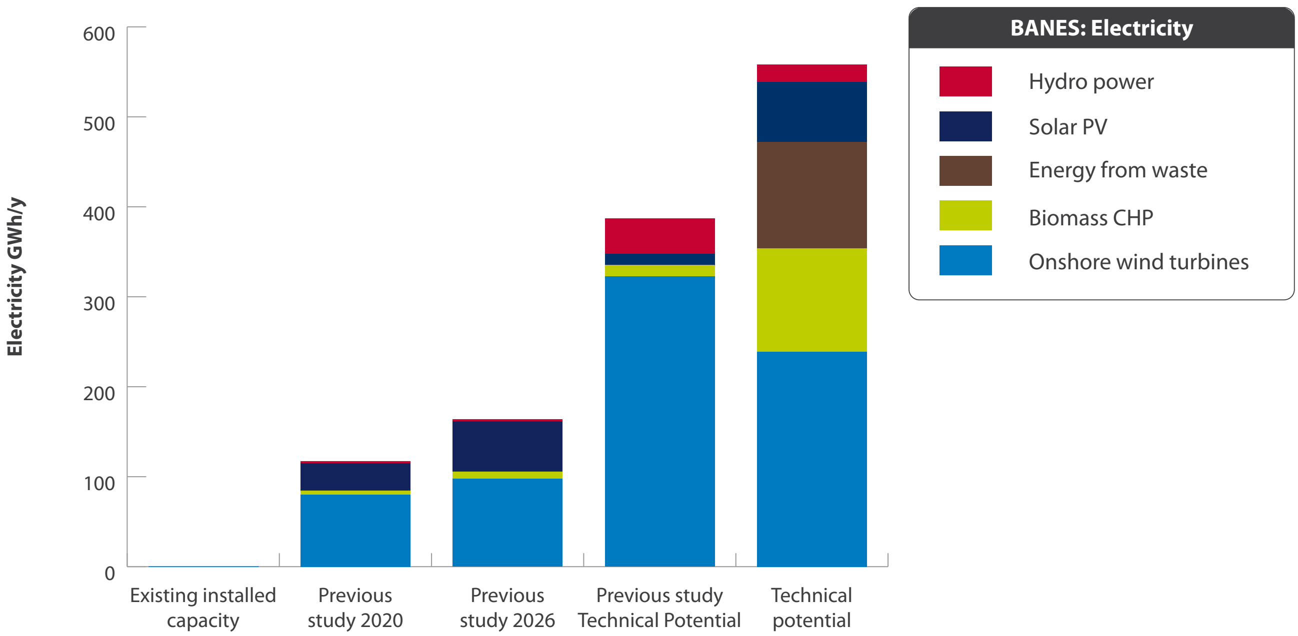


Figure 4.7: B&NES installed electrical capacity, previous study estimates and technical potential

Previous Studies

The graphs in Figures 4.6 and 4.7 show the exiting installed capacity, previous study estimate and the Buro Happold technical potential for sustainable energy in Bath and North East Somerset. Existing installed capacity is taken from the Regen South West Annual Survey.

The previous study by CAMCO presented the technical potential, practical potential by 2020, and the practical potential by 2026.

Key differences between the methodology used by CAMCO and the methodology used by Buro Happold are as follows:

- The practical potential for 2026 is similar to that for 2020, but slightly larger, reflecting the longer period for construction and supply chain development which has been allowed.
- Both of the sets of practical potential values are significantly lower than technical potential, due to the additional deployment, planning, economic and other constraints applied.
- The Buro Happold estimate for technical potential, which is comparable with that estimated for other areas, is significantly different to the CAMCO technical potential estimate. Key differences include:
    - Much smaller estimate of capacity for heat pumps in the Buro Happold estimate.
    - No energy from waste in the CAMCO estimate due to a policy decision against energy from waste in B&NES. This policy is still in place, but the technical potential estimate includes energy from waste (from the Joint Waste Core Strategy) for consistency with the other UAs.
    - Greater biomass potential in the Buro Happold estimate due to land area based analysis.

North Somerset

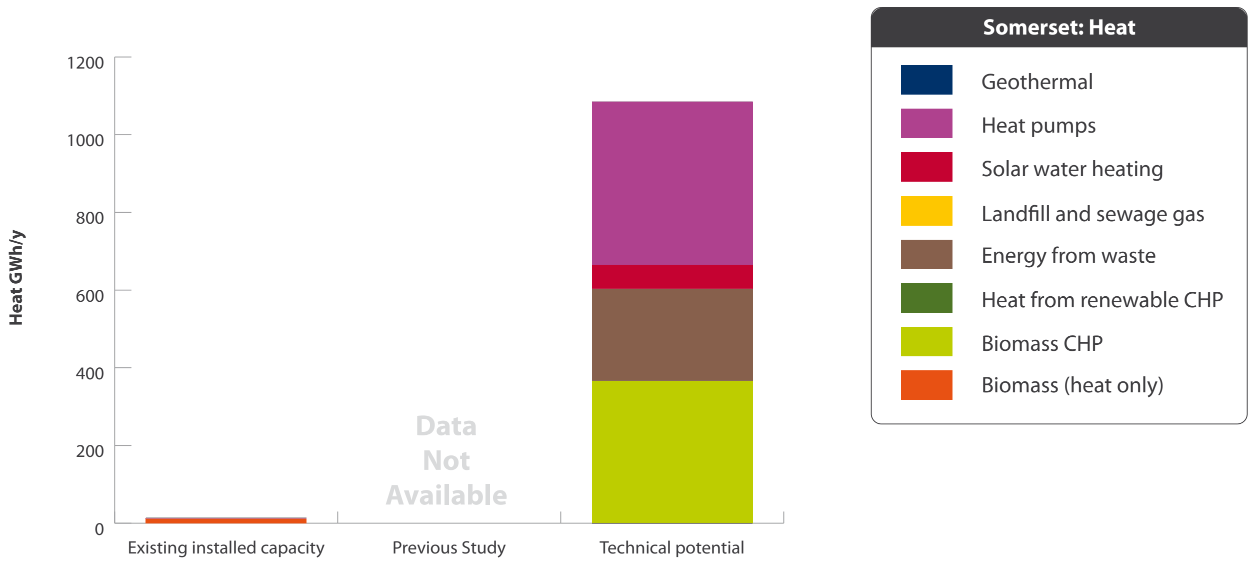


Figure 4.8: North Somerset installed heat capacity and technical potential

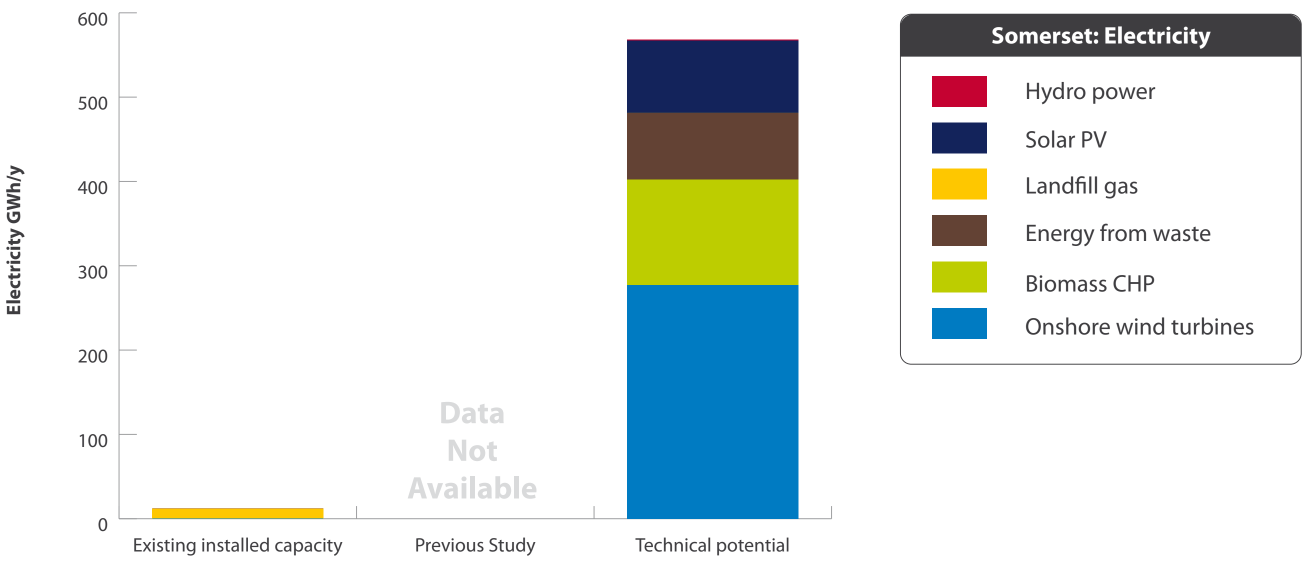


Figure 4.9: North Somerset installed electrical capacity and technical potential

Previous Studies

The graphs in Figures 4.8 and 4.9 show the existing installed capacity and the Buro Happold estimate of technical potential for sustainable energy in North Somerset. There was no previous study carried out for North Somerset, so the data shown is the Buro Happold estimate of technical potential, using the same assumptions and data as for the other UAs. Existing installed capacity is taken from the Regen South West Annual Survey.

4.4 Contrast between technical and practical potential

The contrast between the technical potential as calculated from comparable data across the four UAs, and the practical potential as presented in the South Gloucestershire and B&NES studies is striking. It shows a large gap between the practical potential and the technical potential, and therefore how challenging it would be to achieve the full technical potential. The estimate of the technical potential is based primarily on physical barriers, such as the fact that large wind turbines cannot be built on roads or rivers. However, social and economic factors relating to planning, the value we give to retaining the current landscape and built environment, costs and payback periods, skills, supply chain and feasible rate of deployment are all material, and some may prove to be too onerous.

The estimates of practical potential carried out in previous studies are not comparable, but they serve as a reminder that even if there is the technical potential to supply 55% of current energy demand through sustainable energy resources, achieving this would require significant policy and public support and change in the economics or incentives for sustainable energy. It also shows the important role to be played by additional measures such as energy efficiency and sustainable energy from outside the WoE, e.g. offshore wind, in order to achieve the national 80% carbon dioxide reduction target by 2050, even if the full technical potential were to be achieved within the WoE.

4.5 DECC methodology

The assessment of technical potential described in the previous chapter of this report was carried out in order to create a comparable set of data, due to the incomparability the data from the previous studies for each UA. The methodology developed by SQW in January 2010 was commissioned by DECC in order to address this issue and help standardise data. However, even this standardised methodology requires some professional judgement from users, and the later stages (5 to 7) are not defined at all.

The objectives of the DECC methodology are to:

- Help regions assess renewable energy potential.
- Underpin an evidence base for setting regional ambitions.
- Help plan for sustainable development in ways that adopt opportunities for new or extended decentralised energy systems.
- Support Government policy and targets.

The DECC methodology was used for regional sustainable energy potential assessments around the country, and DECC are now in the process of bringing together these different studies and making them comparable on a national level.

It is worth noting that the development of the DECC methodology was an attempt to standardise assessments for the sake of comparability, rather than a methodology which gives a certainty about exactly how much can be achieved. It is very difficult to present an exact prediction in this assessment as the policy, commercial and social context changes continually, but can have a significant impact on the estimate of the potential in the 'inner rings' of the of the DECC methodology.

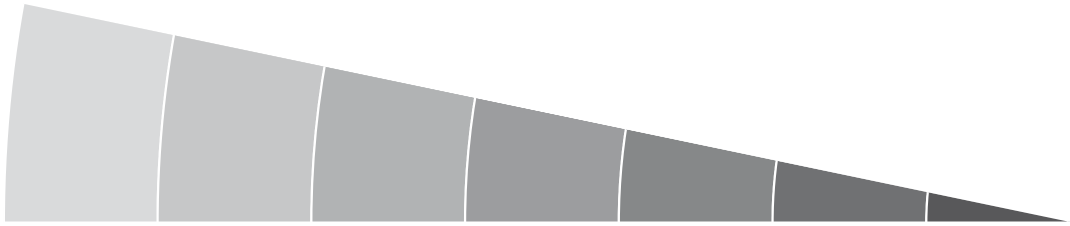
Each stage in the DECC methodology adds a further layer of constraint to the resource, starting with the full technically available resource, then drilling down to include planning, regulatory, economic and deployment constraints to set a "realistic" target. This approach to evidence-based target setting is not the only one. For example, in Greater London an ambitious target of 25% decentralised energy by 2025 was set, based on climate science (London First, 2008). This has galvanised significant action, but is proving difficult to achieve.

Stages 1 and 2 of the DECC methodology represent opportunities for harnessing renewable energy from what is available in nature and Stages 3 to 4 address constraints to deployment as previously discussed. The methodology does not yet define an approach for Stages 5 to 7, so the consultants who produced the previous studies discussed in this chapter used their professional judgement to add further constraints towards the 'practical potential'.

Stages 5 to 7 are more difficult to define than the technical stages 1 to 4 of the DECC methodology, as they are dependent on a range of social, economic and political factors. The DECC methodology puts target setting as the final outcome of the analysis, whereas in reality the target set can lead to policies and incentives which can alter the planning and financial landscape.

A summary of the DECC methodology as it applies to each resource can be seen in Figure 4.10 overleaf. The methodology does not cover water based energy resources, including hydro power, wave or tidal power.

Previous Studies



	1 NATURALLY AVAILABLE RESOURCE	2 TECHNICALLY ACCESSIBLE RESOURCE	3 PHYSICAL ENVIRONMENT CONSTRAINTS	4 PLANNING AND REGULATORY CONSTRAINTS	5 ECONOMICALLY VIABLE POTENTIAL	6 DEPLOYMENT CONSTRAINTS	7 REGOINAL AMBITION TARGET SETTING
	OPPORTUNITY		CONSTRAINTS		DECC METHODOLOGY UNDEFINED		
RENEWABLE	**WIND**	**E.G.** **commercial scale wind speed** > 5m/s @ 45m **small scale wind speed** > 4.5m/s @ 10m	**E.G.** • roads • railways • built up areas • airports	**E.G.** • ancient woodland • sites of historic interest • buffer zones applied to stage 3 constraints • civil air traffic control			
RENEWABLE	**BIOMASS** • animal • plant/wood • human activity (organic)	**E.G.** • estimate potential yield and convert to primary energy	**E.G.** • alternative markets (e.g. animal/human feed) • potential that can be collected	**E.G.** • air quality • waste incieration directive			
RENEWABLE	**SOLAR**	**PHOTOVOLTAIC** **SOLAR HOT WATER**	**E.G.** • available roof space orientation & exposure • hotwater demand (SHW only)	**E.G.** • conservation areas			
RENEWABLE	**AIR OR GROUND**	**AIR SOURCE HEAT PUMP** **GROUND SOURCE HEAT PUMP**	**E.G.** • percentage breakdown of domestic and commercial • percentage new build and existing • domestic 5kW commercial 100kW	**UNDEFINED**			
LOW CARBON	**DISTRICT HEATING AND CHP**	**HEAT DENSITY** e.g. >3000kW/km^2	**UNDEFINED**	**UNDEFINED**	**LARGELY DRIVEN BY ECONOMIC CRITERIA**		
LOW CARBON	**BIOMASS** human activity (MSW)	**E.G.** • estimate potential yield and convert to primary energy	**E.G.** • plant efficiency	**E.G.** • air quality • waste incineration directive			

Table 4.1 Summary of the SQW DECC methodology

4.6 Comparison of methodology used for the previous studies

The following section provides a summary of the methodology used within each previous UA sustainable energy study carried out for each resource or technology. The methodology summary below explains how the analysis of the technical potential varied between each of the previous studies. Several of the previous studies also carried out an estimate of the practical potential, using professional judgement for the DECC stages 5-7 where the DECC methodology is not defined. The assessment of the earlier stages 1-4 also requires some interpretation. For a detailed description of the additional constraints applied to derive the practical potential shown in Figures 4.2 to 4.9 earlier in this chapter, please refer to the original studies.

Wind

The methodologies differ on the wind speed requirements for assessment as well as the size of buffer zones placed around sensitive areas. B&NES and North Somerset (Wardell-Armstrong, 2010) closely follow the DECC methodology for the determination of large wind turbine capacity although this does not reflect potential planning constraints, which would need to be considered on a site by site basis. Bristol and South Gloucestershire have used higher wind speeds (6m/s rather than 5m/s) as a lower cut off wind speed to estimate potential capacity and assumed differing buffer zones around sensitive areas. Medium and small wind assessments have not been carried out by South Gloucestershire. Bristol did not go into detail for stages 3 and 4 due to the small wind capacity, stating that it would be more relevant to consider this on a case-by-case basis.

Biomass and waste

There is inconsistent methodology adopted for assessment of plant, woody and waste biomass streams within each study.

The DECC methodology for biomass has several steps that are open to interpretation. Professional judgment has been applied where the DECC methodology is unclear. Bristol includes all resource streams within a 40km zone, including land within the boundaries of the other UAs in the WoE and a significant area outside. With the other UAs in the WoE counting all biomass within their area as available to them, there is a danger of double counting at the strategic level. Discussion of a common approach to biomass planning and strategy across the WoE is therefore recommended.

Energy from waste is also dealt with differently in each UA. Some have assessed the potential for energy from sewage gas, landfill gas and municipal solid waste separately. B&NES has a policy against energy from waste plant, so this was not assessed in the CAMCO study for B&NES.

Heat networks

The DECC methodology for the assessment of heat network potential is partially undefined. It should be noted that this is largely driven by economics, which define a cut off for viable 'heat density'. The higher the heat density in an area, the more economically viable the implementation of a heat network will be. There is inconsistent mapping of anchor load sources and existing heating plant across the UA's. Priority areas are defined using differing levels of constraints meaning that assessing cross UA opportunities will need interpretation. B&NES have carried out a very detailed assessment which has also considered financial appraisals.

Hydro power

All mapping and analysis is based on the 2010 Environment Agency study: Mapping Hydropower Opportunities and Sensitivities in England and Wales. The B&NES study applies constraints to the source data in order to develop a practical potential based on environmental sensitivity and capacity factors. This is the most developed data set. Planning constraints would then need to be applied on a site by site basis. There are gaps in the data for Bristol and South Gloucestershire.

Previous Studies

Solar PV and solar thermal

B&NES uses roof deployment factors similar to the DECC methodology. Bristol does not use the same roof deployment factors and subsequently the overall capacity for Bristol is different and an underestimate compared to that if the DECC methodology had been used. This is why the Bristol capacity is estimated as less than B&NES despite Bristol having a greater number of available roofs. The South Gloucestershire methodology has used regional coefficients for the uptake of PV (Element Energy, 2008). This approach is more stringent and so the results show lower capacity than if the DECC methodology had been used.

The DECC methodology assumes a modest (2kW) installation on domestic roofs. With the arrival of the Feed in Tariff, the economics of solar PV have dramatically improved, and so the size of typical installations have increased significantly. The reduction in Feed in Tariff for installations over 50kW in August 2011, and for smaller installations in December 2011 has reduced the size and the rate of PV installations. The rate of Feed in Tariff for PV is scheduled to continue to decrease, and the tariff rates for other technologies are under consultation at the time of writing this report.

The methodology for estimating the potential for solar thermal technology is very similar to that of solar PV, and is scaled by number of roofs. However, the constraint on size of installation is more technical rather than economic as it is for PV, as the heat produced needs to be used in the building or nearby.

5 Gap Analysis

5.1 Introduction

A gap analysis has been carried out on the data presented in the previous studies, and gaps have been filled using publicly available data and information already owned by the UAs. Table 5.1 shows the data that is available for each resource, first showing the data from the previous studies, then the gaps which have been filled, and finally the data which has not been obtained or is not available. The table also distinguishes between 'data', meaning tabulated numerical data, and 'GIS' meaning data in a format compatible with Geographical Information System mapping.

The sources of data for filling the gaps are those used for the estimation of technical potential, and are shown in Figure 3.1 'Sources used for assessing the technical potential for the WoE' on page 24 of this report.

Table 5.1 : Gap analysis carried out on previous UA sustainable energy reports

	Unitary Authority	B&NES	South Gloucestershire	Bristol	North Somerset
	Previous study by	AECOM/ CAMCO	AECOM	CSE	No previous study
Wind power	Large	GIS	GIS	GIS	GIS
	Medium	GIS	Not available	GIS	Not available
	Small	GIS	Not available	GIS	Not available
Biomass	Animal	DATA	DATA	Not available	Not available
	Energy Crop	GIS	GIS	GIS	GIS
	Wood	GIS	GIS	GIS	GIS
	Waste	DATA	DATA	DATA	DATA
Solar	Potential PV	DATA	DATA	DATA	DATA
	Potential SHW	DATA	DATA	DATA	DATA
Hydro power	Hydro Installed	DATA	DATA	DATA	GIS
	Potential	GIS	DATA	DATA	GIS
Heat Pumps	Potential	DATA	DATA	DATA	DATA
Large Scale Heat	Existing Heat Demand	GIS	DATA	GIS	GIS
	Anchor Loads	GIS	GIS	GIS	GIS
	Proposed Development	GIS	GIS	GIS	Not available

Legend: GIS data from previous UA specific study; Data from previous UA specific study; GIS data - regional or national; Data - regional or national

Gap Analysis

5.2 Gap analysis summary

Table 5.1 provides an overview of the gaps in data from the previous studies and how they have been filled where possible. The following points give more detail of what is behind the 'GIS' or 'DATA' available.

Data from other sources was used to provide a comparable and complete set of data across the WoE. This comparable data included data from: Regen South West (AEA 2010, CSE and Geofutures 2010, Wardell-Armstrong, 2010), the Joint Waste Core Strategy (WoE Partnership, 2011), the Environment Agency (2010) and the Centre for Sustainable Energy (CSE, 2009):

5.3 Wind power

Different methodologies were used to assess capacity in each of the previous studies, so the data was not directly comparable. The Regen South West wind map data was therefore used to provide WoE wide technical potential information and also fill gaps for North Somerset.

5.4 Biomass

There are gaps relating to potential animal waste source streams that should be filled to complete a WoE wide picture, particularly given the number of farms in the WoE. There were also inconsistencies relating to the assessments of woody, plant and waste biomass resources within the previous studies. Therefore the CSE assessment of woodland and energy crop areas has been used to provide a comparable set of data for assessment of the WoE's technical potential.

5.5 Solar PV and hot water

The previous studies for each UA used different methodologies for assessement of the potential for solar technologies. Regen South West data was therefore used to provide a comparable set of data and assess the technical potential for the WoE.

5.6 Hydro power

There is a complete national dataset provided by the Environment Agency, and this was therefore used for the assessment of technical potential.

5.7 Heat pumps

There was no data available for Bristol in the previous study as this was not considered a suitable technology to adopt for older house types. This gap was filled using Regen South West data for consistency in assessing the WoE wide technical potential.

5.8 Heat networks

A significant amount of work has been carried out by the UA's to develop an evidence base for heat networks with B&NES providing significant cases for deployment within their UA, and a Heat Priority Area identified in Bristol. The Regen South West heat map has been used to fill gaps for North Somerset.

The analysis shows that there are gaps in the data for all UAs except for B&NES which has a complete set of data. However, the data as described above is neither comprehensive nor comparable between the UAs.

6 WoE Geography and Stakeholders

6.1 Introduction

The potential for sustainable energy mapped in the previous chapter of this report sits within a wider context of existing energy infrastructure, the stakeholders engaged with energy policy and implementation, and sustainable energy plans already in place. A fuller understanding of this context has been achieved through stakeholder engagement in Stage Two of this study, so this chapter serves mainly to provide an introduction to the characteristics of the WoE.

6.2 Community energy

There are a number of community projects aimed at developing sustainable energy supply. Notably Bath and West Community Energy has installed solar PV panels on a number of schools in B&NES, funded by a community share issue, in a similar way to initiatives around the country such as Baywind and OVESCO. There are a number of other groups preparing to do set up similar social enterprises, and also a number of Transition Town groups, or other groups of a similar nature, fulfilling a networking and education role. These include the Bristol Energy Network, the Bristol Energy Cooperative, local Transition Town groups in Bristol, Low Carbon Gordano, Transition Pill and The Environmental Network of North Somerset, Transition Bath and Sustainable Thornbury.

Another measure of community engagement with sustainable energy is the inclusion of this theme in parish plans. Parish plans with a sustainable energy focus in South Gloucestershire and B&NES have been plotted on the map in Figure 6.1.

Figure 6.1 is a geographical map of several active community groups concerned with sustainable energy. It has been updated following the community energy focussed workshop which formed part of Stage Two, where community groups attending the workshop added themselves to the map.

6.3 Avonmouth and Portbury Docks

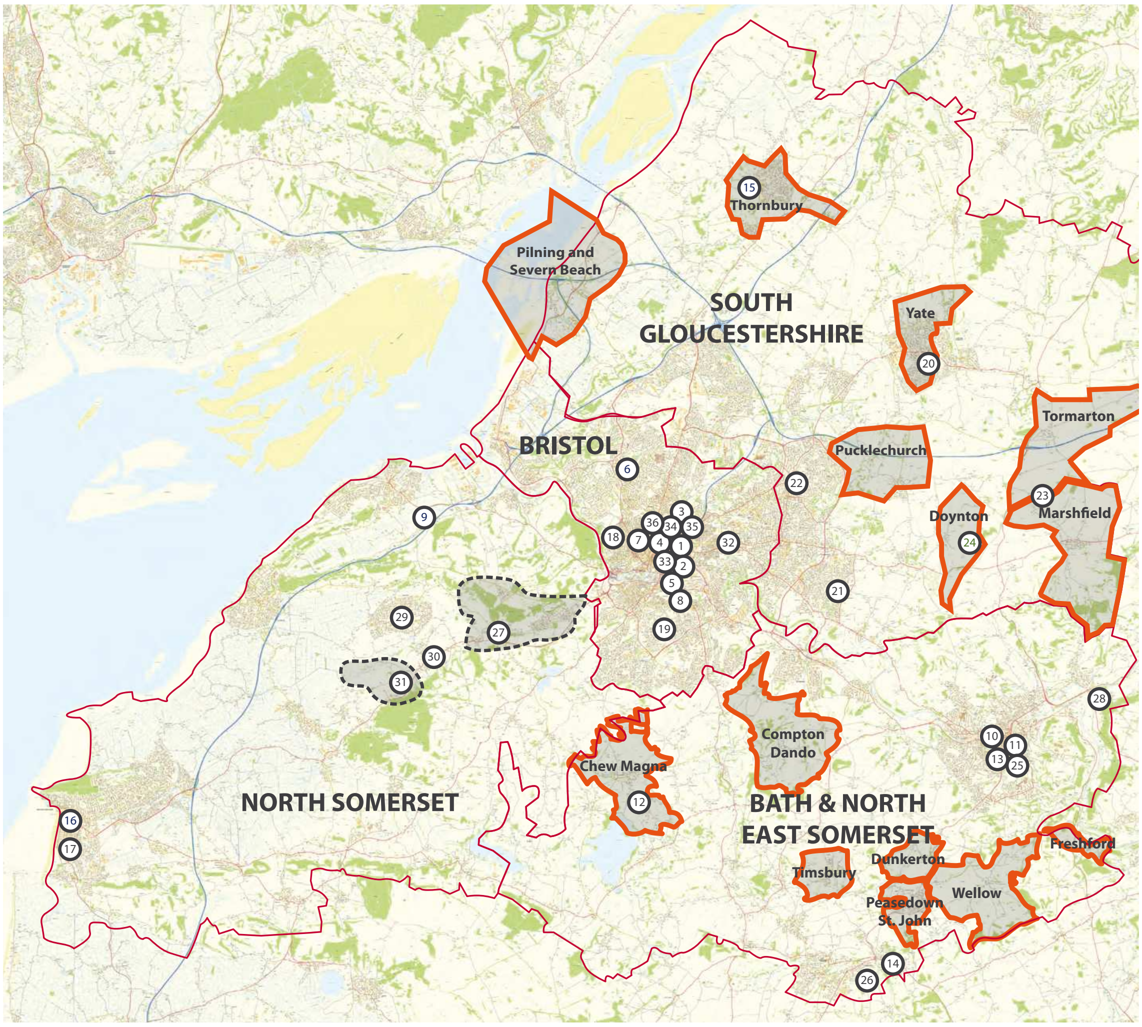
There is significant potential for sustainable energy in the industrial area of Avonmouth. This includes the use of waste heat from industrial processes, which could be transported to nearby residential areas, and the potential for electricity generation from waste or from imported biomass, and large wind turbines. The potential for heat networks has been investigated in the Low Carbon South West Heat Grid study. Several projects and plans are already in place, including: planned energy recovery from municipal solid waste and imported biomass; three large wind turbines owned by the Port Authority and managed by Ecotricity; and a number of other wind turbines are in the planning stage or under development, including wind turbines to be owned and managed by Bristol City Council. The use of waste heat from the area is technically feasibly, but not likely to be currently economically viable, which presents a challenge to find a mechanism for implementation. The waste, biofuel and district heating proposals have potential for cross-boundary opportunities between Bristol and South Gloucestershire.

In the Portbury Docks, North Somerset, there are proposals from EOn to develop a 150MW biomass plant.

6.4 Strategic development sites

New build domestic or non domestic development sites offer the opportunity for building integrated or district energy systems without the complication of competing with an incumbent energy system. A number of sites which are currently or soon to be under development are of strategic interest for cross UA collaboration on sustainable energy. These are shown in more detail on the sustainable energy potential maps. Large sites with potential cross-boundary interest include Cribbs Causeway/Patchway and Harry Stoke on the border between South Gloucestershire and Bristol. There are also sites identified in the Regional Spatial Strategy at Hicks Gate, Ashton Park, and Weston Super-Mare. The previous AECOM district heating study carried out for B&NES showed that contributions from new developments can have a significant role in the financial viability of retrofitting district heating, and so finding the right mechanism for

WoE Geography and Stakeholders



Legend

1	Bristol Energy Network (Bristol)	**19**	Sims Hill Shared Harvest (BS3 1BJ)
2	Bristol Energy Cooperative (Bristol)	**20**	Yate Eco Group (BS37)
3	Bristol Green Doors (BS1 3QY)	**21**	Unity Oldland Common Methodist Church (BS30 9QS)
4	Bristol Inter Faith Group (BS1 5BB)	**22**	Downend Baptist Church (BS16 5UF)
5	Ecomotive (Bristol)	**23**	Marshfield / Tormarton Ecogroup (GL9)
6	Transition Town Bristol (BS9 3HQ)	**24**	Doynton Environmental Group (BS30 5TE)
7	Ecojam (BS8 1RJ)	**25**	Energy Efficient Widcombe
8	Bristol Permaculture Group (Bristol)	**26**	Somer Renewable Energy Action Area
9	Low Carbon Gordano (BS20)	**27**	FLoW Community Energy (Failand, Long Ashton and Wraxall)
10	Transition Town Bath (BA1 1JB)	**28**	Bathford Energy Group
11	Bath Community Energy Ltd (Bath)	**29**	Transition Towns Nailsea
12	The Community Farm, Chew Magna (BS40 8SZ)	**30**	Sustainable Backwell
13	Bath Preservation Trust (BA1 0HX)	**31**	Transition Winscombe and Sandford
14	Radstock Action Group (BA3 3PL)	**32**	Demand Energy Equality (.org) - DIY Solar
15	Sustainable Thornbury (BS35 1NA)	**33**	Bristol Power CIC
16	North Somerset Green Unison (BS23 1UJ)	**34**	Ashley Vale Self-build Co-operative
17	The Environmental Network of North Somerset, Tenons (BS23)	**35**	Bristol Community Land Trust
18	Solar Club (B58 1DJ)	**36**	Saxon Road Green Space Group

Parishes which mention sustainable energy in their parish plans

Larger area covered by group

Figure 6.1: Map of community groups concerned with sustainable energy in the WoE

enabling district heating or district ready systems to be installed in these new developments is challenging but an important issue to address.

6.5 Other special interest groups

There are a number of other important community stakeholders who are not directly working on sustainable energy. These include heritage and conservation groups, who aim to preserve the buildings and landscape of the WoE and whose concerns need to be addressed in order to implement sustainable energy. CSE in Bristol has been working in partnership with the Bath Preservation Trust to develop guidance for the improvement of energy efficiency in Victorian and Georgian homes in Bath. The previous report produced for B&NES included a landscape sensitivity analysis for wind turbines, which can help inform community groups and planners during the planning process.

6.6 Renewable energy targets

There are differing ways in which each UA approaches the requirements for renewable energy to new developments. As well as this there are additional needs surrounding rating systems such as BREEAM and the Code for Sustainable Homes standard that may require further validation on a site by site basis. Core strategies that set out planning frameworks up to 2026 are in some instances in draft form (e.g. South Gloucestershire) and others have now been adopted. Key points are summarised for each UA below:

South Gloucestershire – the core strategy is in draft. There will be a 'high priority' given to renewable energy system and heat networks where appropriate. There is no 'Merton rule' type target for percentage reduction in carbon dioxide emissions using renewable energy.

Bristol – the core strategy was adopted on 21st June 2011. There is a focus to encourage heat networks where possible and also a 'merton rule' to ensure that all new developments target a 20% reduction in carbon dioxide emissions through renewable energy where feasible.

North Somerset – the core strategy has been submitted for examination by a government inspector. There are a number of policies that address climate change and carbon reduction. Combined Heat and Power (CHP) will be 'encouraged' and applicants should be responsible for 'demonstrating the environmental sustainability credentials of schemes'. There is a requirement for 15% on-site renewable energy generation for 10 or more dwellings in the submitted core strategy and the replacement local plan.

Bath and North East Somerset – the core strategy has been submitted for examination by a government inspector. Policy seeks to increase the level of renewable energy generation and may establish "allowable solutions" for zero carbon development to facilitate the use of the Community Energy Fund and developer contributions once the parameters are clarified by national government. There is no 'Merton rule' type target for percentage reduction in carbon dioxide emissions using renewable energy.

6.7 Unitary Authority ESCo plans

The Bristol UA has plans to set up an Energy Service Company (ESCo) in the near future, funded through the EU ELENA fund. There is potential for collaboration between Bristol and other UAs should they wish to set up ESCos in the future.

6.8 Energy efficiency

Energy efficiency falls outside the scope of this study, but will make a vital contribution to reducing carbon dioxide emissions through reduction in energy demand. There are a number of initiatives taking place in this regard. In terms of community groups, these include Energy Efficient Widcombe, combatting excess winter deaths from cold through energy efficiency measures, and MakeYourHomeEco, a Bristol based group running a six week course for developing

WoE Geography and Stakeholders

an action plan for energy efficiency improvements to homes. On a national level, the Energy Efficiency Trust and the Carbon Trust aim to help businesses and individuals reduce waste in energy through the provision of advisory services.

6.9 Wider context

Reducing the carbon footprint of the WoE will require contributions from projects of national interest. This could include tidal power in the Severn Estuary, a project which has been put on hold by the government but which could become viable at some point in the future. One of the larger options, the Cardiff-Weston barrage, would land in North Somerset. One of the 2011 National Policy Statements for Energy Infrastructure identifies eight specific sites for new build nuclear power, including the site of the existing nuclear power station at Hinkley in West Somerset, south of the WoE, and at Oldbury in South Gloucestershire. Nationally, there are opportunities for generating and supplying energy from offshore wind power, and for importing renewable electricity e.g. from solar power in southern Europe or the north of Africa, or from hydro power in Norway. Severnside is also the site for a proposed new gas fired power station, which is worth noting as part of the wider context, although there are currently no plans to use the waste heat from this.

6.10 Land use

The land use detailed within the following charts provide context to the WoE's geography (South West Observatory, 2011):

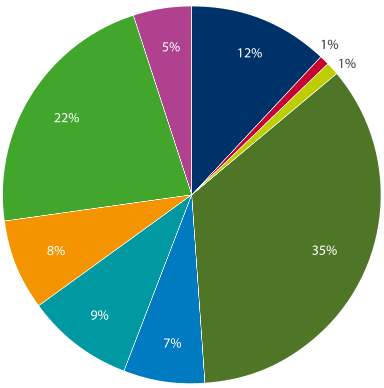


Figure 6.2: Bristol Land use

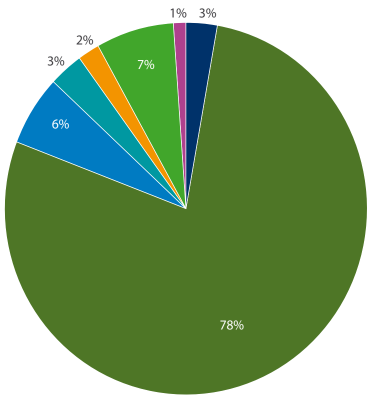


Figure 6.3: North Somerset Land Use

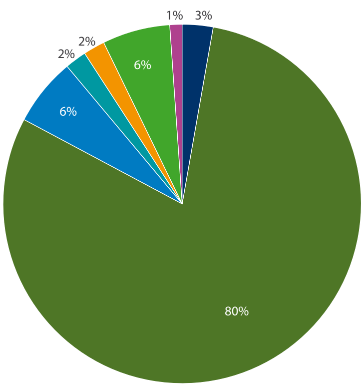


Figure 6.4: South Gloucestershire Land use

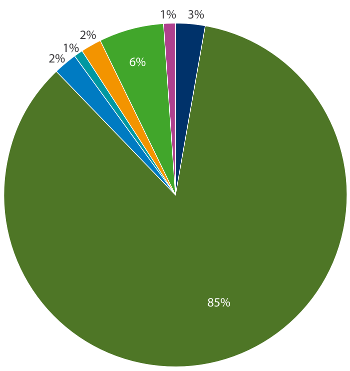


Figure 6.5: Bath and North East Somerset Land use

Overall the WoE has a very large proportion of green space compared to other land use. The green space percentage includes agricultural land and city parks. The amount of green space provisionally suggests there is good opportunity for the WoE to grow biomass for use within the region. It should be noted that as part of these greenspaces there are significant AONB, for example the Mendips and the Cotswolds, as well as farmland, conservation areas, etc. Also within these rural areas there are significant parts of South Gloucestershire, B&NES and North Somerset with little or no connection to existing gas networks. These areas should be targeted as priority areas for deployment of sustainable energy to provide cost effective and carbon dioxide emission reducing solutions that do not need the costly extension of the existing gas network.

6.11 Waste

The use of energy from waste technology has the potential to make a significant contribution to energy supply in the WoE, and reclaiming the residual energy in waste can be a sustainable way of making the most of a resource, once a waste hierarchy has been followed to ensure that waste is minimised from the outset. To maximise the potential, connection to heat networks are required. Heat output provides 75% of the total energy potential for energy from waste.

Each UA has taken a different approach to waste management and energy, with a policy against energy from waste in B&NES, and strong support of energy from waste in Bristol. There has been a history of cross UA collaboration on waste policy, with the development of a Joint Waste Core Strategy through the WoE Partnership. Discussions about how best to manage waste need to consider factors such as the risks of reducing the incentive to minimise waste from the outset, the availability of suitable sites for landfill, the recycling supply chain, the need for energy and opportunity of reclaiming some of the embodied energy in waste and air quality management. It is understandable that different UAs come to

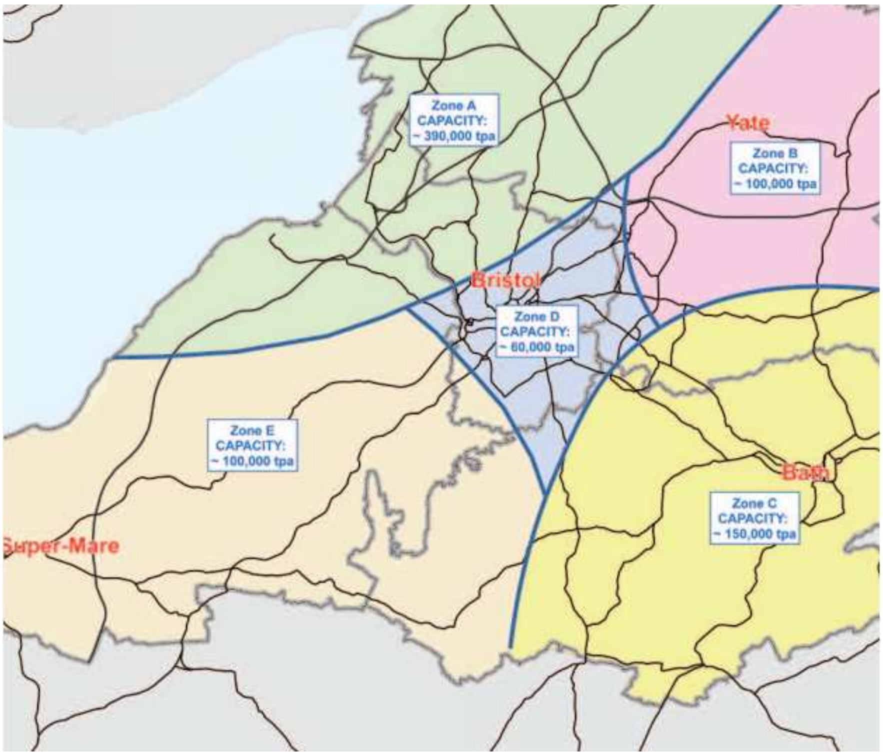


Figure 6.6: Indicative capacities for generation of waste (tonnes per annum) within the WEP sub-regional spatial strategy

different conclusions about the best way forward, but in the interests of continued collaboration keeping the discussion open about the best way to manage waste is considered in the best interest of the WoE.

6.12 Professional services

The WoE is home to or served by a number of professional service organisations promoting and supporting the development of sustainable energy. These include Regen South West, Low Carbon South West, Forum for the Future, and CSE. The WoE is also home to the world's largest independent renewable energy consultancy, Garrad Hassan.

6.13 Listed buildings and heritage

There are significant areas of listed properties (for example there are 6,400 listed buildings alone in B&NES) and many conservation areas all of which represent a significant 'hard to heat' demand that requires appropriate and sympathetic solutions. These areas also generally have more onerous planning requirements for any proposed development. Planners will need to work closely with local communities to ensure appropriate sustainable energy solutions are developed that both meet challenge of serving these areas and also the needs of the community. Heat networks can be an effective way of providing significant carbon dioxide emission reductions without affecting the visual appearance of listed buildings.

6.14 Gas connections in the WoE

Gas grid connections within the WoE are not uniform, with some areas of very low or zero connection to the gas grid. Homes and businesses not connected to the gas grid tend to be dependent on oil for heating, so the potential for carbon savings and favourable economics for alternative sources of energy in these areas is high. The off gas grid areas tend to coincide with rural areas with significant potential for biofuel production, and lower air quality management risks than densely populated urban areas. Areas off the gas grid are shown in figure 6.7.

6.15 Fuel Poverty in the WoE

Levels of fuel poverty vary around the WoE, as shown in Figure 6.7. There are high levels of fuel poverty in much of Central Bristol, in the East of North Somerset, in the West and the East of B&NES and the East of South Gloucestershire

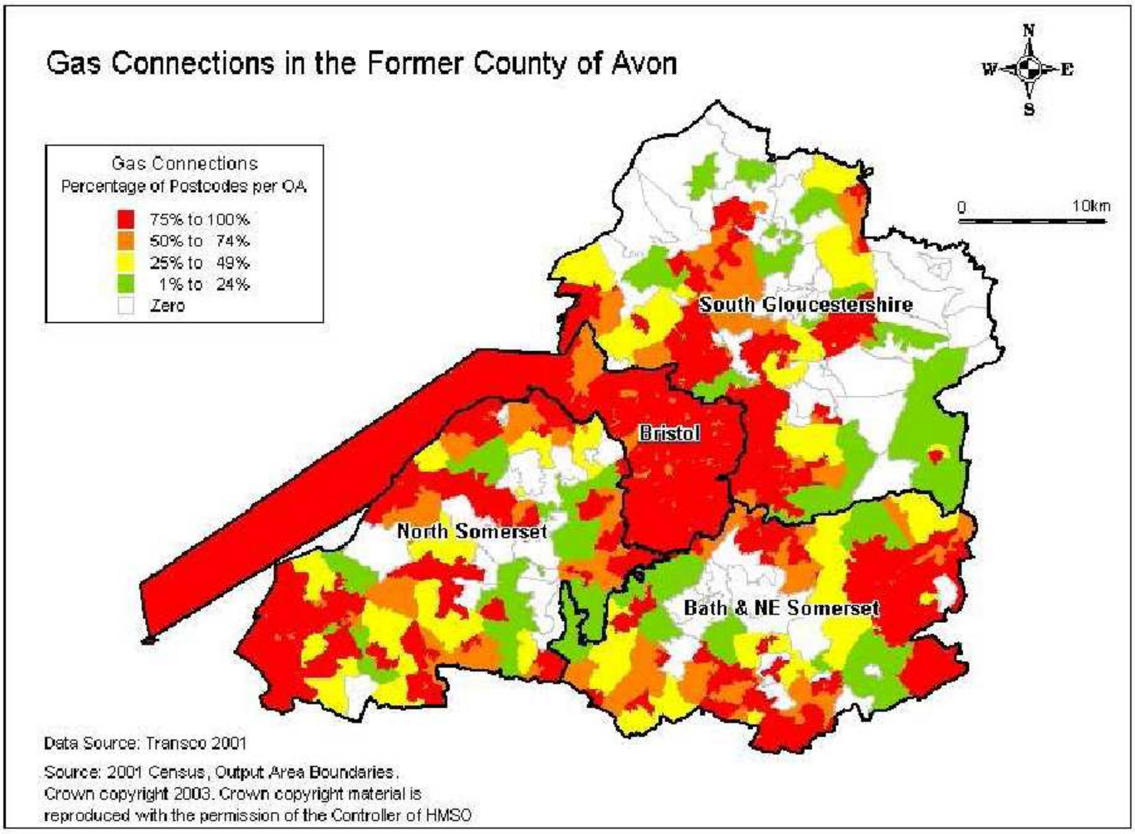


Figure 6.7: Gas connections in the WoE (CAMCO 2010)

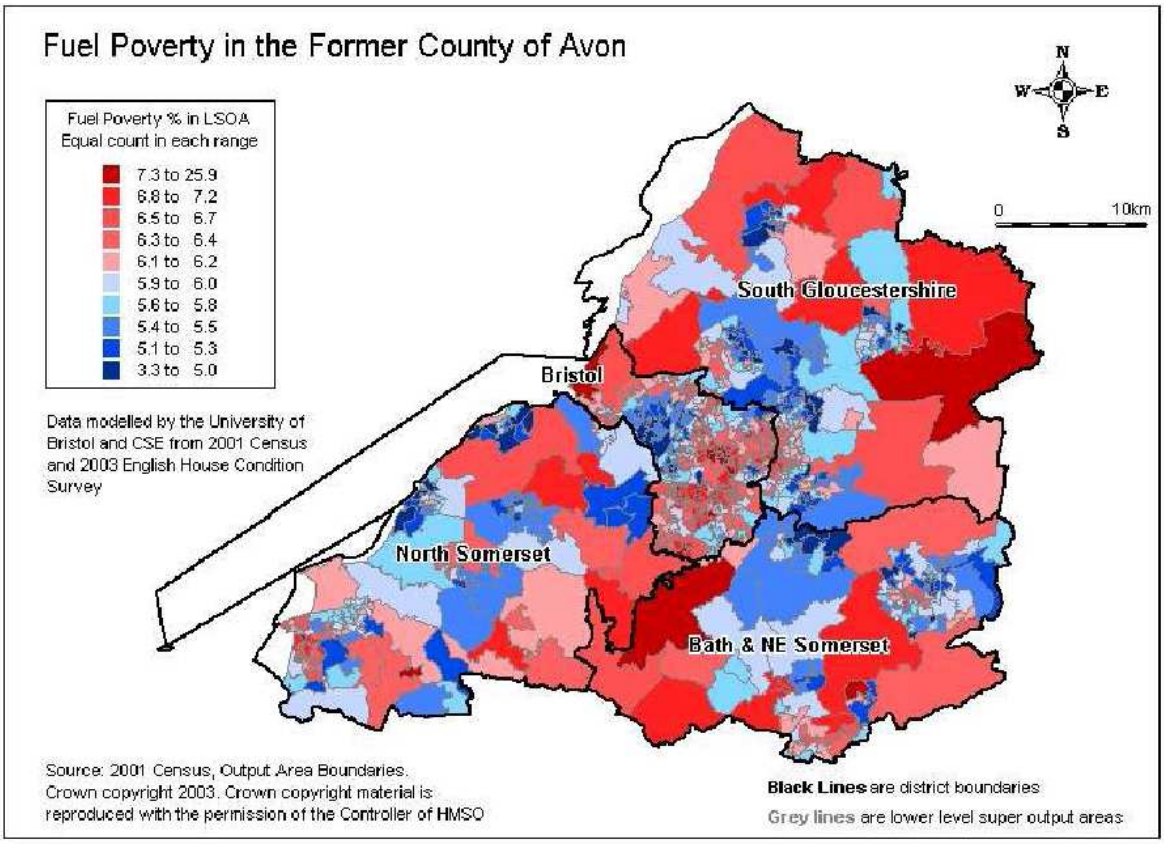


Figure 6.8: Fuel poverty in the WoE (CAMCO 2010)

including the area around Yate. There is the potential to address fuel poverty through improvements in energy efficiency of dwellings and access to low cost forms of energy.

6.16 Existing installed renewable energy in the WoE

Regen South West have carried out an annual survey of installed renewable energy capacity in the south west since 2004. This survey is accompanied by a map of all the non-domestic renewable energy projects. Figure 6.9 shows the section of this map for the WoE (referred to as 'Former Avon' by Regen South West). Data gathered by Regen South West is collected from installers and from local authorities, so there may be some additional renewable energy projects not registered in this survey.

The breakdown of full current installed capacity presented in the Regen South West annual survey is shown in Tables 6.1 and 6.2 (Regen South West, 2011b). These Figures include domestic installations, and so are greater than the total shown on the map, which excludes domestic installations.

Regen South West note several key points from the 2011 annual survey. Box 1 quotes the key points for Former Avon (the WoE) as stated in the Regen South West Annual Survey 2011 (Regen South West 2011b).

Box 1: Regen South West Annual Survey - Former Avon Key Points:

Renewable Electricity

- Only five projects installed in 2010/11 were commercial projects. The remaining 318 were domestic.
- 97 per cent of all the renewable electricity projects across the four unitaries are solar PV, but these make up only 7.5 per cent of installed capacity in the area.
- Bristol Port Company's application to double their number of turbines at Avonmouth was approved in October 2010 near Bristol. They plan to install three 3 MW turbines.

Renewable Heat

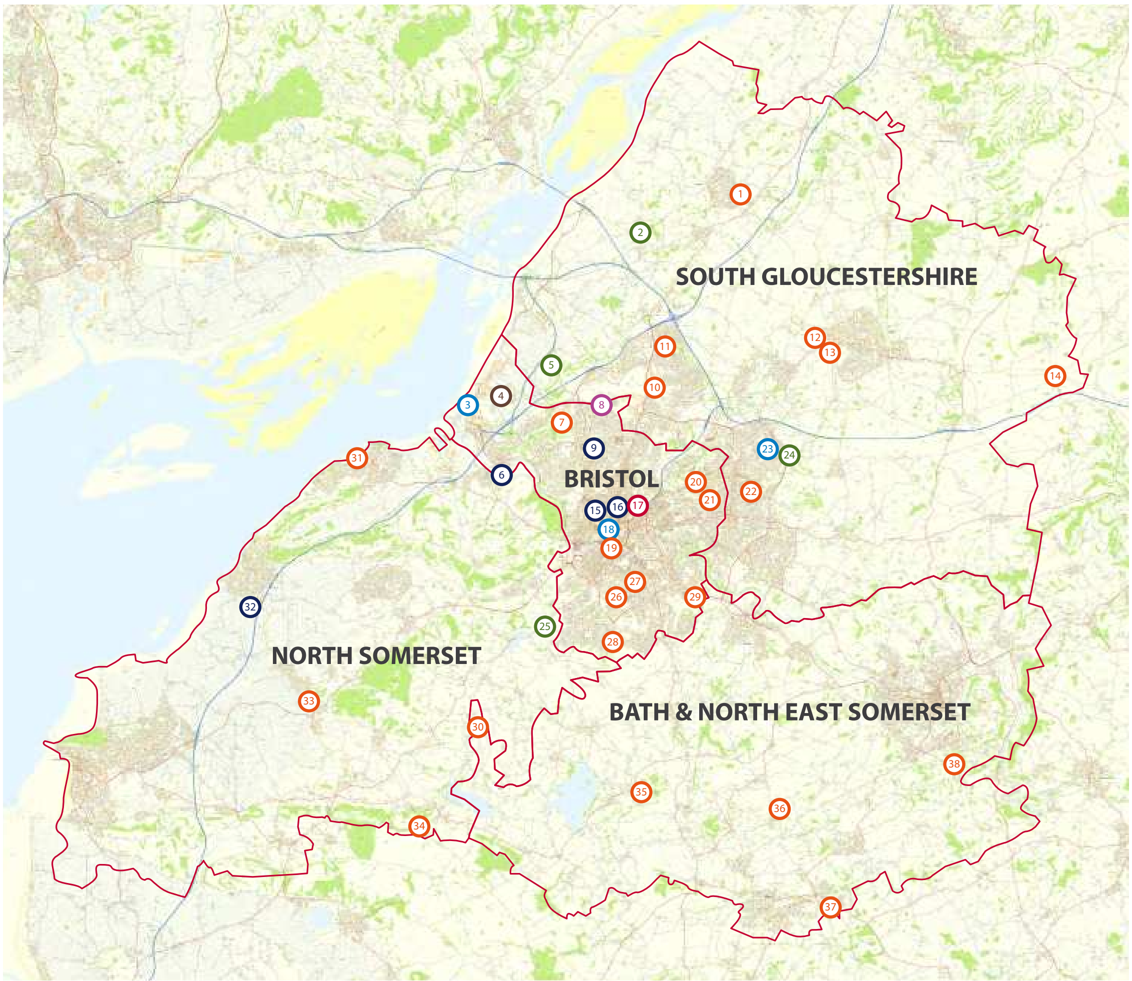
- Biomass contributed 4.31 MW or 88.3 per cent to the new combined capacity for the unitaries, despite making up only 12.7 per cent of the new projects.
- 16 new ASHP and two new GSHP were installed, adding 0.38 MW capacity. All of these projects were domestic with the exception of the new Environment Agency offices.
- 70.9 per cent (3.46 MW) of new capacity came from schools.
- Although it has a lower population and smaller area, Bristol now sits just behind Cornwall with the second highest total renewable heat capacity in the south west.

Table 6.1 Regen South West Annual Survey data for the WoE - Sustainable electricity

		Renewable electricity capacity (MW)						
Local Authority	Number of projects	Advanced treatment of waste	Hydro	Landfill gas	Onshore wind	Sewage gas	Solar PV	Area total
Bath & North East Somerset	108	0	0.024	0	0.006	0	0.268	0.298
Bristol City	152	0.225	0	0	6.005	5.750	0.444	12.424
North Somerset	149	0	0.009	2.349	0.020	0	0.461	2.839
South Gloucestershire	123	0	0.001	4.445	0.051	0	0. 357	4.854
Former Avon totals	-	0.225	0.034	6.794	6.082	5.750	1.530	20.415
Number of projects	532	1	3	5	8	1	514	-

Table 6.2 Regen South West Annual Survey data for the WoE - Sustainable heat

		Renewable heat capacity (MW)					
Local Authority	Number of projects	Advanced treatment of waste	Biomass	Heat pumps	Sewage gas	Solar thermal	Area total
Bath & North East Somerset	53	0	0.785	0.128	0	0.105	1.017
Bristol City	73	0	6.912	0.155	7.000	0.285	14.352
North Somerset	92	0	1.413	0.175	0	0.352	1.939
South Gloucestershire	105	0	1.525	0.262	0	0.256	2.043
LA unknown	1	0	0.160	0	0	0	0.160
Former Avon totals	-	0	10.795	0.719	7.000	0.998	19.512
Number of projects	324	0	43	35	1	245 -	



Legend

- Biomass
- Onshore wind
- Landfill gas
- Sewage gas
- Solar PV
- Solar thermal
- Advanced Treatment of Waste

	Project	Capacity
1	Gillingstead School	0.15 MW
2	Harnhill Quarry Landfill	2.7 MW
3	Avonmouth Dock	6 MW
4	Avonmouth STW	6 MW
5	Berwick Farm	0.6 MW
6	Myrtle Drive	5 kW
7	Blaise Nursery	0.4 MW
8	Compact Power Pilot Scheme	0.2 MW
9	Westbury-on-Trym Primary Care Centre	unknown
10	Filton Hill Primary School	0.2 MW
11	Stoke Lodge Primary School	0.2 MW
12	South Glos Council Offices	0.4 MW
13	Abbotswood Primary School	0.2 MW
14	Trinity Primary School	0.1 MW
15	Redland Friends Meeting House	unknown
16	Colston Girls School	unknown
17	The Children's Scrapstore	unknown
18	Colston Hall	unknown
19	Bristol Museum	0.5 MW
20	Whitefield Fishponds Community School	0.36 MW
21	BSF Speedwell / BSF	0.4 MW
22	Kings Forest Primary School	0.2 MW
23	Sainsbury's Emersons Green	15 kW
24	Shortwood Quarry	1.14 MW
25	Yanley 1	1.56 MW
26	Florence Brown School	0.2 MW
27	The Park Community Centre	0.5 MW
28	BSF Hartcliffe Skanska	0.6 MW
29	BSF Brislington Enterprise College	0.65 MW
30	Winford Manor	0.3 MW
31	Portishead Swimming	0.4 MW
32	Yeo Bank, 105	40 kW
33	Goblin Combe	55 kW
34	The Mendip Centre	22 kW
35	Folly Farm Environment Centre	0.15 MW
36	St Mary's School	0.11 MW
37	Writhlington School	0.35 MW
38	Midford Castle	0.1 MW

Figure 6.9: Map of installed sustainable energy in the WoE (Regen South West 2011a)

7 Case Studies and Best Practice

Given an understanding of the local context as described in the preceding chapter of this report, there is much to be learned from case studies of organisations which have completed similar projects to those being envisioned for the WoE. Each location and context is different, but there are some lessons learned from around the country which can be of value in the WoE, as the national policy and legal context is common.

The following case studies outline existing projects covering a variety of locations, ownership structures and technologies. When setting up an Energy Service Company, or ESCo, the choice of ownership structure is key. Figures 7.1 and 7.2 summarise the ownership structures of the case studies discussed in this chapter. This illustrates that the majority of these organisations are some form of hybrid between different types of ownership, or partnership between different types of organisations. The majority fall within the Public/Private sectors or Private/Not for Profit sectors.

The areas of ownership, investment, control and risk are all closely linked, as shown in Figure 7.1.

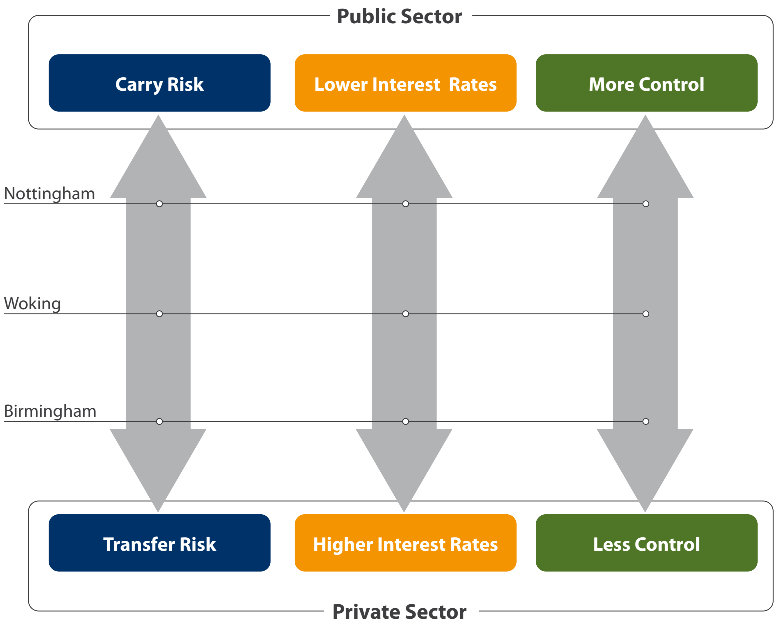


Figure 7.1: Comparison of public sector investment/ownership from the CHP association

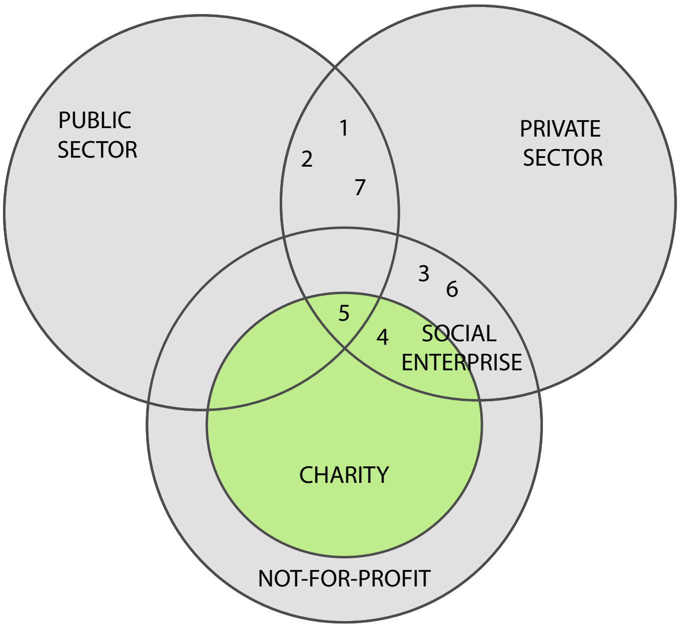
Adapted from: Community Energy; Planning; Development and Delivery. Michael King & Rob Shaw, 2010.

With each technology there are different motivations for looking closely at ownership structure. For some, there is a need for finance from the public or community sector, as they are more able to invest in projects with long payback periods than the private sector. For others, local community ownership and control can overcome resistance to changes to the landscape or heritage of the area. For district heating, there is a natural monopoly associated with the viability of the technology, where the need to address uptake risk leads to long term contracts or commitments between the energy supply company and the consumer. This leads to a risk to the consumer as consumer protection through the usual means of a competitive market is restricted. Community ownership and control offers a potential solution to this tension.

Case Studies and Best Practice

7.1 Case studies

The numbers associated with each case study reviewed in this chapter correspond to where they are mapped on Figure 7.2. This provides an illustration of the ownership structure used in each one.



1. Woking Council ESCo
2. Birmingham City Council CHP
3. Ouse Valley Energy Services Company
4. The Green Valley
5. Kielder
6. Baywind
7. Nottingham energy from waste

Figure 7.2: Project organisation structure map. Adapted from AECOM 2009

Woking Council ESCo (1)

Woking Council is recognised in the UK as being a leader in the provision of district energy through CHP systems. Initially the specialist knowledge required was sought externally through a Danish partner but as the project developed, the Environmental Energy Services Company (EESCo) developed in-house expertise. They now offer this in the form of consultancy on the open market.

Driver	Top down policy driven. Local authority Climate Change Strategy
Technology	Private electricity distribution system
	Solar PV / Vertical Wind Energy powered street lights
	A natural gas Combined Heat and Power (CHP) station in the town centre
	Solar PV and CHP to social housing developments
	Solar PV to public buildings including medical centres and swimming pools
	Fuel cell CHP system to leisure centre
Investment	Local council and private funding (Danish pension fund)
Skills	Initial external knowledge which has been developed in house and is now offered as external consultancy
Management	Woking Borough Council ESCo.

Birmingham City Council CHP (2)

Birmingham City Council installed their first CHP plant in 2007 providing energy to council buildings in the City Centre. The ESCo formed is run by an external large and experienced foreign operator with several members of the board coming from Birmingham City Council.

Driver	Birmingham Declaration, 50% carbon reduction by 2026. Sustainable Community Strategy
Technology	Currently multi site: Broad St scheme features district energy tri-generation (Heat, chilled water& electricity). Eastside scheme features CHP. The library features absorption cooling. More sites are currently planned to join the networks
Investment	DEFRA grant and private investment through Cofely District Energy (subsidiary of Paris based Index Group)
Management	Birmingham District ESCo

Ouse Valley Energy Services Company (OVESCO) (3)

Ouse Valley Energy Services Company is the UK first community-owned solar power station. The project was born out of the local Transition Town movement and was driven by a strong volunteer element that had sufficient technical knowledge to facilitate the project's progress. The community group also won a tender to provide energy efficient services to the local council, thus providing another income stream to the community group.

Driver	Transition Town movement
Technology	Solar PV (545 PV 1.5m^2 panels, 98kW)
Investment	All finance (£306,000) was raised through a share issue to the local community
Management	Through the community formed ESCo

The Green Valley (4)

The Green Valley company (currently applying for charity status) provides services mostly focused on community hydro power schemes in mid Wales. They specialise in 'high-head' hydro only, which places a significant constraint on their involvement in other hydro schemes. They are unique in that they offer finance, design, manufacture and installation services.

Driver	The founder spotted a gap in the market
Technology	High head hydro power only
Investment	Private finance (£20,000) and innovation prize winner (£300,000)
Management	Green Valley (parent company), PGV Hydro (Installation, design, finance), Hydro Light (manufacture)

Case Studies and Best Practice

Kielder (5)

Kielder Community Enterprises Ltd is the trading arm of Kielder Ltd, a registered charity set up to service various projects in a remote village community. A significant element of their activities includes the running of a biomass district heating scheme utilising the large local forestry industry as a cheap and reliable source of renewable energy.

Driver	Off-grid community with a significant local resource. Local council initiated the scheme that was then taken forward by the community
Technology	Biomass district heat supplied by local forest industry
Investment	Local council provided funding
Management	Kielder Ltd ESCo

Baywind (6)

Originating in Cumbria, Baywind community energy co-operative is the first UK co-operative to own wind turbines, and now facilitates similar schemes throughout the UK through a cooperative development company called Energy4All. It was started in the mid-1980s on the initiative of a company from Sweden, where community owned wind power was already common. The co-operative functions in a similar way to a traditional limited company except that voting rights are distributed equally amongst members, no matter how many shares they own.

Driver	Local community ownership
Technology	5no. 500kW wind turbines
Investment	Initial share offer raised £1.2 million for 2 turbines. Further share offers raised the extra funds required. Local investors get priority over investors from further afield
Management	Co-operative style company formed by local residents

Nottingham energy from waste (7)

The energy from waste plant initially built by Boots in the 1970s in Nottingham is one of the largest such schemes in the UK. It supplies over 4,600 homes and variety of business premises with heat from an incinerator.

Driver	Recent additions have been driven by the Nottingham Energy Strategy
Technology	Energy from Waste (EfW) district heat
Investment	Local council and Low Carbon Infrastructure Fund
Management	ESCo formed by local council

7.2 Lessons learned about district energy

The case studies described in section 7.1 provide a means to explore different ownership structures for ESCos. This is especially important for district heating systems for a number of reasons and so a more detailed discussion of the lessons learned regarding district heating is provided below. These lessons were developed from conversations with people involved in the case studies.

District heating schemes are invariably instigated by local authorities due to the size and technology involved for efficient systems. Examples in the UK date back to the 1950's and there is increasing research and feasibility currently underway to increase the proportion of urban energy networks as they have a strong potential to reduce carbon emissions for entire towns and cities.

Although the technical knowledge is fairly readily available through industry supply chains, a recurrent theme in the case studies is the driving force within the local authority needed for success to be enabled. Birmingham's scheme that was developed from early 2001 required the council to undertake the project with few or no precedents. A significant area for consideration noted by all the district energy schemes was the attention that should be paid to procurement and contractual structures. Birmingham's procurement model was designed to cover only the city centre but now as the scheme has proved successful, and is therefore expanding, they are finding this old model insufficient. The element of future proofing should be incorporated into all aspects of district energy projects.

When Woking began to tackle the legal elements there was no clear case study to draw from and extra energy went into developing a framework with their legal team. As the legal precedent exists, new schemes should endeavour to benefit from it.

All of the case studies benefited from external sources of grant funding that are unlikely to be available now. Significant external investment was also required and in the case of Birmingham the baseload energy of existing council buildings provided the security on loans secured by the commercial partner in the ESCo that was formed. The private investor was permitted to make pre-agreed profits while the council's energy bills were guaranteed to be lower than it was projected that they would be without the investment . All profit over and above these agreed targets was split 50:50 between the council and private investor but the risk remained with the private element of the ESCo. Birmingham's new financial model for projects currently in development have loans taken by the council to install infrastructure financed by the implementation of a carrier charge to energy providers wishing to sell to customers over the network.

As district energy schemes are more common in continental Europe, technical expertise was sought by both Birmingham and Woking from French and Danish contractors respectively. To ensure sites were suitable for connection to the district scheme, Birmingham trailled wood fired boilers on potential sites to determine that the target threshold 5,000 run hours usage was reached. Its library also includes absorption cooling meaning waste heat is utilised in the warmer summer months. Although the private partner in the Birmingham ESCo is encouraged to increase participation in the district energy scheme, the city council maintain control to ensure all development takes place within the wider core strategy goals and there are no conflicts of interest.

The Woking scheme currently features a wide range of technologies and Birmingham is also exploring the installation of other appropriate technology. Discussions are in place to offer integrated services under a Multi Utility Service Company (MUSCo). It may be appropriate for WoE authorities to consider these trends when building capacity for sustainable energy.

In order to benefit from best practice within the public sector, cross-authority knowledge sharing should be maximised. Early enquiries with the local authorities above have indicated they are very willing to share any information that may benefit the WoE in their capacity building exercise.

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8 Opportunities

8.1 Introduction

This chapter discusses the opportunities for the delivery of sustainable energy in the WoE. These have been identified through reviewing the existing energy reports, the GIS mapping, the technical potential analysis, discussions held with the WoE project steering group and previous Buro Happold experience. The differing geographies and contexts of each UA, as discussed in previous chapters, have also been taken into account for this discussion.

This chapter looks first at the opportunities for the sustainable energy technologies in the whole of the WoE, then at opportunities for sustainable energy within each UA, and finally looks in particular at cross-boundary opportunities between UAs of the WoE.

The opportunities are illustrated primarily through the GIS maps, which are presented in the following pages.

Large wind

GIS data from the Regen South West wind map was used for all UAs. Large wind was also mapped in previous studies for Bristol, South Gloucestershire and B&NES, with different methodology and constraints. This data can be found in the respective consultants' reports.

Medium and Small Wind

GIS data from the Regen South West wind map was used for all UAs. Medium and small wind were both mapped in the previous studies for Bath and North East Somerset and Bristol, which can be found in the respective consultants' reports.

Biomass Woodland

The CSE 'wood fuel resource assessment' was provided in GIS format from the previous study for Bristol. This data covers the entire WoE.

Biomass Energy Crops

The CSE 'energy crops resource assessment' was provided in GIS format from the previous study for Bristol. This data covers the entire WoE.

Hydro power

Data from the Environment Agency study of hydro power potential was provided through Regen South West.

Solar PV and Solar Hot Water

These are not mapped as the potential for these technologies maps directly onto buildings and urban areas, and separate mapping of this was not carried out in the previous studies.

Heat pumps

These are not mapped as the potential for these technologies maps directly onto buildings and urban areas, and separate mapping of this was not carried out in the previous studies.

Opportunities

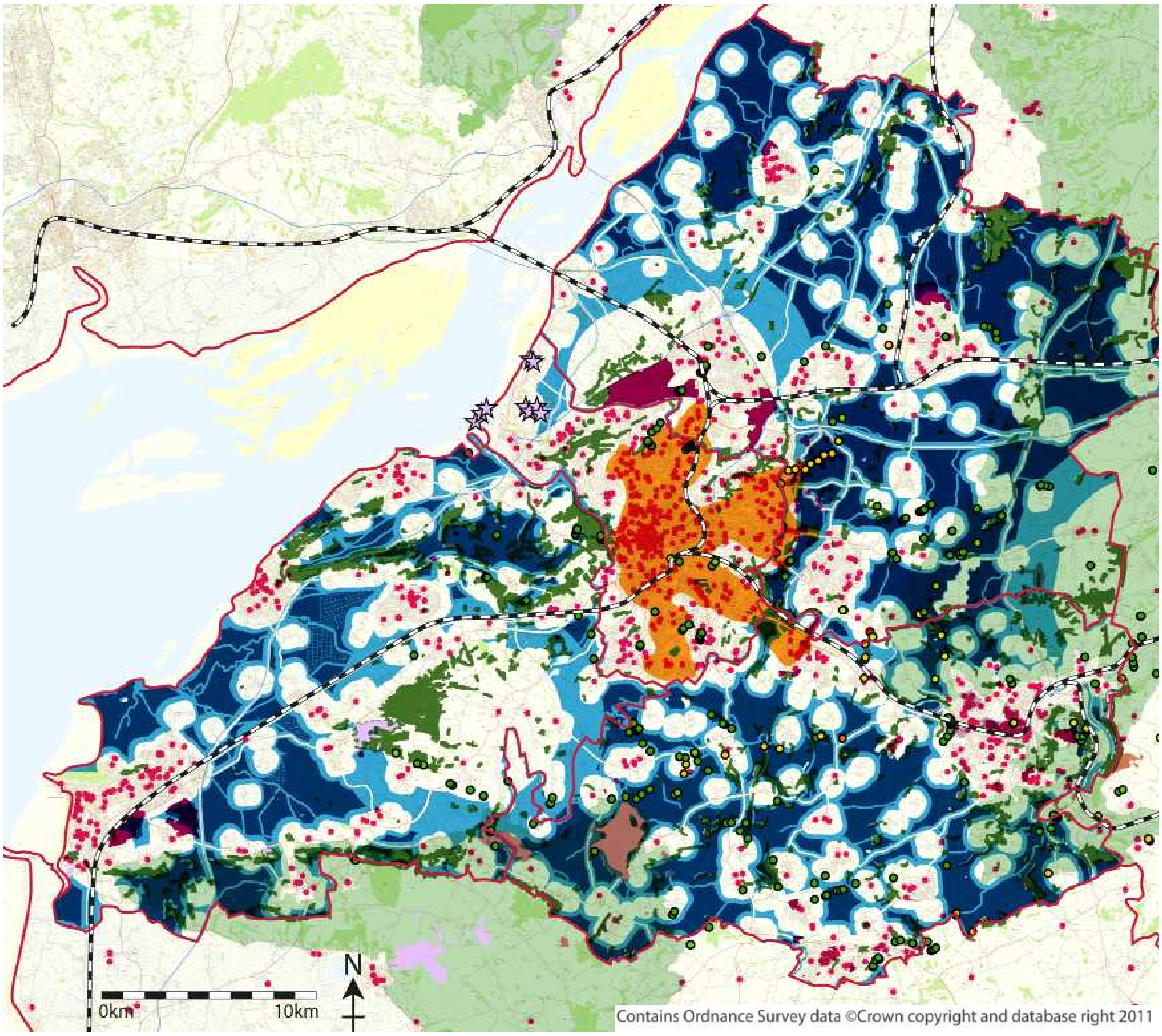


Figure 8.1: Map of all sustainable energy opportunities in the WoE

Technical Potential

New development sites

Strategic development sites allocated in core strategy (NS and SG) or in Local Plan (B&NES)

District heating sites

Bristol heat priority area

B&NES cluster zones for district heating

Anchor loads

Avonmouth wind turbines

Unitary Authority Boundary

Rail Network

Woodland

Large wind capacity

Medium wind capacity

Area of Outstanding Natural Beauty

Sites of Special Scientific Interest

Bat Special Areas of Concervation

Hydro: power category (kW)

0 - 10

10-20

20 - 50

50 - 100

100 - 500

500 - 1500

Opportunities

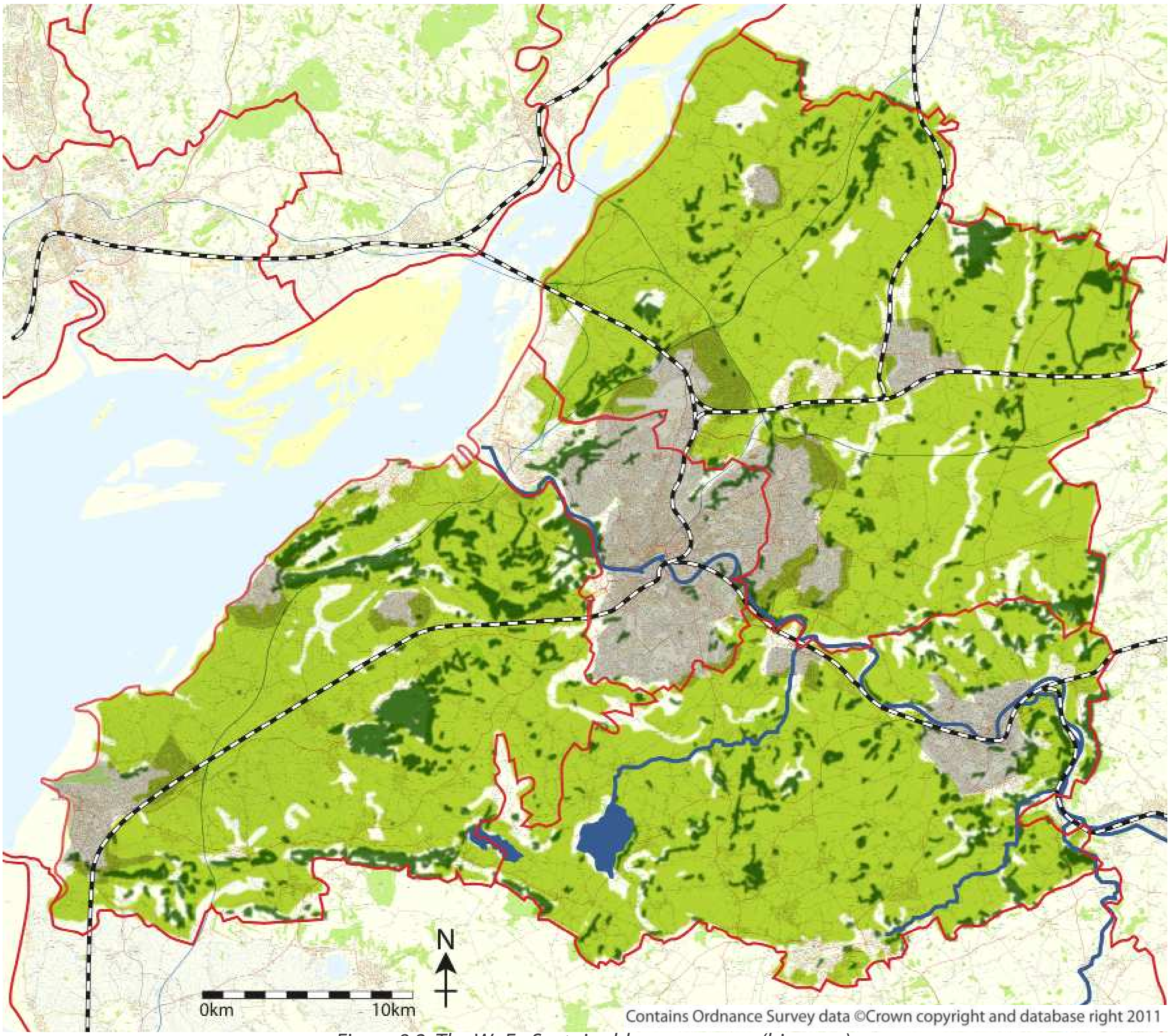
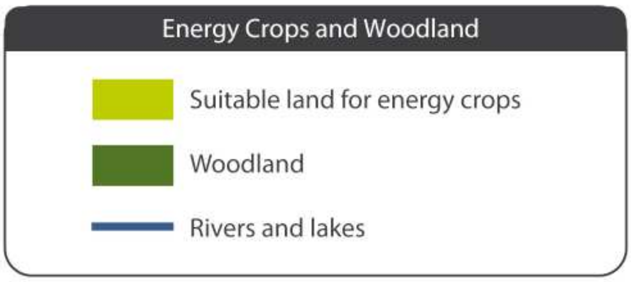


Figure 8.2: The WoE - Sustainable energy map (biomass)



Biomass opportunities in the WoE

There is significant energy crop opportunity throughout the rural areas in the WoE. There are also several areas of woodland, many of which may be suitable for biomass supply. The largest areas of woodland are in North Somerset, in Brockley wood and Kings wood, as well as to the north of South Gloucestershire, north east of Yate.

Opportunities

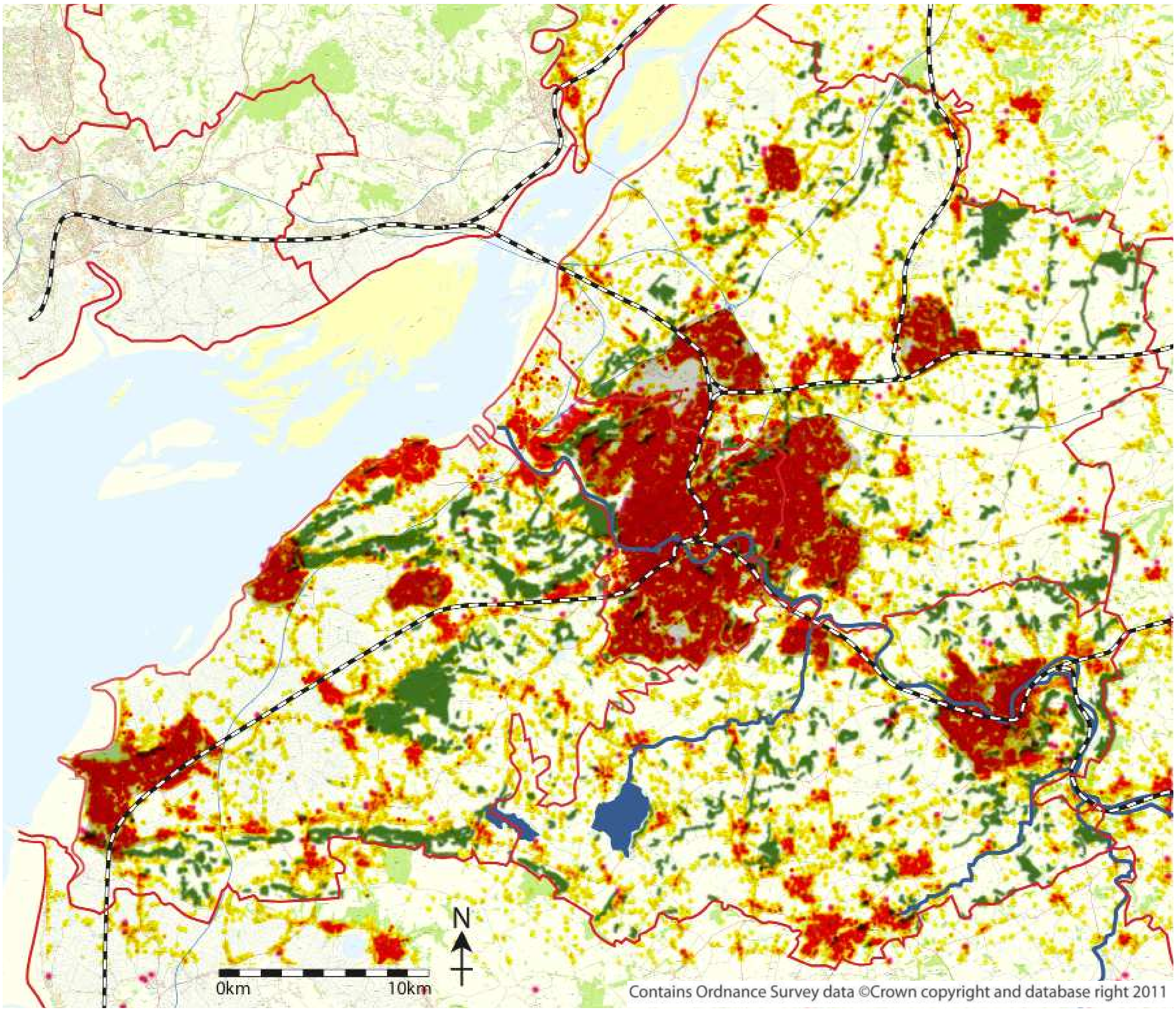
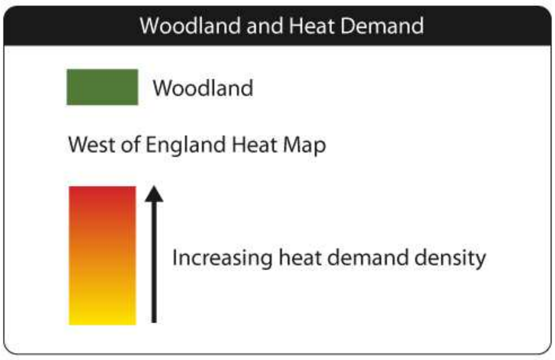


Figure 8.3: The WoE - Sustainable energy map (wood biomass and heat demand)



Woodland and heat demand

This map shows the correlation between woodland and heat demand. There are places where woodland is close to heat demand, and could be used to supply biomass for wood fired boilers or stoves. These areas include:

- Along the south of North Somerset.
- Near Clevedon and Portishead.
- Between Yatton and Nailsea.
- In parts of rural B&NES.
- Ashton Court, Leigh Woods, and Blaise, near Bristol.
- Woodland towards Thornbury to west of South Gloucestershire.

Opportunities

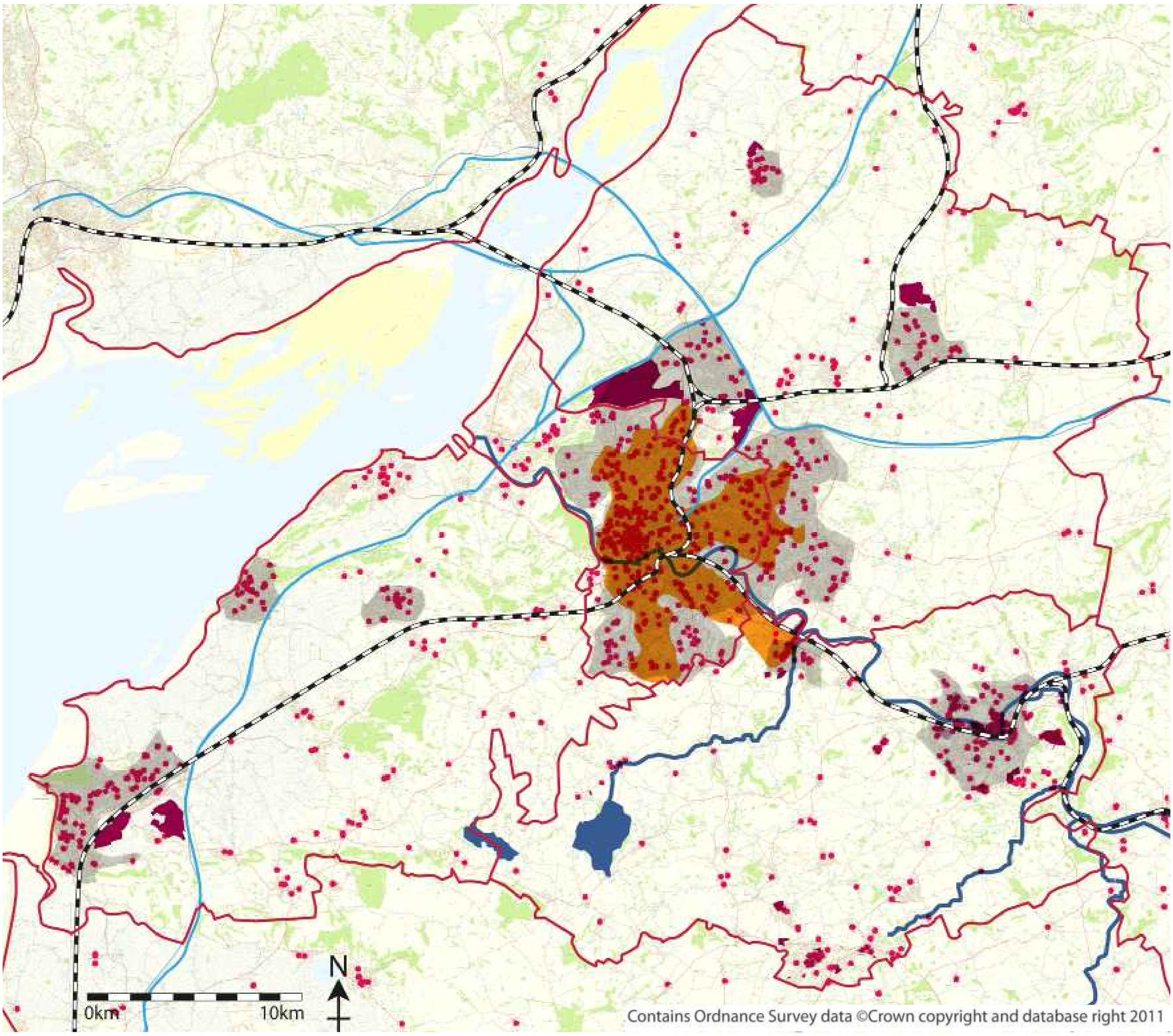


Figure 8.4: The WoE - Sustainable energy map (strategic development sites and anchor loads)

Strategic Development Sites and Anchor Loads

Strategic development sites

- Strategic development sites allocated in core strategy (NS and SG) or in Local Plan (B&NES)

District heating sites

- Bristol heat priority area
- B&NES cluster zones for district heating
- Anchor loads

Strategic development sites and anchor loads

There is opportunity for heat network development where there are existing 'anchor loads' or buildings with high heat demand, and where there are new developments which could install district heating from the outset. The locations of anchor loads and strategic new development sites identifided in the core strategy or in the local plan are therefore shown together, with the identified priority areas for district heating.

Opportunities

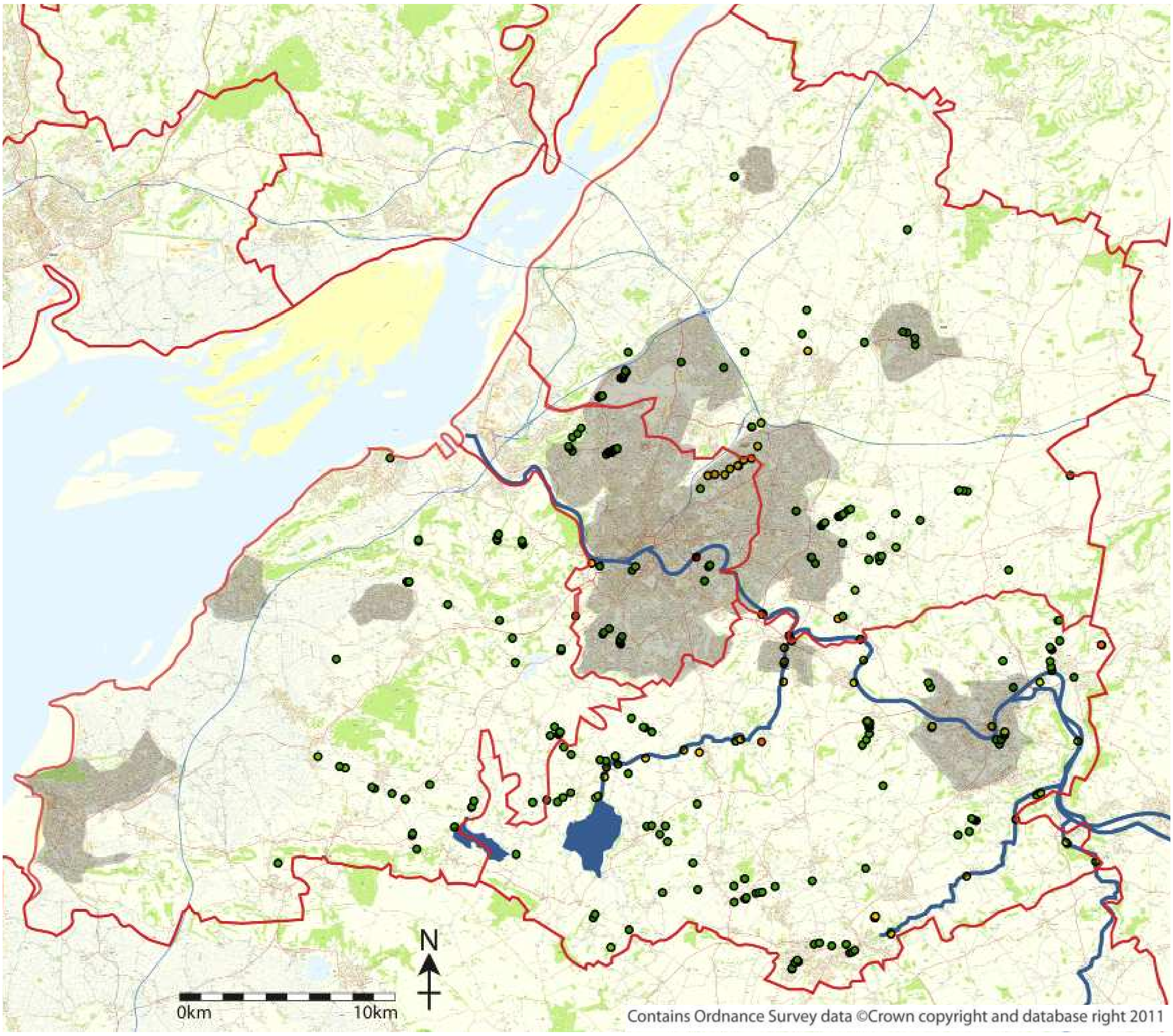


Figure 8.5: The WoE - Sustainable energy map (hydro power)

Hydro power opportunities:

There is significant opportunity for hydro power along the river Chew and the river Avon in B&NES. Hydro power potential is also being researched near Snuff Mills/Oldbury Court on the river Frome in Bristol.

Hydro power provides opportunity for community energy groups, including Bath Community Energy.

The largest single opportunities for hydro power in the WoE are:

- The weir in the river Avon in Keynsham
- The wier in the river Avon near Feeder road, where floating harbour feeds off from the river.

Opportunities

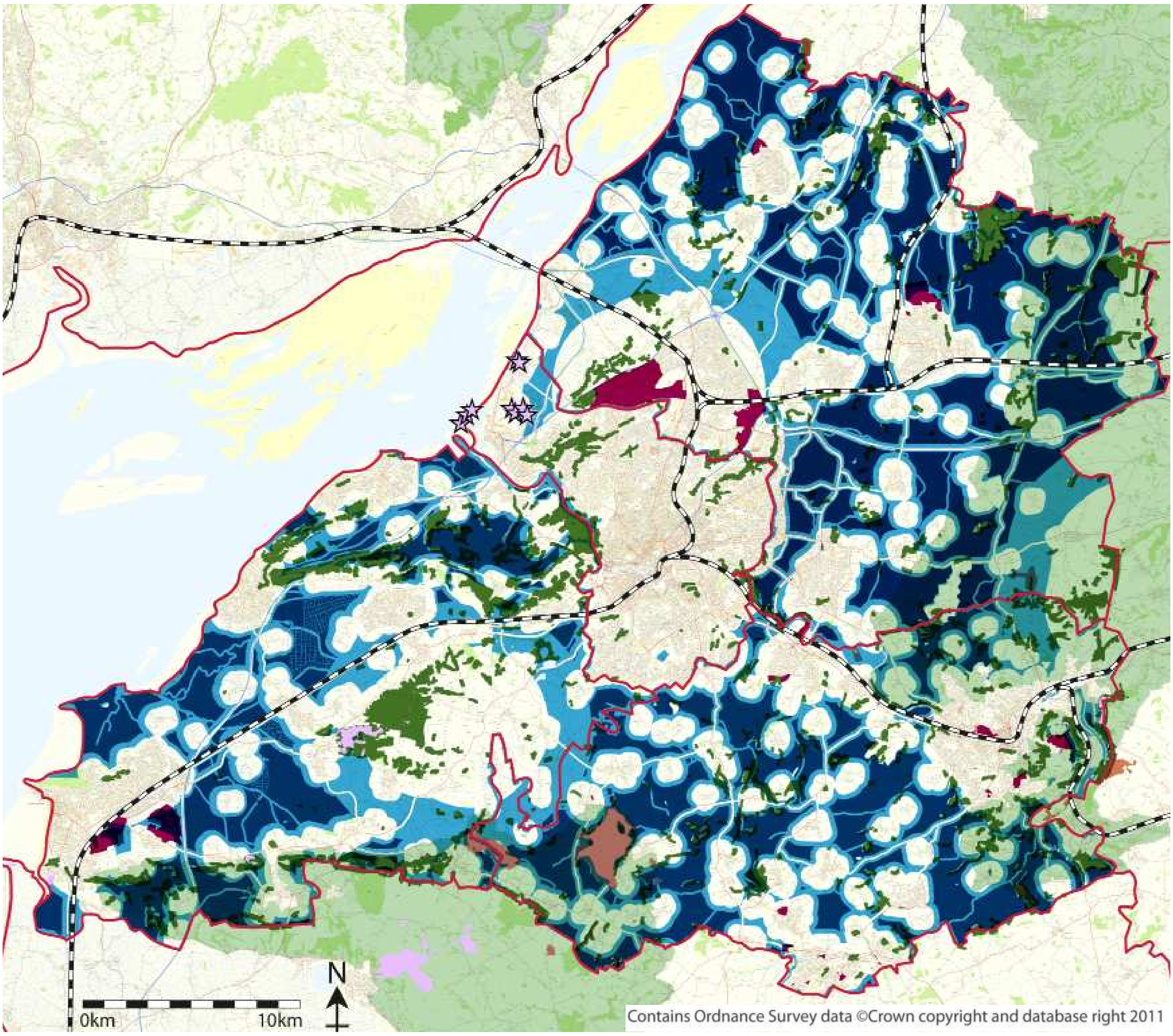
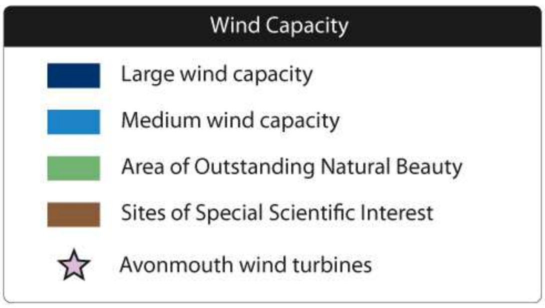


Figure 8.6: The WoE - Sustainable energy map (Wind and AONB/SSSI)



Wind power opportunities

This map shows the Regen South West wind potential, for large and medium wind. This is the practically accessible resource, with exclusion areas around built-up areas, roads, airfields etc, but not excluding SSSI or AONB areas. It also assumes there is no potential for large wind within the Bristol UA, whereas in Avonmouth there are already several large wind turbines. There is significant wind potential in South Gloucestershire, in B&NES and in North Somerset.

Previous studies with further constraints for wind (e.g. landscape, individual houses, AONB) have been carried out, but are not shown here for consistency and comparability between UAs.

Filton Airfield is now due to be decommissioned, which will further increase the wind potential in South Gloucestershire and north Bristol.

The map shows wind potential at the eastern fringe of Bristol, in South Gloucestershire, a built up area, and at Chew valley lake, a body of water. These areas are not actually viable for wind power, as water bodies and built up areas should be excluded as detailed in the DECC methodology.

Opportunities

8.2 Unitary Authority specific opportunities

The following pages show opportunities specific to each Unitary Authority. This is shown with a zoomed in map of all sustainable energy opportunities for each UA, a pie chart showing the technical potential for each sustainable energy technology (which are mapped geographically when applicable, while others are only shown numerically), and a table summarising the key opportunities available.

Opportunities

Specific Unitary Authority opportunities

8.3 South Gloucestershire

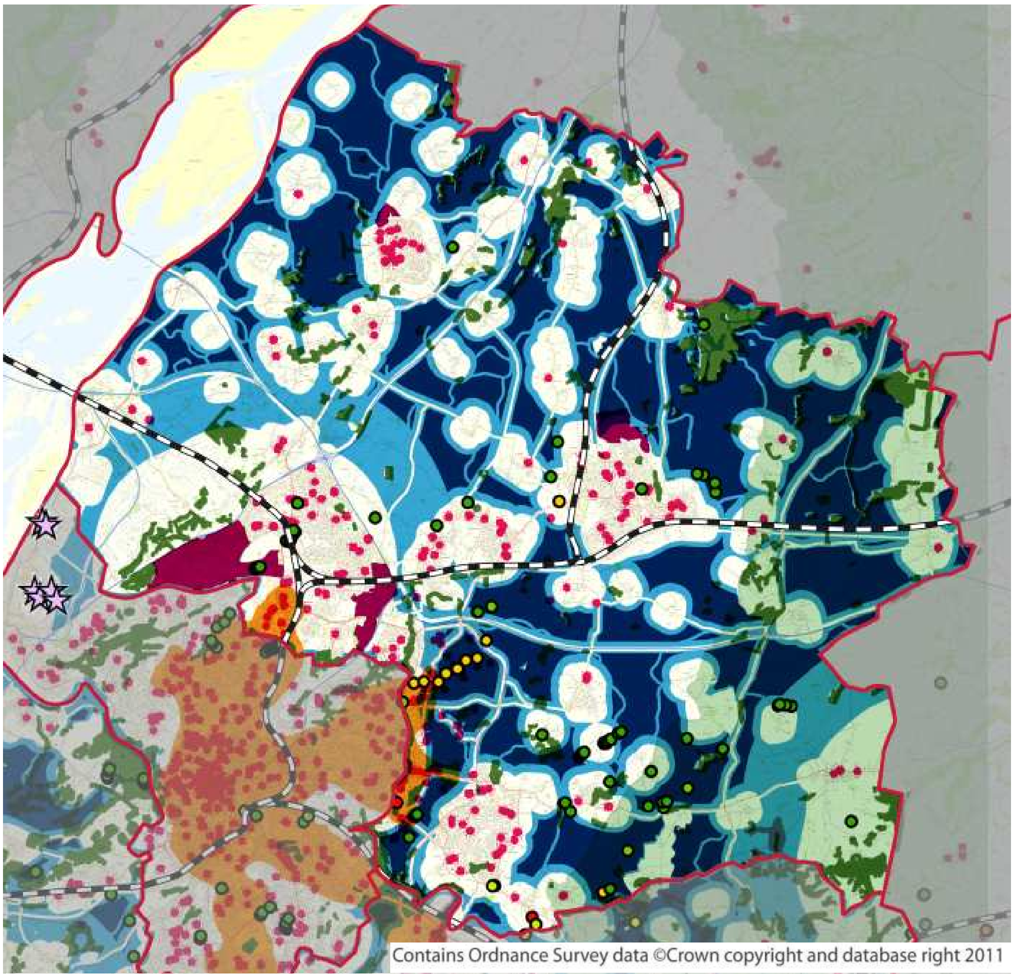
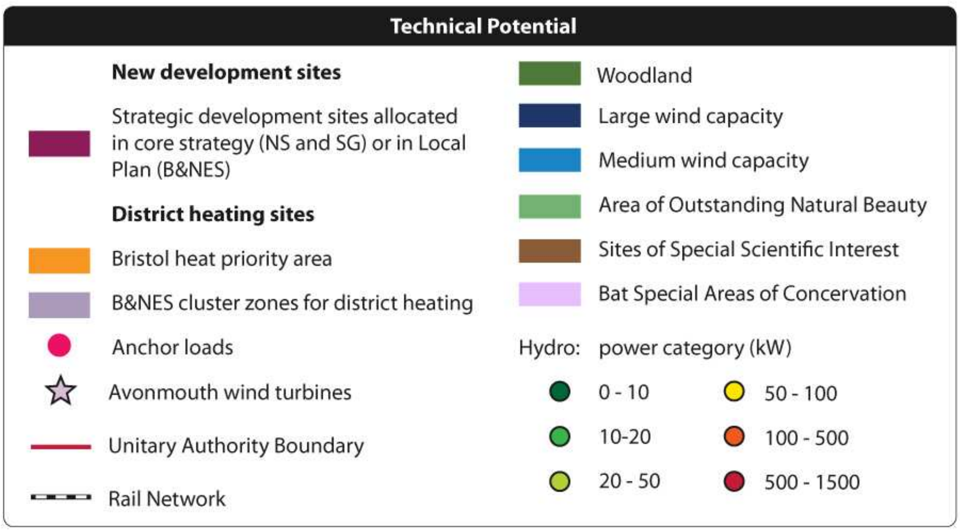


Figure 8.7: South Gloucestershire sustainable energy map



Opportunities

South Gloucestershire

From the analysis of technical potential in chapter three of this report, in South Gloucestershire the greatest potential for sustainable energy is from biomass (41%), due to the large area of agricultural land. Wind follows at 21%, with energy from waste at 19%. Solar (PV and hot water) and heat pumps could provide 9% and 10% of energy respectively. Table 8.1 shows site specific opportunities identified from the maps and steering group workshops.

Table 8.1 Opportunities for sustainable energy in South Gloucestershire

Area	Technology mix	Opportunity
North Yate	Energy from Waste and heat network	Brimsham Secondary School could provide an anchor load. Waste site in the Joint Waste Core Strategy.
Cribbs / Patchway	CHP and heat network	Rolls Royce could supply local commercial businesses with sustainable energy. Heat network could extend to Southmead hospital. Site adjacent to Chartlon Hayes with consent for 22,000 homes. Sea Bank power station 5km west of Cribbs Causeway has potential to supply heat to development area. Planning submitted by SITA for 37MWe energy from waste. Potential future commercial development on Filton Airfield site.
Severnside	Gas power station	New gas fired power station proposed on border with Avonmouth (Bristol). Potential for heat network connection to make use of waste heat.
Alveston	Wind farm	Planned Ecotricity 6.9MW wind farm.
Several areas	Wind power	South Gloucestershire has the greatest wind potential in the WoE, and with the closing of Filton Airfield, the potential for wind power is even greater. Some of the wind potential is within the Cotswolds AONB, and so will need to be treated with caution.
Harry Stoke	CHP and heat network	Frenchay hospital and UWE could provide anchor loads for heat networks, although for Frenchay Hospital this would need to cross the M32.
Rural areas	Biomass	There is significant biomass (energy crops) potential in South Gloucestershire.

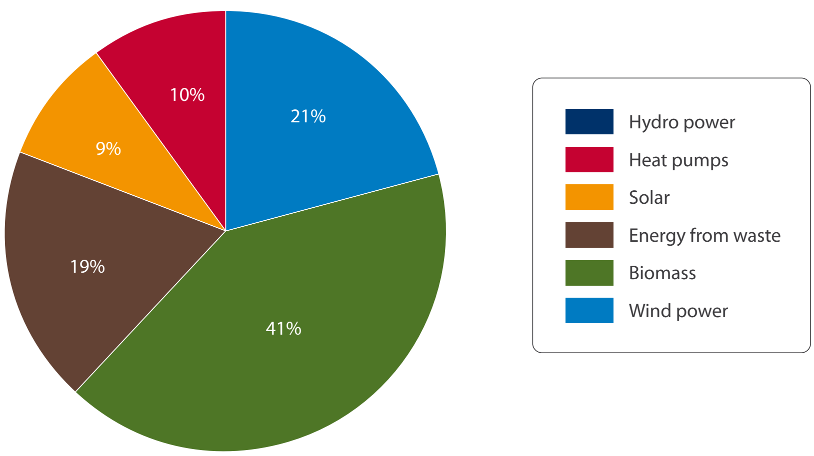


Figure 8.8: South Gloucestershire technical potential for sustainable energy

Opportunities

8.4 Bristol

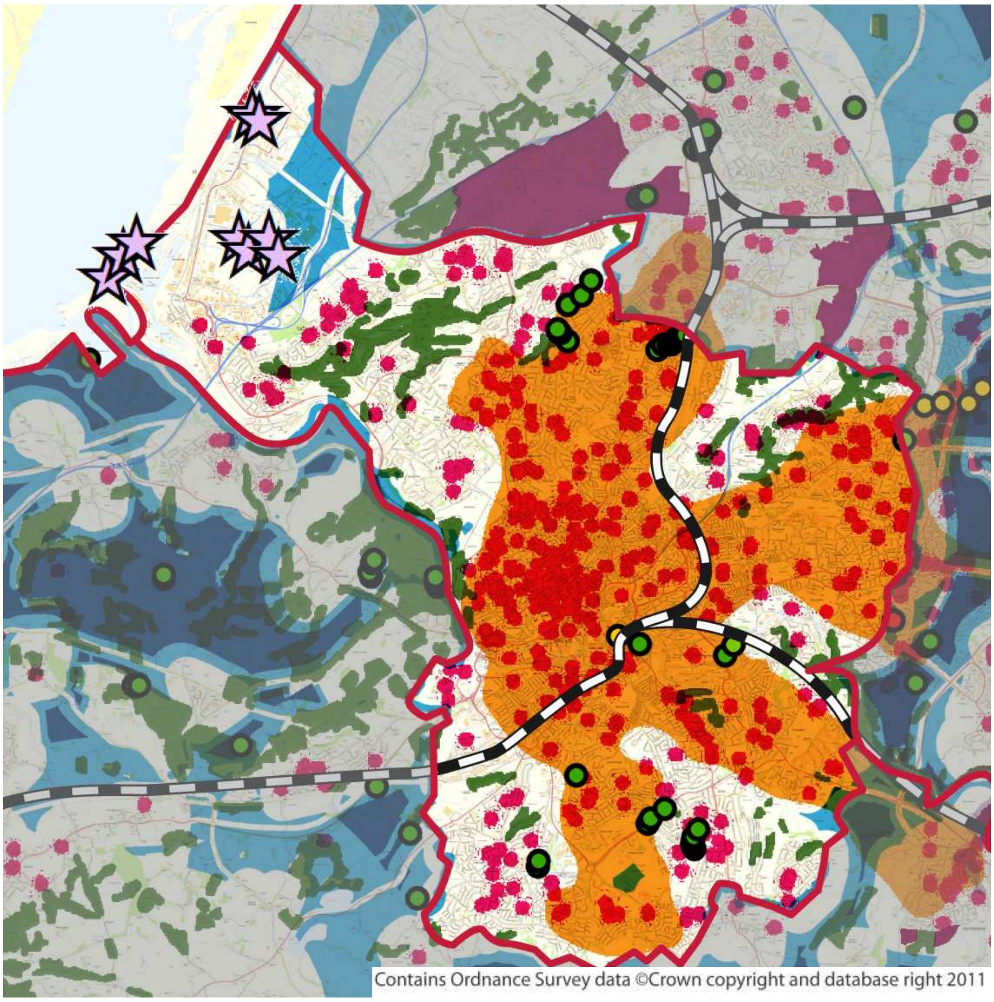


Figure 8.9: Bristol sustainable energy map

Technical Potential

New development sites

- Strategic development sites allocated in core strategy (NS and SG) or in Local Plan (B&NES)

District heating sites

- Bristol heat priority area
- B&NES cluster zones for district heating
- Anchor loads
- Avonmouth wind turbines
- Unitary Authority Boundary
- Rail Network

- Woodland
- Large wind capacity
- Medium wind capacity
- Area of Outstanding Natural Beauty
- Sites of Special Scientific Interest
- Bat Special Areas of Concervation

Hydro: power category (kW)

- 0 - 10
- 10-20
- 20 - 50
- 50 - 100
- 100 - 500
- 500 - 1500

Opportunities

Bristol

From the analysis of technical potential in chapter three of this report, the majority of sustainable energy potential within Bristol is for energy from waste (73%) much of which is imported from South Gloucestershire as per the Joint Waste Core Strategy. This is followed by air or ground sourced heat pumps (14%) and solar (PV and hot water) (12%). All of these building integrated technologies are scaled by the number of buildings. Bristol also has some potential for wind, including significant installed capacity in Avonmouth. The 'technical potential' assessment carried out by Regen South West was used here for consistency although this gave a 'zero' potential for wind power in Bristol to the urban nature of the city. . Table 8.2 shows site specific opportunities identified from the maps and steering group workshops.

Table 8.2 Opportunities for sustainable energy in Bristol

Area	Technology mix	Opportunity
Avonmouth	Wind power CHP and heat network	Installed 6MWe wind turbines. Full capacity for wind deployment should be explored as this area is identified as having good technical potential. Potential for CHP from energy from waste or biomass, but in the short term connection to residential loads in city centre is likely to not be economically viable due to the large distance of the pipe which would be required.
Heat network anchor loads	CHP and heat network	Opportunities for heat network anchor loads at: Southmead hospital, Bristol University, UWE, Bristol City Council buildings, Hengrove hospital and leisure centre.
Lockleaze, Clifton Downs, Henbury, Filton.	Wind power	Some opportunity for wind, mainly small, a little medium, and very little large wind. This opportunity was identified in the CSE study, but is not shown here in the Regen SW data, due to the different methodology and constraints applied to the built up area.
Heat priority area	CHP and heat network	There are a number of new development sites around Bristol, of varying sizes, including Hengrove new housing, Dove Lane, and Redcliffe. They could be constructed to be ready to connect to a district heating system if and when it is implemented, and potentially to contribute to retrofitting of district heating in the surrounding area through S106 contributions or Allowable Solutions.

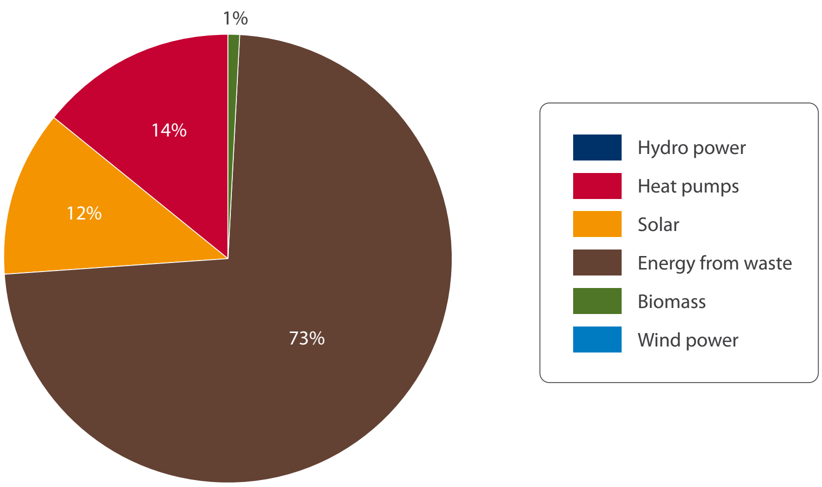


Figure 8.10: Bristol technical potential for sustainable energy

8.5 Bath and North East Somerset

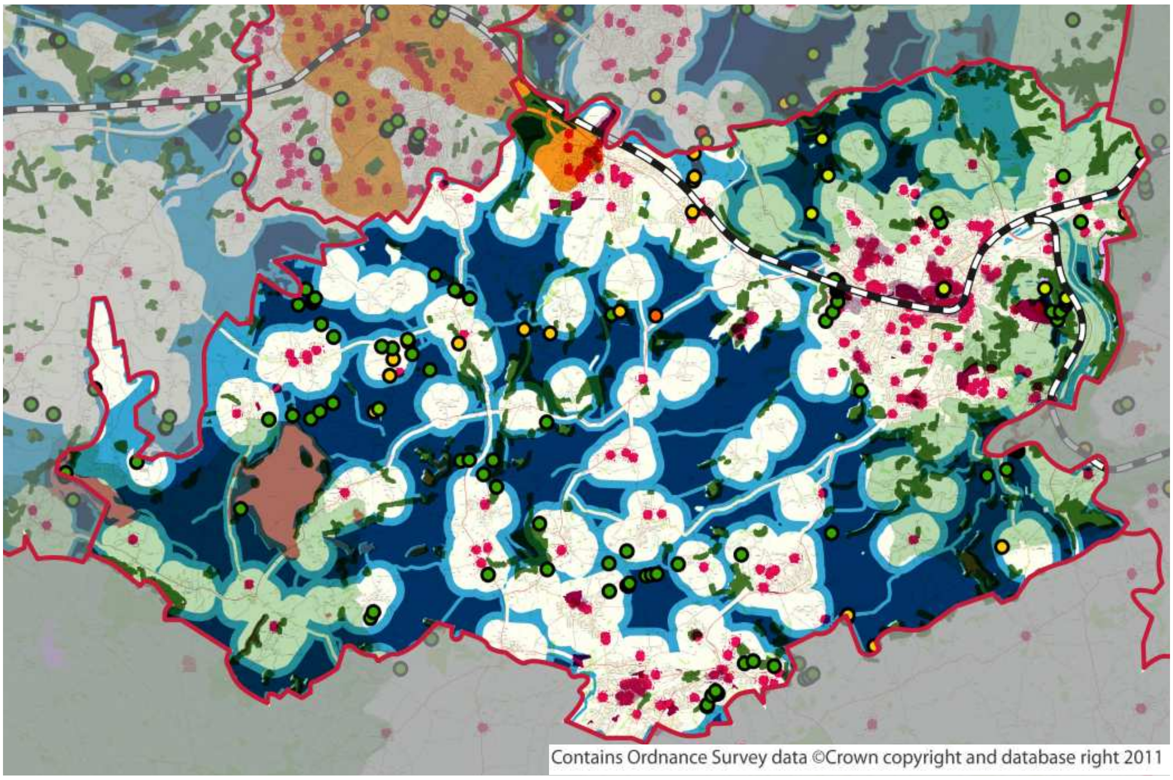


Figure 8.11: Bath and North East Somerset sustainable energy map

Technical Potential

New development sites

Strategic development sites allocated in core strategy (NS and SG) or in Local Plan (B&NES)

District heating sites

Bristol heat priority area

B&NES cluster zones for district heating

Anchor loads

Avonmouth wind turbines

Unitary Authority Boundary

Rail Network

Woodland

Large wind capacity

Medium wind capacity

Area of Outstanding Natural Beauty

Sites of Special Scientific Interest

Bat Special Areas of Concervation

Hydro: power category (kW)

0 - 10

10-20

20 - 50

50 - 100

100 - 500

500 - 1500

Opportunities

Bath and North East Somerset

From the analysis of technical potential as described in chapter three of this report, in B&NES there is significant potential for energy from waste (33%) and from biomass (32%), followed by wind (17%) then solar (PV and hot water) and heat pumps (8% and 9% respectively). B&NES also has more hydro power potential than the other UAs in the WoE (at 1%). The figure for energy from waste should be treated with caution, as there is a policy against energy from waste in B&NES. Table 8.3 shows site specific opportunities identified from the maps and steering group workshops.

Table 8.3 Opportunities for sustainable energy in B&NES

Area	Technology mix	Opportunity
Bath western riverside	CHP and heat network	Potential for sustainable energy supply for the area with deployment of heat networks and CHP, although various stakeholders would need to be engaged.
Bath centre	CHP and heat network	Provide opportunities for hard to heat buildings to be served by low carbon heat networks. UA as major land owner carries good influence. Projected low rate of return means that significant private investment may be difficult to obtain, and partnership with Bath and West Community Energy could be explored.
Keynsham	CHP and heat network	High level of commercial viability. Council in strong position to lead on implementation of small scale heat from the town hall to the riverside centre.
Several places	Wind power	There is significant potential for large wind power and for medium or small wind power within B&NES. Due consideration will need to be given to the Area of Outstanding Natural Beauty in the Cotswolds and the Mendips, and surrounding the city of Bath. The CAMCO study for B&NES applied further constraints, and carried out a landscape sensitivity analysis. This is not shown here, but is available in the original CAMCO report for reference .
Several places	Hydro power	There are several sites suitable for hydro power in B&NES, however the total electricity they could generate is only 1% of the total potential for sustainable energy.

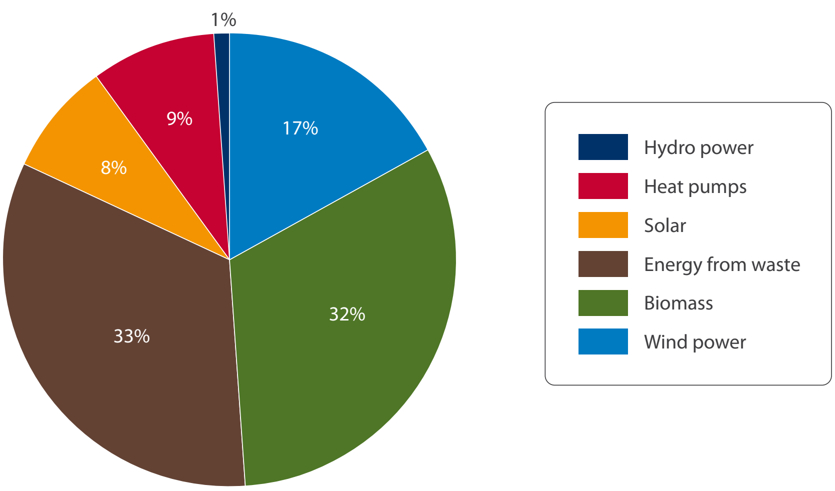


Figure 8.12: B&NES technical potential for sustainable energy

Opportunities

8.6 North Somerset

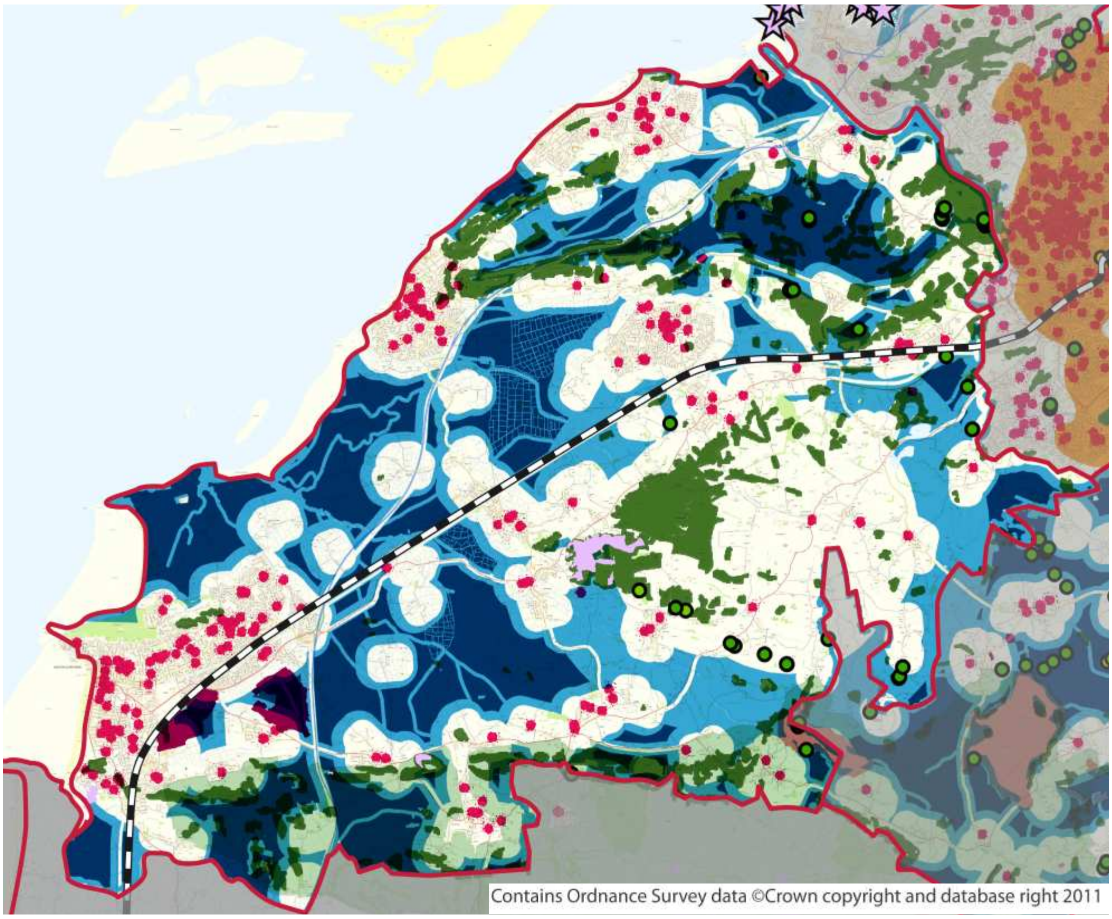


Figure 8.13: North somerset sustainable energy map

Technical Potential

New development sites

- Strategic development sites allocated in core strategy (NS and SG) or in Local Plan (B&NES)

District heating sites

- Bristol heat priority area
- B&NES cluster zones for district heating
- Anchor loads
- Avonmouth wind turbines
- Unitary Authority Boundary
- Rail Network
- Woodland
- Large wind capacity
- Medium wind capacity
- Area of Outstanding Natural Beauty
- Sites of Special Scientific Interest
- Bat Special Areas of Concervation

Hydro: power category (kW)

- 0 - 10
- 10-20
- 20 - 50
- 50 - 100
- 100 - 500
- 500 - 1500

Opportunities

North Somerset

From the analysis of technical potential as described in chapter three of this report, North Somerset has a high potential for biomass (35%), followed by energy from waste (23%) and wind (20%). Solar (PV and hot water) and heat pumps could each provide 11% of energy demand. Table 8.4 shows site specific opportunities identified from the maps and steering group workshops.

Table 8.4 Opportunities for sustainable energy in North Somerset

Area	Technology mix	Opportunity
Weston Super Mare, Clevedon, Portishead, Nailsea	CHP and heat network	These urban areas all have heat demand loads which could support a district heating system, if the correct financing mechanism was found.
Several	Wind power	There is significant potential for wind power in North Somerset. The Area of Outstanding Natural Beauty in the Mendips will need to be taken into consideration, but there is high wind potential in much of central and northern North Somerset. Bristol Airport presents the largest constraint on wind power in the UA. The concern of North Somerset for the impact of wind turbines on bats must also be taken into consideration.
Several	Biomass	There are several areas of existing woodland within North Somerset which could provide some biomass, as well as significant agricultural land.
Barrow Tanks	Hydro power	There is potential to use hydro power to generate electricity from the fall of water from the resevoirs into Bristol.

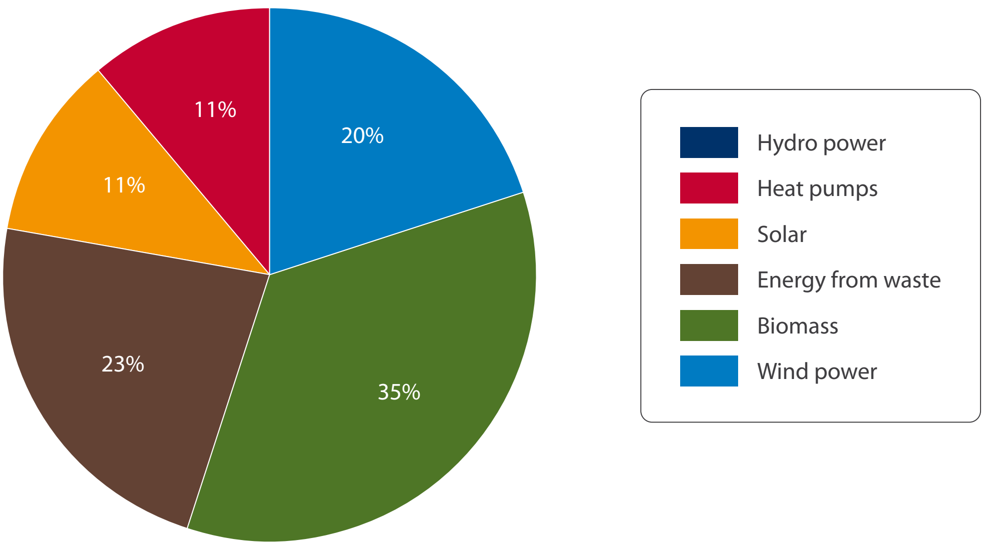


Figure 8.14: North Somerset technical potential for sustainable energy

8.7 Cross boundary opportunities for UAs

Cross boundary sustainable energy maps have been developed to identify specific strategic energy areas and locations from previous studies. The WoE boundaries have been assessed as follows:

1. South Gloucestershire boundary with Bristol
2. South Gloucestershire boundary with Bristol, B&NES and North Somerset
3. Bristol boundary with North Somerset
4. Bristol boundary with B&NES and South Gloucestershire
5. South Gloucestershire boundary with B&NES
6. North Somerset boundary with B&NES

It should be noted that the realisation of these opportunities would be subject to a new planning framework and a 'duty to co-operate' in the Localism Act (2011).

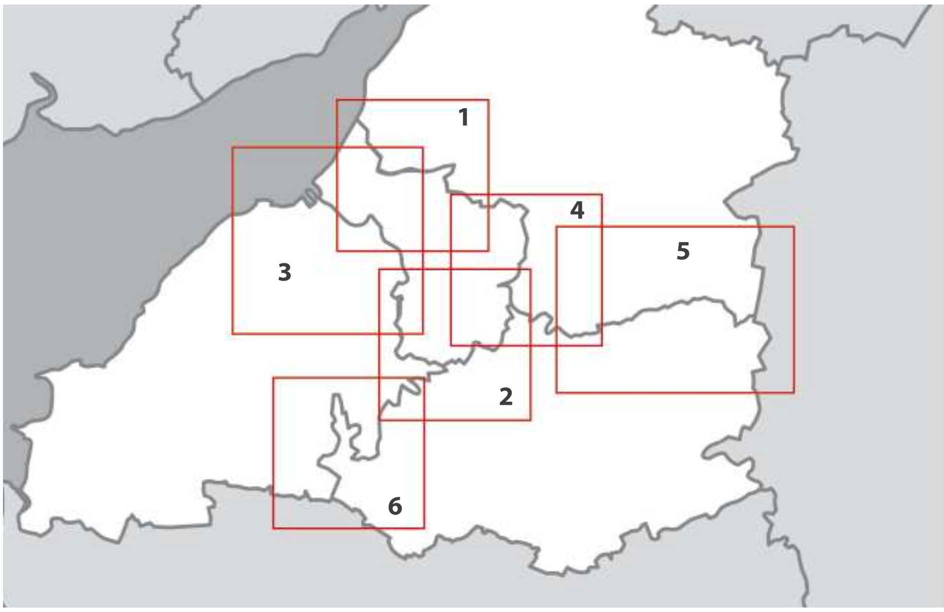


Figure 8.15: Key to boundary maps

Opportunities

8.7.1 South Gloucestershire boundary with Bristol (1)

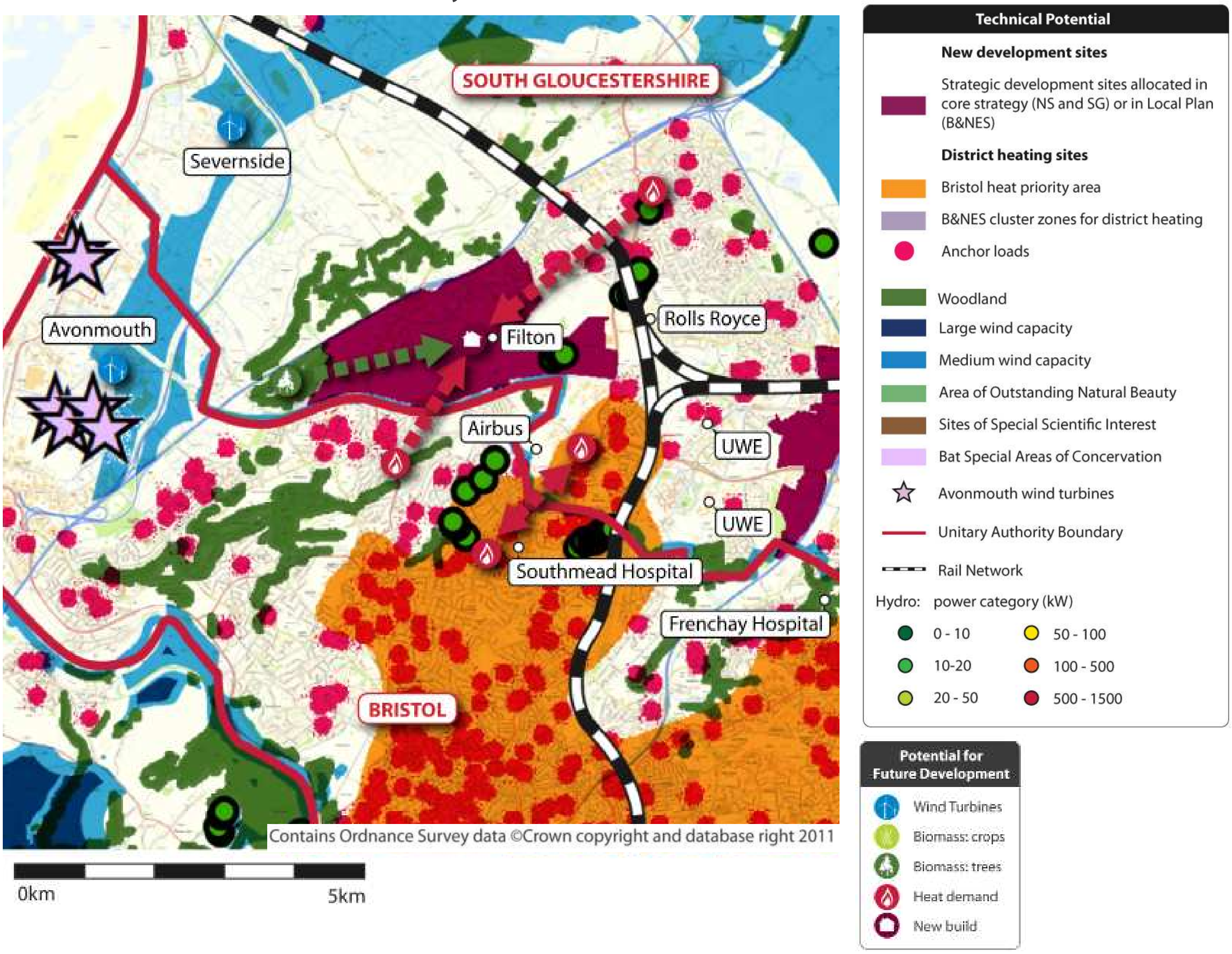


Figure 8.16: South Gloucestershire with Bristol boundary sustainable energy map

There are the following cross boundary opportunities:

- Strategic sites exist at Patchway and Cribbs Causeway for heat networks and CHP that adjoin the Bristol City border. There are a number of key anchor loads that could be used for triggering local heat networks here such as Rolls Royce, Airbus, UWE, Frenchay Hospital, Filton Airfield.
- There is potential for wind power across the South Gloucestershire and Bristol boundary at Avonmouth, and for heat networks from industrial sites at Avonmouth connecting with possible heat networks in Bristol and South Gloucestershire. The distances between Avonmouth and residential heat load centres mean that this is not likely to be currently economically viable, but it is technically possible, and may become economically viable in the future. A study into an industrial heat grid is currently being carried out by Low Carbon South West.

8.7.2 Bristol, B&NES, South Gloucestershire and North Somerset (2)

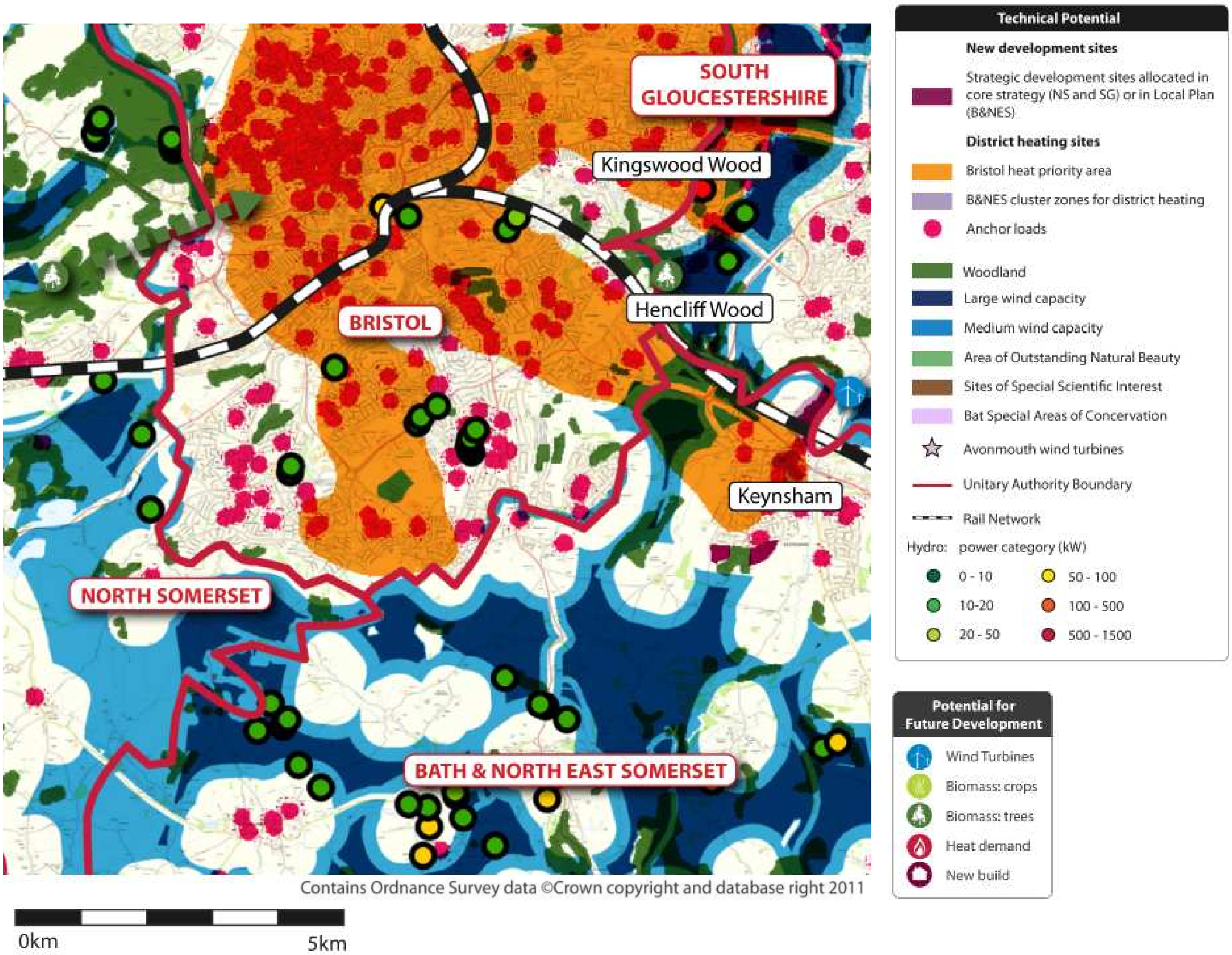


Figure 8.17: South Gloucestershire, Bristol, B&NES and North Somerset boundary sustainable energy map

There are the following cross boundary opportunities:

- The Bristol heat priority area crosses the boundary between Bristol and B&NES near Keynsham, and between Bristol and South Gloucestershire in the Kingswood area.
- There is potential for large wind power in B&NES and North Somerset near the boundary with Bristol, which could connect to nearby villages and to south Bristol.
- There is some woodland in Hencliffe Wood along the Avon, which could supply biomass to nearby residential areas.

Opportunities

8.7.3 Bristol and North Somerset (3)

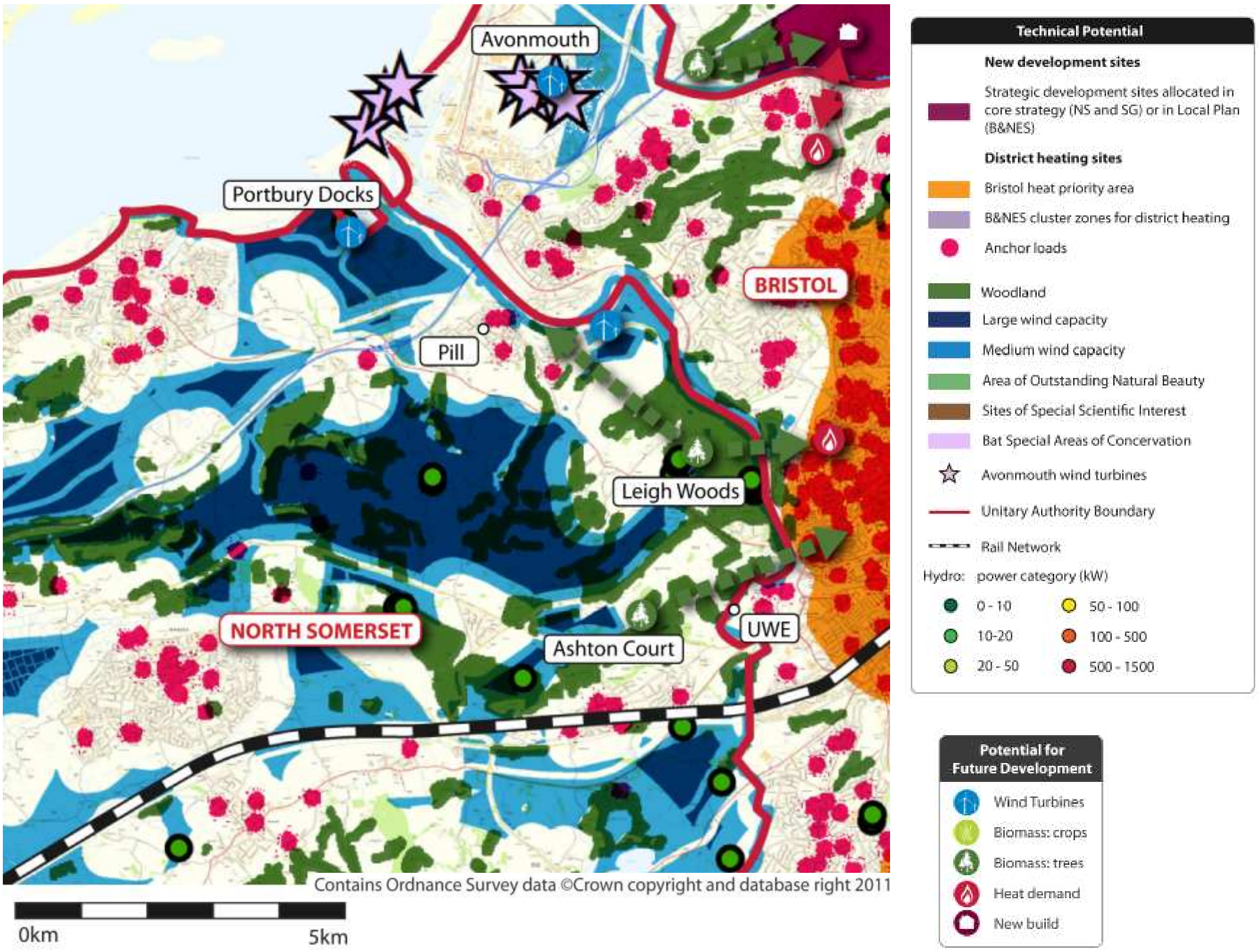


Figure 8.18: Bristol with North Somerset boundary sustainable energy map

There are the following cross boundary opportunities:

- There is potential for large wind power along the border at Portbury Docks, Avonmouth and south east of Pill.
- There is biomass wood resource potential from North Somerset (i.e. Ashton court and Leigh Woods), which could connect to heat demand in West Bristol.

Opportunities

8.7.4 Bristol, B&NES and South Gloucestershire (4)

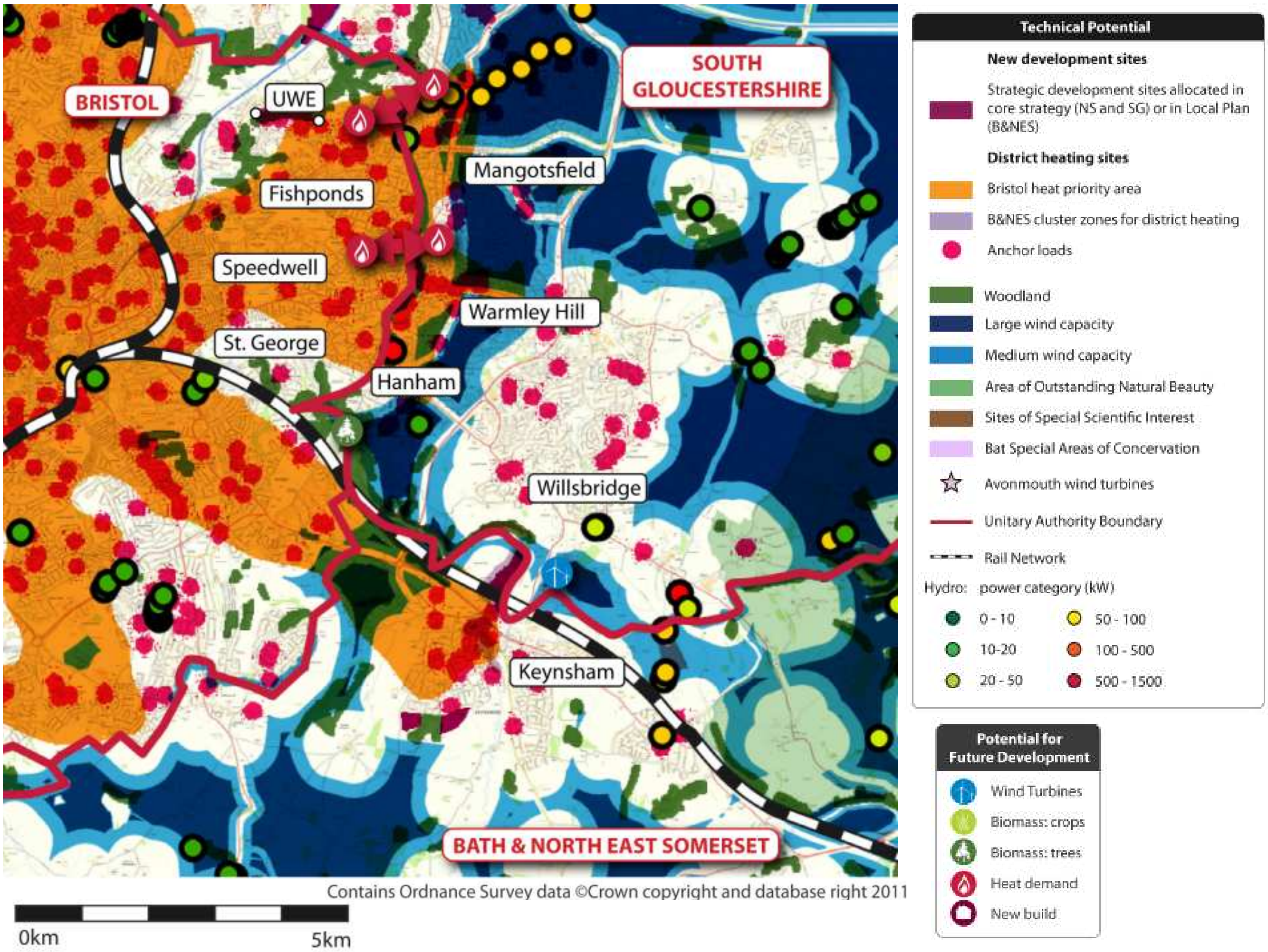


Figure 8.19: Bristol with B&NES and South Gloucestershire boundary sustainable energy map

There are the following cross boundary opportunities:

- Potential for large wind power on the B&NES border at Keynsham Hams serving either Keynsham or community at Willsbridge in South Gloucestershire
- Urban heat networks across the Bristol and South Gloucestershire border where networks could be explored between St George and Hanham, Speedwell and Warmley Hill, Fishpond and Mangotsfield.

Opportunities

8.7.5 South Gloucestershire and B&NES (5)

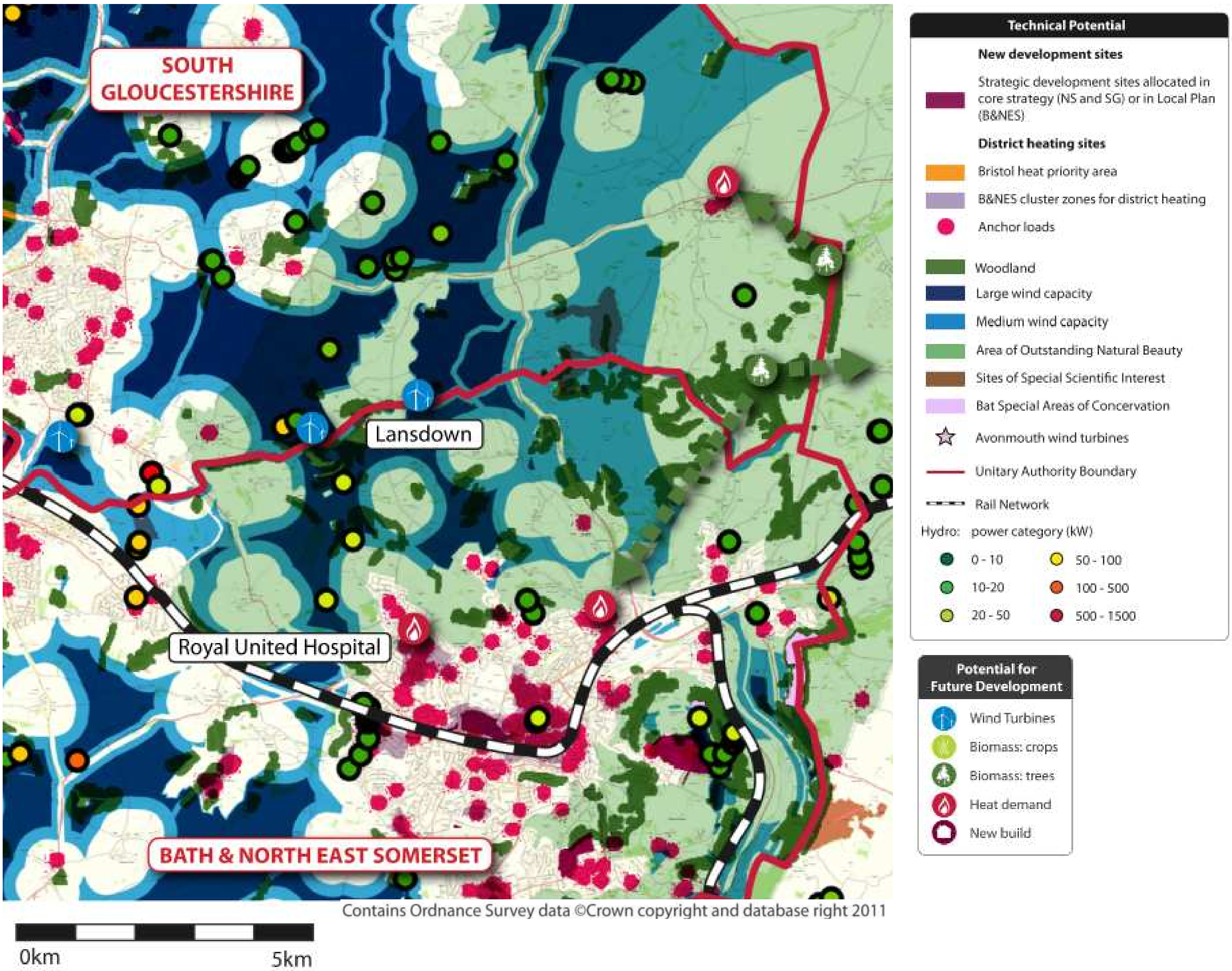


Figure 8.20: South Gloucestershire with B&NES boundary sustainable energy map

There are the following cross boundary opportunities:

- Large and medium wind power potential near Lansdown this would need to be considered against AONB constraints.
- Potential for biomass (energy crop) sources which could serve anchor loads and clusters to the north of Bath city for example the Royal United Hospital.

8.7.6 North Somerset and B&NES (6)

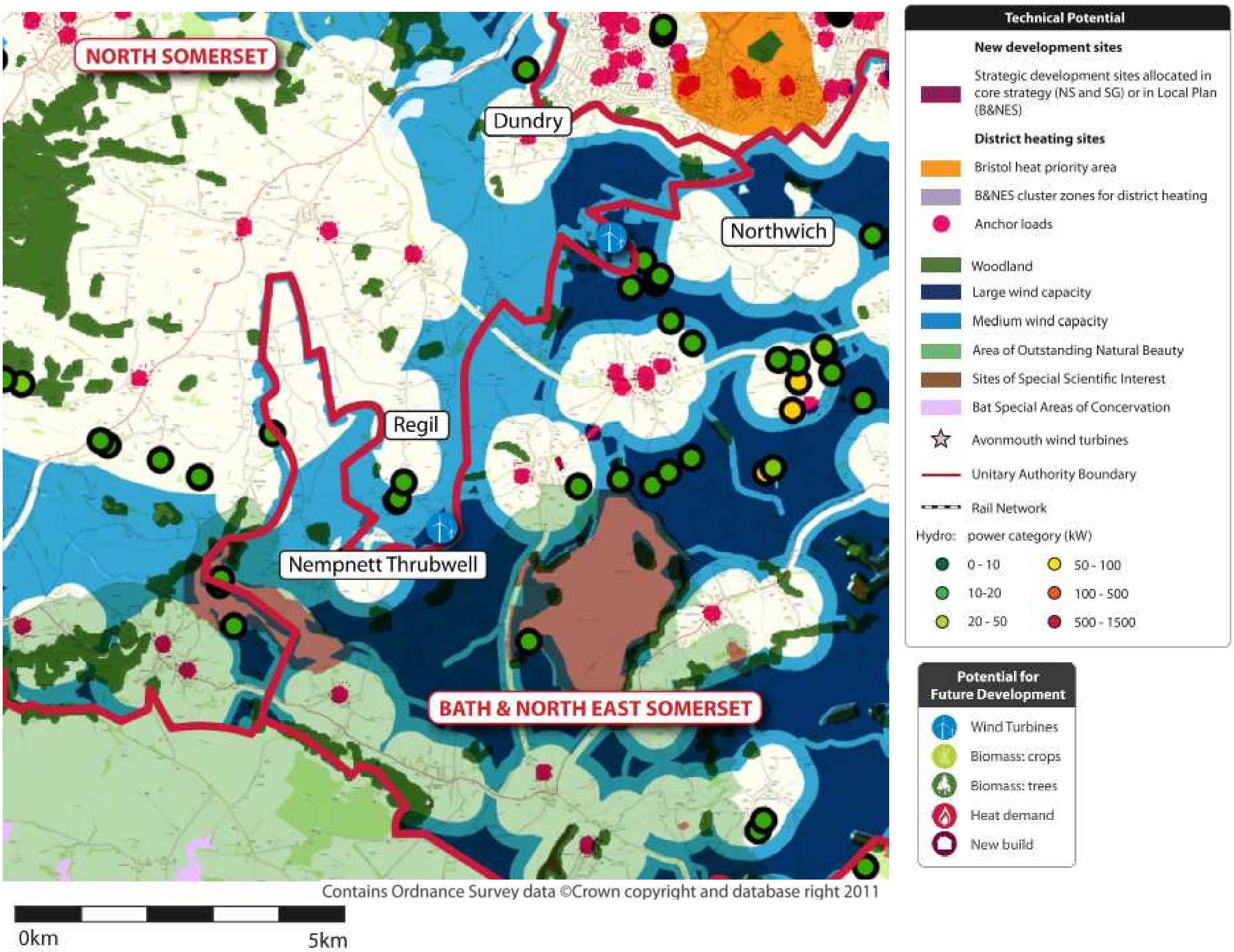


Figure 8.21: North Somerset with B&NES boundary sustainable energy map

There are the following cross boundary opportunities:

- There is large wind power potential with North Somerset near the boundaries of Nempnett Thrubwell, North Wick although these would need to be considered against AONB and SSSI constraints.

8.8 Cross-boundary opportunities

Table 8.5 Summary of cross-boundary opportunities

Boundary	Technology mix	Opportunity
South Gloucestershire/Bristol	Wind power	There is potential for wind power at **Avonmouth** and on the north side of the M32.
South Gloucestershire/Bristol	CHP and heat network - new development	There are planned development sites with South Gloucestershire/Bristol cross boundary district heat networks in: **Patchway/Cribbs Causeway**, **Filton/Brentry** and in **Harry Stoke** with potential for a heat network connecting **UWE** and adjacent residential development.
South Gloucestershire/Bristol	CHP and heat network - new development	There are several areas where the Bristol heat priority area goes across the boundary with South Gloucestershire. This includes the boundary between **Horfield** and **Filton**, and **Fishponds**, **Hillfield** and **Two Mile Hill** on the Bristol side and **Staple Hill**, **Soundwell** and **Kingswood** on the South Gloucestershire side.
South Gloucestershire/Bristol	Hydro power	There is potential for hydro power on the river **Frome** near **Snuff Mills**.
South Gloucestershire/ B&NES	Wind power	There are potential wind power sites shown within the AONB around the cotswolds in B&NES. Wind potential within the AONB was excluded in the South Gloucestershire mapping, although the DECC methodology states that this should be addressed on a case by case basis. There may be potential for a cross-boundary wind farm near **Hanging Hill** in South Gloucesterhsire, although planning permission may prove to be difficult as this is in an AONB.
Bristol/B&NES	CHP and heat network	The Bristol heat priority area from Bristol through the boundary with B&NES to Keynsham, indicating that there are cross boundary district heat opportunities. This also coincides with projected new residential development on the urban fringe of Bristol along the A4.
Bristol/North Somerset	Biomass	The woody biomass potential from **Leigh Woods** and **Ashton Court** in North Somerset could supply some biomass fuel to Bristol and North Somerset. CSE conducted a study into existing wood waste streams within Bristol in 2003, which would supply **Blaise nursery** and potentially up to two or three tower blocks. More intensive management could lead to a greater supply.
Bristol/North Somerset	Wind power	There are potential wind sites in North Somerset near the boundary with Bristol and near **Bishopsworth**, **Portbury docks** and **Ham Green**. However, the presence of the River Avon between Bristol and North Somerset restricts the potential for cross-boundary wind farms in the latter two.
North Somerset/ B&NES	Wind power	There is potential for wind power in North Somerset and in B&NES on the boundary between **Dundry** and **North Wick** (next to **Hartcliffe** in Bristol), and near **Nempnett Thrubwell**. These could be sites for cross-boundary wind farms.
North Somerset/ B&NES	Hydro power	There are potential hydroelectric sites along the river between **Winford** in North Somerset and **Chew Magna** in B&NES, and between **Regil** in North Somerset and **Chew Stoke** in B&NES. If several of these sites were to be developed, there could be potential collaboration or unification of development between the two UAs

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Opportunities

8.9 Delivery Framework

There are a wide variety of actors and stakeholders who have a potential role to play in delivering sustainable energy in the WoE. These include: UAs, public and private sector organisations, community groups and land owners.

Buro Happold has developed a delivery framework to enable the UAs to assess the opportunities for driving forward sustainable energy in the WoE and the role which each of these different actors and stakeholders could play. This framework takes the form of a matrix of energy technologies versus actors and stakeholders shown in Table 8.6.

The left hand side of the table focuses on the role of the UA in several different capacities including planning policy, strategic planning, direct procurement, stakeholder influence, and lobbying national government.

The right hand side explores the potential role of a number of other actors, including public sector organisations, commercial building/land owners, private building/land owners, private sector supply chain, and community groups.

The framework is organised by each sustainable energy technology, identifying the potential roles and opportunities for each actor separately. This allows comparison and integration with the numerical and geographical analysis discussed in the earlier chapters of this report.

The delivery framework was initially drafted following Stage One of this study, and informed the selection of key stakeholder groups and themes for the workshops which took place in stage two. The content of the workshops and the selection of speakers was also informed by the delivery framework.

Opportunities

Table 8.6 Delivery Framework

Actor	Unitary Authority (UA)				
Sustainable energy technology / measure	Planning policy	Planning	Direct procurement	Stakeholder influence	Lobby national government
General	Use ambitious targets to catalyse investment, release financing and encourage the step change required for maximum deployment towards the technical potential.	Take into account wider context e.g. offshore renewables (tidal, wave, wind), national plans for nuclear power and gas, etc. in the region. Ensure these provide local benefit (e.g. jobs, contributions to infrastructure etc.), and relate to local plans (heat networks etc). Consider land use characteristics of each UA, and the alignment between these.	Use whole life costing as part of long term procurement policies.	Support community energy projects e.g. Bath Community Energy and Bristol Energy Co-operative. Provide or engage with networking opportunities for actors delivering sustainable energy, including developing links between the not for profit, public and private sectors.	To have consistent policy and incentives showing a strong direction towards sustainable development and sustainable energy.
Wind (Commercial scale)	Include preferential areas for wind farms in LDF for the following key cross boundary sites: - Avonmouth. - Lansdown (border of B&NES pending consideration of AONB). - the M32 corridor near on the South Gloucestershire boundary. - Dundry/North Wick, on the North Somerset/ B&NES boundary. - Portbury Docks between North Somerset and Bristol. - Cotswolds on the South Gloucestershire/B&NES boundary.	Ensure that planning officers understand wider strategic aim of national and local carbon reduction targets (e.g. 80% by 2050), and that individual decisions on wind farms or other specific developments are consistent with the wider objectives and targets. Ensure planning officers take into account wider public opinion and strategic long term local and national interests as well as the opinions of local groups.	Identify areas of UA land holdings which could house wind turbines, soft market test interest with on-site wind providers (Ecotricity, Wind Direct etc).	Encourage wind farm developers to provide investment opportunities and benefits to local communities. Consider facilitating this through legal mechanisms and advice, straightforward regulation and training, as well as networking with community wind providers such as Baywind/Energy4All.	To provide public awareness of sustainable energy policy and the need to find acceptable solutions to energy supply. This could be through funding made available to local government. Lobby national government to invest in the grid improvements required to facilitate connections.
Energy from waste	Implement the provisions included in the Joint Waste Core Strategy to divert waste from landfill and recover energy from the residual waste that cannot be recycled.	Provide land for waste treatment facilities in accordance with the sites allocated in the Joint Waste Core Strategy. Acknowledge the different policies on energy from waste in each of the UAs whilst keeping a dialogue open to achieve a coherent implementation of the Joint Waste Core Strategy. Provide collection and storage facilities for waste, including wood from tree surgery, demolition and domestic waste to be reused for construction or burned in biomass boilers. Learn from best practice e.g. Nottingham incinerator.	Consider requiring energy from waste facilities to be CHP plants and facilitate connection to existing district heating schemes.	Work closely with waste treatment companies to avoid unnecessary delays in the planning application of energy from waste facilities. Be clear on pros and cons of energy from waste and the reasons for the policy on this issue in the UA, so that residents can make informed decisions on any public consultations.	Lobby the national government to present the exemplar joint and coordinated work on waste management carried out in the WoE to other waste authorities so that they can learn from it.

Opportunities

Actor Sustainable energy technology / measure	Public sector organisation	Commercial building / land owner	Private building/ land owner	Private sector supply chain	Community
General	Install sustainable energy and invest in energy efficiency either directly or through leasing public sector owned land and buildings. Invest pension fund and any other financial capital in sustainable energy where this is commercially viable.	Make land or buildings available for sustainable energy either for direct investment or by leasing land.	Make land or buildings available for sustainable energy either for direct investment or by leasing land. Be vocal in support of specific local sustainable energy projects.	Continue to innovate and increase supply chain efficiencies to drive down costs of sustainable energy.	Organise buyer's groups, as constituted community enterprises, to deliver sustainable energy and energy efficiency directly. Lobby local and national government to provide incentives and a policy framework to support sustainable energy. Include sustainable energy commitments in parish plans and other local participatory planning opportunities. Be vocal in support of specific local sustainable energy projects.
Wind (commercial scale)	Provide land for suitable use of wind to help with CRC. - Invest in wind energy as a long term secure source of income. - Consider leasing publicly owned land to community wind farms and commercial wind farms or partnerships between the two.	Provide land for suitable use of wind to help with CRC. Lease appropriate land to wind power operators.	Invest in and support wind farms on neighbouring land. Make land available for wind development, either through own investment, or leasing land to commercial or community investors.	Propose a variety of possible mechanisms for funding cost of grid improvements required to facilitate connections. Provide investment opportunities and benefits to local communities to increase public support.	Identify farmer / rural land owners interested in wind energy development (for medium to small applications). Show active support for large wind farms, encourage local people to invest and benefit from wind farms if commercial developer offers this opportunity, consider setting up community ESCo to own and install wind energy. This is especially applicable to community groups in rural areas, e.g. - Low carbon Gordano. - Pilning and Severn Beach parish. - Marshfield and Tormarton ecogroup and parishes.
Energy from waste	Sign waste disposal contracts with companies that maximise recycling and recover energy from residual waste instead of sending to landfill.	Sign waste disposal contracts with companies that maximise recycling and recover energy from residual waste instead of sending to landfill.	Request clear and simple information on energy from waste to make informed decisions during public consultations.	Propose mechanisms to fund heat and power distribution infrastructure from the energy from waste plant. Develop waste to energy technologies that minimise toxic emissions and impacts to local air quality.	For the local community, request connections to the energy from waste plant district heating or private wire schemes at preferential prices.

Opportunities

Actor	Unitary Authority (UA)				
Sustain-able energy technology / measure	Planning policy	Planning	Direct procurement	Stakeholder influence	Lobby national government
Biomass (heat-ing and CHP)	Align planning policy with strategic consid-erations for biomass to ensure siting of biomass heating plant is in most strategic locations and does not exceed maxi-mum technical potential for local supply resulting in the need to import biomass from outside the region.	Agree coherent WoE strategy for biomass, to avoid double counting of resource and prioritise best use for the resource. Considerations for this include: - hard to heat properties, transport distances, processing, air quality, level of gas grid connection and fuel poverty.	Provide land for energy centres. Manage council owned woodland sustainably to provide biomass for energy generation. Consider leasing council owned farm land to energy crop cultivation. Procure biomass and energy crops from lo-cal sources to support local jobs. Learn from Kielder best practice in vertical integration of supply chain and de-mand, with biomass district heating sup-plied by local forest industry.	Support farmers in developing energy crop and sustainably managed woodland and anaerobic digestion facilities. Support both individual private initiatives and groups of farmers who want to share infrastruc-ture or business structures. Continue engaging with local wood brokers e.g. Westwoods to develop supply chains.	Lobby national government to ensure that plan-ning and best use of limited local biomass resources are con-sidered strategically.
Building integrated renewable en-ergy (including solar PV and hot water, and heat pumps)	Provide clear information on planning require-ments.	Map locations suitable for building integrated renewables and make this information publicly available e.g. CSE map of Bristol PV potential.	Install appropriate building integrated energy technology on council owned buildings.	Provide advice/informa-tion in conjunction with retailers/EST/Carbon Trust.	Lobby for consist-ent national policy around incentives for renewable elec-tricity and heat on a building level.
Heat networks	Establish dedicated zones for areas suitable for heat networks. These include: Central Bath, Keynsham, Bath Western Riverside, other cluster zones in B&NES as identified in the AECOM study, the Bristol Heat Priority Area, development areas such as Cribbs Causeway/ Patchway, Harry Stoke, Weston-Super-Mare, Clevedon, Nailsea, Portis-head, north Yate. Include potential areas in LDF and require new development to be 'district' connection ready. Require contributions to heat network from developers as part of al-lowable solutions, Com-munity Infrastructure Levy, S106, or alternative to 'Merton Rule' compli-ance.	Develop long term vision for heat networks in spe-cific areas, especially cross boundary opportunities. Set out delivery approach. Set standards for tem-perature and pressure of networks to allow com-mon platform for future interconnection.	Lesson learned from case studies that role of council as initiator of district heating net-works is crucial. Set up ESCo to man-age and establish district heating networks. Find mechanisms to protect consumer while ensuring viabil-ity of heat network development by securing uptake risk. Set up project deliv-ery mechanism to catalyse heat network development (similar to GLA/LDA).	Create forum for discus-sion of particular locations e.g. Central bath heat net-work stakeholder forum including key anchor load building owners, etc. Facilitate commitments to connect to district heating when network becomes available.	Lobby to develop appropriate legal structures and regulatory support to facilitate heat networks. Raise national awareness of the benefits of heat networks.

Opportunities

Actor / Sustainable energy technology / measure	Public sector organisation	Commercial building / land owner	Private building/ land owner	Private sector supply chain	Community
Biomass (heating and CHP)	Consider leasing land for growing biomass. Coordinated Park and landscape management to ensure biomass resource is used most effectively. Provide storage and processing space for tree surgery waste as discussed in the CSE study 'Biomass Feasibility Study for Bristol City Council'.	Consider leasing land for growing biomass. Ensure biomass waste generated through land and woodland management is used as fuel. Where possible, actively seek local biomass fuel storage for disposal of any wood waste.	Consider leasing land for growing biomass. Ensure old furniture, waste wood from construction/DIY is re-used or burned as fuel where appropriate and where re-use is not possible.	Tree surgeons and farmers: actively seek wood / agricultural waste disposal sites for use as fuel. Building and demolition: send waste wood and offcuts which cannot be re-used in construction to be used as fuel where appropriate rather than to landfill.	Consider setting up community owned and managed woodland and/or crop sites where appropriate.
Building integrated renewable energy (including solar PV and hot water, and heat pumps)	Carry out feasibility studies for low and zero carbon technologies deployed in buildings, and actively seek financial support if needed.	Carry out feasibility studies for low and zero carbon technologies deployed in buildings, and actively seek financial support if needed.	Carry out feasibility studies for low and zero carbon technologies deployed in buildings, and actively seek financial support if needed.		Set up bulk buying groups to achieve economies of scale for domestic installations. Install sustainable energy on community buildings (community centres, churches etc). Learn from best practice e.g. OVESCO community energy cooperative.
Heat networks	Sign up to long term heat network connections. Agree to connect public sector owned buildings to heat networks when network is available, or host energy centre to trigger emerging heat network. Organisations to consider this include: - Frenchay Hospital - Southmead hospital - UWE - Bath city college Learn from best practice e.g. Woking, Nottingham, Birmingham.	Create linked up strategy for use of waste heat within in Avonmouth, and possible connection to existing or new domestic development near Avonmouth (e.g. Shirehampton, Lawrence Weston etc.). Potential large anchor loads that can trigger local networks include Airbus, Rolls Royce, Dyson.	Homeowners can engage with district heating schemes and negotiate ways to ensure consumer protection whilst making district heating systems viable.	Engage with communities and public sector to assess best structure for delivery, ownership and management. Innovate to find viable technical and financial mechanism for delivering heat from CHP in Avonmouth to domestic or other demand centres.	Be proactive in setting up community owned district heating system and communicate with UA to request support and possible finance from public/private sector. Possible community groups include St Werburgh's/Saxon Road group.

9 Workshop Summaries and Action Plans

Stage Two of this project involved stakeholder workshops to build capacity for sustainable energy in the WoE, and develop next step actions. Three workshops were held in December 2011 and January 2012 as follows:

Workshop 1: 13th December 2011, full day workshop: Building Capacity for Heat Networks

Workshop 2: 14th January 2012, full day workshop: Building Community Capacity

Workshop 3: 25th January 2012, business breakfast: Strategic Energy Planning

Each workshop brought together a different group of participants to build capacity, share the learning and evidence base presented in this report, and to identify next steps to lead to progress on specific projects. The workshops developed the understanding and experience of key players in the UAs, including planning officers and council members. They have also laid the groundwork for progress on specific sites, and collaboration between specific partners.

The delivery framework table in chapter 8 of this report formed the basis for the selection of the workshop themes and design of the workshops, and this was used to ensure that the actions proposed drew on the knowledge and experience of a wide variety of perspectives.

The workshops proposed were site and technology specific, and used detailed discussion of real projects to enable wider learning applicable to a variety of situations.

9.1 Workshop 1: Building Capacity for Heat Networks

9.1.1 Workshop details:

- Date: 13th December 2011
- Place: Bristol and Bath Science Park
- Number of participants: 39

This workshop brought together a range of stakeholders to discuss opportunities for the implementation of district heating networks in the WoE with particular attention to the Bristol North Fringe and Central Bath areas. Findings from Stage One of this study, and experiences from experts in the field were presented, followed by focussed discussions on two live case studies to build capacity in the Bristol North Fringe and in Central Bath areas.

The workshop explored the process of implementing heat networks in these case study areas. Key learnings from the workshop are summarised in the following text, and next steps coming out of the workshops presented in the form of action plans. Attendees included developers, planning agents, large businesses and public sector organisations with significant heat demands, planning officers involved with development in the central Bath and Bristol North Fringe areas, and others with a professional interest in developing capacity for heat networks in the West of England.

9.1.2 Presentations and speakers:

- Introduction : Brian Glasson, Head of Strategic Planning, South Gloucestershire Council
- Overview of Renewables and Low Carbon Energy Capacity in the WoE : Austen Bates, Buro Happold
- The business case for heat networks: Alasdair Young, Buro Happold
- District heat network case studies (Southampton): Mike Smith, Cofely
- District heat network case studies (London Borough of Islington): Charlotte Parkes, Islington Council

Workshop Summaries and Action Plans

9.1.3 Key learnings and conclusions

- Each stakeholder group has a different role to play in delivering district heating networks.
- The role of the UA is critical in implementing a heat network, as demonstrated in the case studies presented by speakers, and through discussion in sub-workshops.
- The role of the UA includes ownership and control of relevant public assets such as the highway network and potential anchor loads, decision making around planning policy, location of new development, and use of staff time. The UA also has a direct influence through development control and promotion of district heating as a low carbon solution.
- Anchor loads and developers have a key role to play, by agreeing to long term contracts and playing an active role in promoting connection to and implementation of new district heating networks.

9.1.4 Action plans and next steps for specific sites

Central Bath

- Map internal and external stakeholders.
- Map the benefits of district heating.
- Investigate allowable solutions/development constraints.
- Investigate finances for a heat network connecting Bath Spa University to Twerton.
- Engage landowners, especially owners of large areas of land to secure routes for distribution networks and potential biomass energy resource.
- Set up a council action team to form a working group and then identify a wider stakeholder group.
- Build on contacts developed through the WoE Low Carbon Initiative.

Harry Stoke and UWE site

- Investigate what others are doing in particular other University schemes including Leicester, and Aston.
- Hold high level talks with the South Gloucestershire Council Chief Executive and the Vice Chancellor of UWE, with the potential to feedback the results of this workshop to the LEP in January.
- Talk to wider stakeholders.
- Commission a feasibility study.
- Cofely to provide points of contact and examples of relevant feasibility studies to be referenced and engaged to distill key learnings.

Avonmouth and Severnside area

- Review potential link to central Bristol, and identify energy demand starting with the public sector, including universities, hospitals, and local authority buildings.
- Bring forward planning guidance through Core Strategies, spatial allocations and Supplementary Planning Documents.
- Develop Area Action Plans.
- Establish governance model for ESCos, including an understanding of stakeholder influence relative to investment.

- Encourage businesses with high heat demand to locate in Avonmouth and Severnside area.

Cribbs/Patchway/Filton Airfield area

- Commission a more detailed feasibility study. The scope needs to be wider than district heating and it needs to look at a range of possible energy solutions for the area, including district heating.
- Identify options regarding the scale of heating network(s). For example, this could be a larger network incorporating existing anchor loads as well as the extensive new development sites (and potentially extending to sources of waste heat in Severnside), or one or more smaller networks centred around the most dense areas of demand from existing and future anchor loads.
- Understand the role of the Local Authority? South Gloucestershire Council owns some assets in the area (such as Schools) but is not a significant player in terms of energy consumption or land ownership locally. However, coordination is required in order to develop a shared understanding of the best energy solution for the area.
- UA to draft Terms of Reference for an energy solutions feasibility study for the Cribbs / Patchway / Airfield area, for circulation to those present (and other important stakeholders in the area such as Western Power, BAE, Skanska, Bovis) for consultation / possible joint commissioning.

The workshop participants were keen to understand what part they could play in delivering these action plans. It is recommended that the UAs commit to following this up in the context of their next step for the WoE wide energy strategy.

9.2 Workshop 2: Building Community Capacity

9.2.1 Workshop details:

- Date: Saturday 14th January,2012
- Place: Colston Hall, Bristol
- Number of attendees: 43

This workshop brought together groups involved in developing community energy throughout the WoE, to share knowledge, network, and identify potential areas of collaboration. The findings of Stage One of this study were presented, to inform the identification of opportunities for community energy projects in the WoE. This was also an opportunity for community groups and council officers to listen to each other and gain an understanding of each other's plans and the potential opportunities for collaboration.

Workshop attendees included groups and individuals involved in developing community energy projects in the WoE, who were interested in networking with others, finding out about the technical potential for different renewable and low carbon energy technologies, and in identifying potential areas of collaboration.

9.2.2 Presentations and speakers:

- Introduction: Paul Crossley, Leader of B&NES Council
- Overview of Renewables and Low Carbon Energy Capacity in the WoE: Austen Bates, Buro Happold
- Communities for Renewables programme: Hazel Williams, Regen South West
- Plan LoCaL: Rachel Coxcoon, Centre for Sustainable Energy
- Bristol Energy Network : David Tudgey and Daniel Quiggin
- Energy 4 All: John Malone

- Bath and West Community Energy: Peter Capener

9.2.3 Key learnings and conclusions

Participants shared experience and knowledge on four topics: funding and legal issues; collaboration between groups; technologies and engaging a wider audience. Key learnings included:

- Funding and finance are complex, but there are many sources of support and many options for financing projects.
- Community energy groups in the WoE would like to collaborate more, and find ways of doing this.
- Many groups are planning to carry out further technology feasibility studies, some funded through the LEAF scheme.
- Connecting with existing events or groups in the community is crucial to engaging the wider community in sustainable energy projects.

9.2.4 Action plans

Individuals attending the workshop all committed to taking forward actions, either individually or in collaboration with one or two other groups. However, a number of collaborative, WoE wide actions were proposed, and are summarsied below.

Collaborative actions proposed

- Joint WoE community energy response to DECC consultations and joint lobbying for a community Feed in Tariff.
- Development of shared resource database, e.g. expertise, speakers, sources of advice, document templates, equipment (pedal powered sound systems, energy monitors, thermal imaging cameras), workshop plans, etc. There is a question as to where this should be hosted. There are networks in each UA. The Bristol Energy Network website is a good existing resource, and open to all, but may not be appropriate for WoE wide resource sharing.
- Potential for bulk purchase across community energy groups to achieve economies of scale.
- Groups outside of Bristol could draw in additional community investment from Bristol, where the population is higher.

The UAs could play a role in facilitating further WoE wide community energy networking events, as participants found this useful and would welcome similar events in the future.

9.3 Workshop 3: Strategic Energy Planning

9.4 Workshop details:

- Date: Wednesday 25th January, 2012
- Place: Buro Happold office, Camden Mill, Bath
- Number of attendees: 28

This business breakfast aimed to start an evidence based discussion about the potential and need for cross-bounary collaboration on energy strategy, drawing on the WoE Low Carbon Initiative study into the potential for Renewable and Low Carbon Energy in the WoE, and experiences from senior officers and members of the four UAs of the WoE. Robert Tudway, a Senior Policy Advisor Climate Change at London Development Agency, shared his experiences of cross-borough collaboration on strategic energy plan development.

The discussion addressed two key questions:

- Should the WoE develop an area-wide strategy for energy?
- If not, are there specific aspects which would require collaboration?

Presentations and speakers:

- Introduction: Andrew Pate, B&NES
- Overview of Renewable and Low Carbon Energy Capacity in the WoE: Austen Bates, Buro Happold
- Case Study: Robert Tudway, GLA
- The role and influence of the Unitary Authority: Alasdair Young, Buro Happold
- Announcement of ELENA funding: Alex Minshull, Bristol City Council

9.4.1 Key learnings and conclusions

- There is significant interest in collaboration on energy strategy on a WoE wide scale, and a wish to keep up the momentum generated by the WoE Low Carbon Initiative project.
- The case study of London showed the potential for collaboration and joint working across political and policy differences between distinct Local Authorities. Components of success in this included the mandate of the GLA in setting policy, and the employment of central expertise to coordinate decentralised energy development. For such an approach to be successful in the WoE there would need to be sufficient room for each UA to take their own approach, with sufficient coordination for successful collaboration.
- Successful collaboration would require:
  - Political leadership and policy direction.
  - Clarity on drivers and motivations for collaboration.
  - Clear objectives and specific projects for partnership.
- Leadership for collaboration would need to involve council members and leaders, and senior officers. Involvement of the LEP would also be key.

9.4.2 Action plan

- Identify drivers for collaboration on energy strategy at the WoE scale.
- Take this discussion to the LEP and other existing collaborative bodies e.g. WoE Partnership joint scrutiny committee.
- Identify specific projects for collaboration, and prioritise these.
- Develop a WoE wide energy strategy which allows sufficient scope for each UA to develop their own approach, while benefiting from formal coordination where appropriate.
- Employ a full time WoE energy coordinator to enable collaboration and avoid duplication of knowledge in the WoE.
- Disseminate learning from the Bristol ELENA project and share this with other UAs in the WoE.

There is an interest in collaboration on strategic energy planning between the UAs fo the WoE. It is recommended to continue to hold a forum of this sort for the UAs at a regular frequency.

10 Conclusions

This section outlines the conclusions from stages One and Two of the study. These inform the recommendations for WoE wide action by the UAs

10.1 Conclusions from Stage One

- There is significant technical potential for sustainable energy in the WoE, which could meet up to 55% of total heat and electricity demand in the WoE. Of the demands that need to be met, the domestic market dominates heating requirements and the industrial/commercial sectors dominate electrical requirements.
- Achieving the full technical potential would be extremely challenging, and moving towards achieving it would require significant policy support, public acceptance, and change the economics of or incentives for sustainable energy. Even if the full technical potential for sustainable energy within the WoE was achieved, additional carbon reductions through demand reduction, energy efficiency and sustainable energy generation and supply from outside the sub-region would be required to meet national carbon targets.
- Biomass energy crops, heat pumps and energy from waste have the greatest technical potential for heat provision. Solar thermal can provide a relatively limited input.
- Wind power, biomass energy crops and energy from waste have the greatest potential for renewable electricity generation. Solar PV can also provide significant input.
- There is a difference in the characteristics of Bristol compared to the less urban UAs, where Bristol has significant potential for CHP and heat networks, as well as energy from waste, and the less urban UAs have more potential for wind power and biomass energy crops. Also there are currently differences in policy between the UAs regarding waste incineration.
- There are differences in catchment area assumed for biomass by the previous studies for each UA, with Bristol counting biomass from within a 40km radius of Bristol, and the other UAs counting biomass from within their own boundaries. Therefore a coordinated WoE approach is required to ensure the most appropriate deployment of biomass is used for each UA.
- Heat pumps have high technical potential in the WoE. However this technology may not perform well when used within older and not very well insulated properties. Heat pumps require grid electricity which currently has quite a high carbon intensity (i.e. in the UK a large portion of electricity is still provided by coal fired power stations).
- There is significant potential for district heating identified in a number of urban areas in the WoE. To facilitate heat networks UAs can:
  - Provide planning policy support,
  - Connect their own buildings,
  - Take responsibility for strategic planning,
  - Advocate the connection of other public sector buildings,
  - Identify sites for energy centres,
  - Undertake feasibility studies and tender viable opportunities.
- A number of strategic new development sites may be appropriate for district heating but this requires financial and policy support to be viable. Options for the UAs to explore include requiring contributions from new developments in the form of Allowable Solutions for Zero Carbon Homes or Section 106 contributions, and incentives such as waivers to a stringent 'Merton Rule' requirement for developers contributing by incorporating district heating in heat priority areas, or allowing for future connection.

- The WoE is very active in terms of interest at a community level; with sustainable energy appearing in many parish plans in South Gloucestershire, many local groups being part of the Transition Town movement, and several community energy social enterprises in existence at various stages of development.
- The WoE is served by, or home to, a number of professional service organisations and initiatives relating to sustainable energy, including the Centre for Sustainable Energy, Regen South West, Low Carbon South West, the West of England Carbon Challenge, Severn Wye Energy Agency as well as many sustainable design and construction, renewable energy installation, and business networking organisations. This provides an opportunity for the WoE to take leadership in developing sustainable energy at a local level within the UK.

10.2 Conclusions from Stage Two

- There is significant interest in sustainable energy from all sectors, including the public sector, private sector and not for profit sector. Workshops were well attended, and participants were enthusiastic and motivated.
- There is an interest in exploring opportunities for a joint WoE energy strategy.
- There is interest in exploring opportunities for collaboration across the WoE, both at a strategic planning level, and at a community level.
- Successful collaboration requires a clearer understanding of mutual benefits and drivers, specific deliverable projects and objectives, and the use of existing partnership structures e.g. LEP or WoE England Partnership Joint Scrutiny Panel.
- Taking projects forward to implementation often requires feasibility work, which the UAs can play a key role in supporting. This can take the form of funding feasibility studies directly, or implementing other finance initiatives.
- The role of the UAs in developing district heat networks is key, and has been significant in all best practice case studies examined.

10.3 Identified further work

This study has brought together previous work from a wide variety of organisations, and collated it in one document. This collation and gap analysis process has made progress towards making sense of the complex and detailed information available on the subject of sustainable energy in the WoE. However, there are still issues which could benefit from further more detailed study, beyond the scope of this report. These include:

- Investigate the impacts of decarbonisation of the national electricity grid, and the role that sustainable energy would play in this within the WoE.
- Whole life carbon and cost comparison of district heating retrofit compared to insulation retrofit on existing buildings, and of combining these approaches. This could include consideration of other drivers such as the heritage value of buildings.
- Integrate strategic planning for energy efficiency with planning for energy generation, to determine the most effective allocation of resources, and realising efficiencies from a joined-up approach.
- Design an interactive web-based tool for maps generated within this report. This could ultimately be managed and kept up to date by UAs to ensure information is current. This would provide an effective screening tool for planners and developers to help better understand 'live' opportunities, similar to the London Heat Map.

11 Recommendations and Action Plans

Recommendations from Stages One and Two of the study are summarised below. They are arranged under the following three headings 'Leadership', 'Strategic planning' and 'Delivery' to reflect the level at which change could be effected or delivered. Actions need to be taken at every level in order to build momentum towards sustainable energy delivery. At the leadership level, council leaders can provide the mandate and context for officers to take action on strategic planning and to work with a variety of stakeholders and partners to enable delivery of projects.

Leadership

- Set an ambitious shared target for sustainable energy in the WoE.
- Develop a clear shared policy direction between the four UAs and their stakeholders about how this target should be delivered.
- Enable policy officers, development control and building control officers to provide coordination and facilitation to build momentum towards a shared target.

Strategic planning

- Plan for long term targets e.g. the 2050 target of 80% reduction in carbon dioxide emissions, to ensure progress is made towards this long term goal rather than locking into technology which will not be able to deliver this. For example, ensuring that high levels of fabric energy efficiency and 'district ready' systems are installed in new buildings from the outset, avoiding the need for future retrofitting. The long term availability of fuel such as biomass and waste should also be taken into account strategically, to ensure best use is made of limited resources.
- Identify the interdependencies for energy strategy between the UAs in the WoE, in order to identify areas with a case for joint strategic planning, with the potential to develop a joint strategic energy plan for the WoE, similar to the Joint Waste Core Strategy. This could begin with a joint strategy on specific technologies, for example developing district heating capacity at a strategic planning level in the UAs of the Woe.
- Develop a list of potential sustainable energy projects in the WoE, to enable strategic allocation of resources. Establish, for each project, its state of readiness.
- Develop a WoE approach to strategic planning for biomass to ensure double-counting is avoided. This could include developing a hierarchy for the most appropriate use of this limited resource.
- Develop a strategic WoE wide approach to maximising the benefits of energy from waste i.e. using heat as well as electricity generation, whilst continuing to incentivise reduction in generation of waste. Acknowledge the different policies on energy from waste in each of the UAs, whilst keeping dialogue open to achieve a coherent implementation of the Joint Waste Core Strategy.
- Embed commitment to supporting community energy projects in strategic energy planning, and involve community stakeholders in policy development discussions. In discussion with community energy stakeholders, set an ambitious target for the percentage of sustainable energy to be delivered by the community over the next five years.

Delivery

- Develop local wood fuel supply chains through contracts and direct procurement, business development support for startups and startup loans for social enterprise and SMEs. Use biomass primarily in rural areas where there are hard to heat properties which are off the gas grid, as this can minimise air quality issues, transport distances and be more economically viable when the incumbent heating system is oil tank based rather than gas grid supply.

Recommendations and Action Plans

- Ensure that learning from the Bristol ELENA experience is shared with other UAs. If Bristol projects do not absorb all of the ELENA funds, consider using this to invest in other WoE UAs.
- Develop masterplans for district heating in strategic development areas and city centre locations, with cross-boundary plans where appropriate. Develop sufficient level of detail to enable individual new developments or segments of district heating systems to be future-proofed.
- Use 'Development Control' to require all new developments to connect to district heating, or be district heating ready and coordinate with the Highways Agency to identify opportunities for district heating networks to be installed with other services and during combined road works packages. Ensure that planners understand the wider strategic aim of significant carbon dioxide emission reductions and that individual decisions on wind farms or other specific developments are consistent with the wider objectives and targets.
- UAs to take a leading role in developing district heating networks, building on the experience of ESCo projects from around the country. Identify and carry out feasibility studies for heat network areas where UAs can act as anchor loads to kick start the deployment of such systems.
- Require contributions to district heating systems from part of the S106 and Community Infrastructure Levy (CIL) contributions of developers in all developments within heat network priority areas. Require developments in heat network priority areas to be 'district ready'.
- Develop wind power on UA owned land, to benefit from the income of generating energy, create precedents for wind power development within the planning process, and take the opportunity where the UA has direct control.
- Encourage wind farm developers to invite participation from, and offer benefits to, the local community at an early stage, to ensure wider buy in.
- Host joint events and workshops with stakeholders, to provide opportunities for cross-boundary networking for community groups and the private sector, and gain an understanding of stakeholder perspectives. e.g. through site specific workshops, talks and training events.
- Measure performance on a WoE level, with joint performance indicators and targets, to focus on collaborative purpose.
- Continue to work with a number of organisations to support community energy projects, and share experience and best practice between UAs. Support can include: coordination, policy support, clear and accessible communications and regulation through permissions and planning for community groups, and the provision of startup loan finance where possible.
- Continue to use the sustainable energy maps and information contained in this report as a basis for informed public debate on sustainable energy strategies.
- Make the information contained in this report publicly accessible, and set up a public awareness initiative showing people the maps and the role that each technology could potentially play in delivering sustainable energy in the WoE. Link in to CSE's Plan Local.
- Build on the workshops and action plans undertaken as part of Stage Two of this study and commit to helping workshop participants and other stakeholders to implement and share this understanding and develop action plans.

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GIS Data

- CSE: wind map for Bristol, south west heat map for the WoE including anchor loads, woodland and energy crops around Bristol and heat priority area.
- North Somerset UA: South West Heat map, anchor loads, South West wind map for North Somerset, hydroelectric potential.
- South Gloucestershire UA: data from AECOM study: Large wind, woodland, anchor loads, proposed development sites.
- B&NES UA: data from CAMCO and AECOM studies of B&NES: Large, medium and small wind potential sites, hydroelectric, heat demand, anchor loads, proposed development sites, heat network cluster zones.

Additional data

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