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Local Development Framework

Herefordshire Renewable Energy Study

October 2010

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Herefordshire Renewable Energy Study

October 2010

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EXECUTIVE SUMMARY

Introduction

Herefordshire Council commissioned Wardell Armstrong to conduct a Renewable and Low Carbon Energy Evidence Base Study. The findings from this study have been used to facilitate the formulation and justification of Local Development Framework (LDF) policies. This Executive Summary is a non-technical section which addresses the following key project objectives:

- Energy Demand.
- Renewable and Low Carbon Energy Technologies.
- Policy Development.

Energy Demand

From the analysis contained in this report, the current total energy demand excluding transport for Herefordshire is calculated as being:

Electrical:	731 GWh/yr
Heat:	1,810 GWh/yr
Total:	2,541 GWh/yr

This equates to:

Total equivalent CO_2 emissions:	895,000 tonnes
	(568,000 tonnes residential properties)
	(327,000 tonnes commercial and industrial sectors)

DECC Energy Usage

The DECC Energy Consumption Report dated 2007 provided an energy use value, which included transport, of 5,177 GWh/yr. Calculations of percentage of total energy demands in this report refer to the 5,177 GWh/yr figure.

Renewable and Low Carbon Energy Technologies

Wind

Wind is a potential electricity generation source for Herefordshire. The available resources are:

Table ES1 - Summary of Wind Resource				
Turbine size	**Number of Turbines**	**Energy resource (MWh/yr)**	**% of total energy demand**	**CO_2 saving (tonnes/yr)**
Large	174	1,180,756	23	634,066
Medium	403	227,131	4	121,970
Small	20,592	266,496	5	143,108

Although wind is clearly a valuable technical resource, it must be acknowledged that many people have negative opinions of wind turbines due to the visual impact of larger turbines. It is important therefore that developments of wind turbines are carefully managed and due consideration is given to the potential impact on the landscape. It may be more likely that the medium and small sized turbines are acceptable for community led developments, which may result in a lower overall generation of electricity compared to the larger turbine potential, but would still offer a useful contribution to meeting renewable energy targets.

Biomass

Biomass is a potential generation source for heat and electricity for Herefordshire. The available resources are:

Table ES2 - Summary of Biomass Resource					
Resource type		**Quantity (tonnes/yr)**	**Energy resource (MWh/yr)**	**% of total energy demand**	**CO_2 saving (tonnes/yr)**
Forest residue		40,074	206,382	4	112,072
Energy crops	Miscanthus	2,152,454	10,331,779	200	2,107,683
	Short Rotation Coppice (SRC)	66,468	338,986	7	69,153
	Maize	2,408,711	7,557,000	146	
Waste wood		74,600	369,369	7	182,983
Biogas (EFW)	Landfill	923	7,693	<1	1,892
	Sewage	-	3,600	<1	886
Animal waste		1,611,164	369,028	7	90,781

NB: the potential for maize has been calculated as a direct alternative to miscanthus

The biomass resources in Herefordshire offer an excellent opportunity to reduce energy from fossil fuels. It must be noted that significant development of the necessary supply chains and infrastructure would need to happen before the resources could be fully exploited.

Hydro-electric

Hydro-electric is a potential generation source for electricity in Herefordshire. The available resources are:

Table ES3 - Summary of Hydro-Electric Resource				
Type	**Number of sites**	**Energy resource (MWh/yr)**	**% of total energy demand**	**CO_2 saving (tonnes/yr)**
Low Head (>10kW)	63	53,853	1%	29,242
Low Head (<10kW)	91	1,767	<1%	959
High Head	18	2,071	<1%	1,125

The deployment of hydro-electric schemes will need to be considered carefully against the impact on the landscape and ecology. Before any such scheme is considered, it is recommended that a further investigation is carried out of the site identified at Symonds Yat to determine if the environmental sensitivity of this site would preclude an installation. If this site did not pass a sensitivity assessment then it is likely that very few low head (>10kW) sites would pass either. This would result in the possibility that only the low head (<10kW) and high head sites would offer any potential for hydro-electric in Herefordshire both of which only offer a modest contribution towards renewable energy targets.

Solar

Solar Photovoltaic (Solar PV) and Solar Water Heating (SWH) technologies are potential generation sources for heat and electricity in Herefordshire. The available resources are:

Table ES4 - Summary of Solar Resource					
Type	**Installed Capacity (MW)**	**Energy resource (MWh/yr)**	**% of total energy demand**	**Solar PV CO_2 saving (tonnes/yr)**	**SWH CO_2 saving (tonnes/yr)**
Domestic – Existing	39	33,164	<1%	8,964	4,072
Domestic – New Build	18	15,300	<1%	4,154	1,559
Commercial	11	9,910	<1%	5,381	
Industrial	18	16,035	<1%	8,707	

Solar PV and SWH are technologies that are well suited to both retrofitting existing buildings and integrating into new buildings and are proving an attractive investment for many householders and businesses due to the introduction of Feed in Tariffs. Although their contribution to the renewables targets is modest, their rate of installation is likely to rapidly increase in the short term and become a relatively common sight on buildings.

Note that this study does not contain an assessment of the potential for solar PV farms.

Heat Pumps

Heat pumps can be classed as ground source (GSHP) or air source (ASHP) and both are a potential source of heat energy in Herefordshire. The available resources are:

Table ES5 - Summary of Heat Pumps Resource						
		Installed capacity (MW)	**Potential annual generation (MWh/yr)**	**% of total energy demand**	**CO_2 savings (tonnes/yr)**	
Domestic					ASHP	GSHP
Existing	Off-grid	192	384,016	7%	10,882	42,162
	On Grid	136	272,197	5%	-3,667	18,505
New Build		45	90,000	2%	-1,212	6,118
Commercial		136	272,850	5%	-3,676	18,549

Note: Air Source heat pumps are best suited for buildings which are off-grid, ie, do not have a connection to the natural gas network. If used on buildings which are connected to the grid, the electricity they use contains a higher proportion of CO_2 compared to a traditional natural gas heating system, therefore resulting in an equivalent negative CO_2 saving.

Ground source heat pumps are most effective when installed in new buildings as this allows the correct design parameters to be followed. If these technologies are deployed successfully, they will provide a useful contribution towards renewable energy targets.

CHP, District Heating and Tri-Generation

CHP (Combined Heat and Power) technology is a potential generation source of heat and electricity. District heating is also a potential generation source of heat in Herefordshire but tri-generation is not considered suitable.

The application of both CHP and district heating is best suited to new developments and the application will depend upon the specific configuration of the planned new developments in the County. CHP will require an outlet for both heat and electricity on a 24hour basis (if possible) usually achieved with a mix of residential and industrial developments, otherwise it may become non-economic to install this technology.

An analysis of the planned urban extensions provides an indication of the likely sizing for each location as shown below:

Table ES6 - Summary of CHP Potential						
Location		**Total Heat Load (MWh/yr)**	**Total Electric Load (MWh/yr)**	**Heat Capacity (MW Peak)**	**Heat Capacity (MW Base load)**	**Electric Capacity (MW)**
Hereford	Bullinghope	5,084	3,286	3.74	2.24	0.38
	Whitecross	7,626	4,929	5.61	3.36	0.56
	Three Elms	7,626	4,929	5.61	3.36	0.56
	Holmer West	2,542	1,643	1.87	1.12	0.19
	Brownfield/ Urban village	4,067	2,629	2.99	1.79	0.30
Leominster		8,643	5,587	6.36	3.81	0.64
Ledbury	Viaduct	3,559	2,300	2.62	1.57	0.26
Ross-on-Wye	Hildersley	1,779	1,150	1.31	0.79	0.13
Bromyard	Hardwick Bank	1,271	822	0.93	0.56	0.09

Further feasibility work is recommended to assess the heat demand of industries nearby the proposed developments to determine the potential to incorporate them into a CHP schemes.

Biomass boilers may be a more useful technology for Herefordshire as it is a technology that is well suited to providing heat to large housing or industrial developments. An analysis of the planned urban extensions provides an indication of the likely sizing for each location as shown below:

Table ES7 - Summary of Biomass District Heating Potential					
Development		**Heat Demand (MWh/yr)**	**Optimum Capacity (MW)**	**Wood Fuel Requirement (tonnes/yr)**	**CO_2 saving (tonnes/yr)**
Hereford	Bullinghope	5,084	2.2	968	1,036
	Whitecross	7,626	3.4	1,453	1,554
	Three Elms	7,626	3.4	1,453	1,554
	Holmer West	2,542	1.1	484	518
	Brownfield/Urban village	4,067	1.8	775	829
Leominster		8,643	3.8	1,646	1,761
Ledbury	Viaduct	3,559	1.6	678	725
Ross-on-Wye	Hildersley	1,779	0.8	339	363
Bromyard	Hardwick Bank	1,271	0.6	242	259

The use of CHP and biomass district heating in these planned urban extensions are however considered small scale and so are unlikely to be economic and so may not be attractive to developer without additional incentives such as the Renewable Heat Incentive (RHI). Therefore, it is impractical to consider these technologies as contributing towards renewable energy targets until additional large scale heat users can be incorporated into the network to justify the cost of these technologies.

Policy Development

Planning Policy Statement 12 promotes the production of robust and locally distinctive policies which must be justifiable and founded on a sound and credible evidence base. In accordance with these principles this study has developed a series of both pioneering and pragmatic planning policies with the potential for implementation over the short, medium or long term.

Pioneering vs Pragmatic Policy

The visionary nature of pioneering polices have the potential for Herefordshire to be at the forefront for low carbon energy promotion in the UK. Pragmatic policy by comparison can be seen as an approach to policy development that will enable the County to deliver national low carbon targets.

Short Term Policy Objectives

Short term policy objectives will harness existing renewable / low carbon technologies which are proven, flexible in their implementation and provide excellent opportunities for community owned energy schemes. Examples include wind, hydro and solar energy technologies.

Medium Term Policy Objectives

Medium term policy objectives will harness existing renewable / low carbon technologies which are proven, flexible in their implementation and provide excellent opportunities for community owned energy schemes but will also encourage the development of County wide infrastructure capable of producing and utilizing Biomass. Examples include Biomass and Ground Source Heat Pumps.

Long Term Policy Objectives

Long term policy objectives will harness existing renewable / low carbon technologies which are proven, flexible in their implementation and provide excellent opportunities for community owned energy schemes but will also focus on implementing wide spread Biomass schemes making use of the locally available Biofuels in coordination with other technologies. Examples include Biomass, Ground Source Heat Pumps and CHP.

Cross cutting policy drivers

Further and more precise directions on renewables can be set at the more detailed planning policy stage, for example in Area Action Plans.

Summary

The table below shows a summary of the potential resource and deployment strategy for the range of Renewable and Low Carbon Energy Technologies for Herefordshire.

Table ES8 - Potential Resource and Deployment Strategy for Renewable and Low Carbon Energy Technologies for Herefordshire						
Renewable Energy Technology	**Total Potential Energy (MWh/yr)**	**Suggested Deployment Target (% of resource)**	**Equivalent CO_2 savings (tonnes/yr)**	**Short Term Suitability (0-5 years)**	**Medium Term Suitability (5-10 years)**	**Long Term Suitability (10+ years)**
Wind – Large Scale	1,180,756 *	30	109,220	1	1	2
Wind – Medium Scale	227,131 *	20	24,394	1	1	1
Wind – Small Scale	266,496	20	28,622	1	1	1
Biomass – Forest residues	206,382**	30	33,622	3	2	2
Biomass – Energy Crops Miscanthus	10,331,779 **	5	105,384	2	2	1
Biomass – Energy Crops SRC	338,986 **	10	6915	2	2	1
Biomass – energy Crops Maize	7,557,000 **	10	154,166	2	2	1
Biomass – Waste Wood	369,369	70	128,088	2	2	1
Biomass – Municipal and commercial waste	98,600	25	-	2	2	1
Biomass – Animal Waste	369,028	10	9,078	2	2	1
Biomass – landfill gas	7,693	20	378	3	3	3
Biomass – sewage gas	3,600	20	177	3	3	3
Hydro – electric >10kW	53,853 ***	20	5,848	2	1	2
Hydro – electric <10kW	1,767 ***	20	192	1	2	2
High Head	2,071	20	225	2	1	2
Solar – Existing Domestic Buildings	33,164 **	20	2,607	1	1	2
Solar – New Domestic Buildings	15,300 **	25	1,428	1	1	2
Solar – Commercial Buildings	9,910 **	20	1,076	1	1	2
Solar – Industrial Buildings	16,035 **	20	1,741	1	1	2
Heat Pumps – Existing Domestic Buildings off grid	384,016	20	10,609	2	2	1
Heat Pumps – Existing Domestic Buildings on grid	272,197	5	742	3	2	1
Heat Pumps – New Domestic Buildings	90,000	75	3,680	2	1	1
Heat Pumps – Commercial Buildings	272,850	10	1,487	2	2	1
CHP and District Heating	-	10	-	3	2	2
Biomass Boilers and District Heating	-	10	-	1	1	1

	Good opportunities	*	At level 6.2	1	High priority
	Possible opportunities	**	Maximum possible – potentially unpractical	2	Mid priority
	Poor opportunities at current time	***	Further environmental feasibility required	3	Low Priority

Note: This information was presented and discussed at a stakeholder event. The individual deployment target percentages were not challenged and have therefore been put forward as recommended targets.

1 INTRODUCTION

1.1.1 This report is a Renewable and Low Carbon Energy Evidence Base Study. It was commissioned by Herefordshire Council to facilitate the formulation and justification of Local Development Framework (LDF) policies relating to renewable and low carbon energy.

1.1.2 The key objectives of this study included:

- Develop a clear understanding of the constraints, barriers and opportunities to renewable energy project development.
- Develop realistic renewable energy targets with broad agreement from the key stakeholders.
- Assess current energy supply and existing and future energy demands in Herefordshire (heat and electricity).
- Identify locational and technological criteria for assessing proposed projects.
- Identify technologies most suited to the local supply and landscape.
- Develop scenarios to aid the understanding of policy options and potential implications for the County.
- Develop model policies to inform Local Development Frameworks and development management decisions.
- Improve understanding between planners, developers, potential developers and other key stakeholders.

2 RATIONALE FOR PROJECT

2.1 Policy and legislative drivers

2.1.1 This study is intended to contribute to the evidence base for Herefordshire Council's Core Strategy policies. It has been prepared in accordance with national guidance, primarily the PPS1 Planning and Climate Change Supplement (the PPS1 Supplement, 2007), which states that planning authorities should have "an evidence-based understanding of the local feasibility and potential for renewable and low-carbon technologies." PPS 12: Local Spatial Planning has also informed the preparation of this report to ensure that policies proposed for in inclusion in the core strategy are locally distinctive, sound, justifiable and effective.

2.1.2 The brief for the preparation of a Herefordshire Renewable Energy Study stated that:

"*The County has the benefit of a recently adopted Unitary Development Plan (UDP) this sets the context for the development of Herefordshire until 2011. The UDP chapter on community facilities and services outlines the Council's strategy to help deliver the Government's targets and goals for renewable energy and climate change, which are central to achieving sustainable development. The policies of the UDP are broadly compatible with the advice set out in PPS22 and the related companion guide, as well as the Regional Spatial Strategy and the West Midlands Regional Energy Study. The Herefordshire LDF is now in the early stages of preparation, work upon the Core Strategy is underway and is due to be adopted in the summer of 2010. Hereford City is a new Growth Point and identified as one of the sub-regional foci for development in the West Midlands Regional Spatial Strategy (RSS) as adopted in January 2008. The Phase 2 Review of the RSS has reached an advanced state (awaiting SoS changes following the Inspectors' Panel report of September 2009) and that proposes re-designating Hereford as one of nine Settlements of Significant Development in the Region. The Inspectors' recommendations include the introduction of a "Merton" style rule on renewable sources of energy in new development and other relevant policy initiatives, although there are also relevant policies in Phase 3 of the revision which will not now progress beyond a series of untested "Policy Recommendations". There is, therefore some uncertainty about the content and status of regional policy pending the outcome of the anticipated General Election and subsequent possible changes to regional governance.*

The Climate Change Act (2008) makes the UK the first country in the world to have a long term legally binding commitment to cut green house gas emissions. The Act commits the UK to reduce carbon dioxide (CO_2) emissions by 80%, from a 1990 baseline. In order to achieve this commitment, and ensure the UK is well placed to take advantage of the opportunities presented by a low carbon economy, the Low Carbon Transition Plan (2009) was developed. Securing energy from low carbon sources is a key element of the plan. The UK Renewable Energy Strategy (RES) (2009) sets a target for 15% of the UK's energy to come from renewable resources by 2020, which represents a seven fold increase from 2008. To achieve this target it is

proposed that 30% of electricity, 12% of heat, and 10% of transport, will be powered by renewable resources.

The RES identified that the planning system is key to a swifter delivery of renewable energy. The Department for Energy and Climate Change (DECC) proposed working with Communities and Local Government (CLG), to support regional and local authorities, to develop robust evidence based strategies for delivering their renewable potential, in line with the national targets. The Office for Renewable Energy Deployment (ORED) has developed a robust methodological approach and criteria to identify opportunities and the constraints to the development of renewable energy (heat and electricity) in the regions.

The RES builds upon planning policy statement 22 (PPS22): planning for renewable energy (2004), which requires regions to set targets in their regional special strategies based upon environmental, economic and social impacts.

The West Midlands Regional Spatial Strategy states that the Region should aim to contribute as far as possible towards the achievement of the national energy target – 10% of electricity produced from renewable energy by 2010, with an aspiration to double renewables' share of electricity between 2010 and 2020. In order to meet national targets for reducing emissions, the West Midlands needs to decrease emissions by 21% by 2020 and 36% by 2026 compared to the 2006 baseline, further year on year reductions would then be needed to meet the 2050 80% target.

Carbon emissions in Herefordshire are well above the national and regional average; therefore an ambitious Local Area Agreement Target has been set, to reduce carbon emissions per head of population across the County by 13.1%, in the 3 years from April 2008 to March 2011. "

2.1.3 Although the Regional Spatial Strategies have now been abolished by the new Government, the requirement to reduce carbon emissions remains and therefore the development of robust policies for Herefordshire is required.

2.2 HC development plan 2010-2026

2.2.1 Within Herefordshire, the City of Hereford is the main focus for higher level retail, commercial, cultural and service activities and has been designated a 'Strategic Sub-Regional Centre'. Although Hereford will be the main focus, the market towns of Kington, Ledbury, Leominster, Ross-on-Wye and Bromyard form 'Non-Strategic Centres' and will also act as growth points with their own characteristics. Herefordshire contains a sufficient amount of new and existing employment land and is well placed to accommodate the anticipated growth for the County.

2.2.2 Herefordshire Council has identified a number of planned strategic urban extensions which are forecast to be developed over the period to 2026. In total, approximately 18,000 new homes are expected across the County with approximately 13,600 of these being located around the principal urban areas. The expected developments are as shown in Table 2.1 below.

Table 2.1: Planned Strategic Urban Extensions

Location		Year		
		By 2015 Houses	**By 2020 Houses**	**By 2026 Houses**
Hereford	Bullinghope	250	600	1,000
	Whitecross	400	900	1,500
	Three Elms	400	900	1,500
	Holmer West	100	250	500
	Brownfield/ Urban village	200	450	800
Leominster		400	900	1,700
Ledbury	Viaduct	350	700	700
Ross-on-Wye	Hildersley	350	350	350
Bromyard	Hardwick Bank	125	250	250
Totals		**2,575**	**5,300**	**8,300**

2.2.3 Due to the level of growth, there is an opportunity to align planning policy to promote developments which use renewable and low carbon energy technologies. The nature and type of developments will define what, and how, technologies can be deployed. The development of policies can encourage a longer term view to reducing carbon emissions through designing developments that can be linked into Combined Heat and Power systems once the development has grown to a sufficient size, for example.

3 BASELINE ENERGY AND CO_2 ASSESSMENT

3.1 Current energy sources

Current Renewable Generation

3.1.1 Current installed renewable energy generating capacity within Herefordshire has been obtained from the RESTAT's database as published by DECC. This database lists planning applications for renewable generation and classifies these developments according to the type of technology they use. The database also contains details of the installed capacity of the device along with other details about the application.

3.1.2 There are only two items listed in the current RESTAT's database that fall within the Herefordshire boundary. These are two dedicated biomass schemes, one being The Yeld Biomass Project at Lyonshall, Kington (1MW) and the other being Unit 5b Biomass Project at Thorn Industrial Estate, Hereford (0.4MW). There are no known operational commercial scale wind turbines installations in the County although there is a proposal for a 9.2MW, four turbine windfarm at Reeves Hill on the Herefordshire border near Knighton. This application (ref number DCNW2008/1289/F) has been in the planning system since May 2008. Queen Elizabeth High School in Bromyard has a 15kW turbine installed.

3.1.3 At the time of writing no further renewable projects have been identified within the County of Herefordshire, although it is quite likely that there are some other small-scale installations present. The above projects are identified in Figure 2.1.

3.1.4 NB: Herefordshire Council has subsequently provided information of three further installations of renewable energy. Whitecross High School in Hereford has 15kW turbines installed, a further turbine has been installed at Earl Mortimer College and a 350kW biomass boiler has been installed at Weobley Primary School.

Current Low Carbon Generation

3.1.5 For the purpose of this report 'low carbon' energy generation refers to fossil fuelled Combined Heat and Power (CHP) plant and non-renewably driven heat pumps.

3.1.6 Non-renewable CHP plant generates electrical power through conventional turbines driven by the combustion of fossil fuel (predominantly gas) but also harnesses the by-product heat energy produced by the process for useful application elsewhere. In a well designed system this results in the overall efficiency of the process being

substantially greater than conventional generation where the heat energy is dumped. There are no known installations of gas-fired CHP within the County.

3.1.7 It is very difficult to obtain information about existing heat pump installations as most of these will be domestic scale and there are no easily accessible records identifying where these are. All heat pumps use electricity to power the pumps and drive the compressor however, a well designed system generates 3-4 times more heat energy than the electrical energy it consumes by absorbing heat from the surroundings. If the electrical power is provided by renewable generation the whole process is carbon neutral but it is most common for the heat pump to be grid-connected and therefore it should be considered low carbon. Heat pumps can be ground-sourced, air-sourced or water-sourced depending on the heat source used to generate the temperature difference needed in the refrigeration cycle. It may be practical to deploy all three variants within Herefordshire, but little is known about the existing installed capacity or the source of electricity used to power any such installations.

Current Non-Renewable Energy

3.1.8 There are no large scale fossil fuel power stations within Herefordshire. This has been ascertained by consulting the Central West Midland's Long Term Development Plan (2005-2010) which includes a schematic map of the region's electrical grid network. An extract of this map showing Herefordshire's electrical grid connections is reproduced in Figure 2.2. Although there are some high-voltage power lines crossing the County there are no power stations. Existing electrical power is generated outside of the County and imported via the national grid.

3.2 Energy Use

3.2.1 In April 2008 the Halcrow Group were commissioned by Advantage West Midlands to produce a report entitled “Heat Mapping and Decentralised Energy Feasibility Study”. The data collected for this study is relatively coarse with a resolution based on the Office of National Statistics Lower Level Super Output Areas. Figures 2.3 and 2.4 reproduce the heat mapping data from this study cropped to the County boundary for domestic and non-domestic heat usage. Figures 2.5 and 2.6 show domestic and non-domestic electrical demand across the County. All of this data is

normalised to a "*per km square*" basis to enable direct comparison across varying sized output areas.

3.2.2 As can be seen the 'hotspots' for heat and electricity demand are, as expected, the urban areas of the County. On this basis further detailed investigations will focus on Hereford (population: 55,700), Leominster (pop: 11,100), Ross on Wye (pop: 10,100) and Ledbury (pop: 9,900)[1].

3.2.3 The heat and power mapping of Herefordshire has proved to be a difficult exercise with data not being readily available, therefore a number of approximations have been required to achieve the results presented below. Due to these difficulties the results should be seen to be indicative of the real demand rather than taken as absolute. The maps (in Appendices 2 & 3) present the energy demand based on postcode areas to indicate overall demand for each of the above towns. Results are presented for heat and power, with further calculations provided as to the carbon savings for each. Residential and non-residential elements are presented separately in Appendix 3.

3.3 Heat

Current

3.3.1 The current housing stock in Hereford is a mixture of detached, semi-detached, terraced and flats. A number of other types of housing do exist but for the purposes of this exercise all housing has been allocated into one of these four categories. The UK housing stock has been built-up over many years and consequently has been constructed to a wide variety of standards. The heat mapping is necessarily based on average consumption and for the purposes of this exercise the benchmarks for each of the housing types has been scaled to match the average consumption of housing within Herefordshire rather than the wider UK in general. This estimates average heating requirements in the County to be 15,023kWh/yr per dwelling[2]. On

[1] 2008 mid-year population estimates taken from the report "The Population of Herefordshire 2009", Version2, The Herefordshire Partnership, November 2009 *(http://www.herefordshire.gov.uk/docs/research/current_hfds_population_digest.pdf)*

[2] Average gas and electrical usage from "2008 Sub-national authority electricity consumption statistics" published by DECC, Jan 2010.

the basis of the modelling conducted for this analysis total current heat demand in Herefordshire is estimated to be 1,810GWh/yr.

Projected

3.3.2 Details of Herefordshire Council's strategic development plans have been identified previously but the Council expects 18,000 new homes to be developed between now and 2026. Of these 18,000 dwellings around 8,300 are planned to be located in strategic urban extensions as identified in the Table 3.1 below. The heat demand for these developments has been estimated based on expected energy benchmarks adjusted for a 25% reduction in CO_2 levels. These benchmarks have been scaled to the existing mix of housing types.

Table 3.1: Forecast Heat Demand for Planned Strategic Urban Extensions

Location		Year					
		2015		2020		2026	
		Houses	Heat (MWh/yr)	Houses	Heat (MWh/yr)	Houses	Heat (MWh/yr)
Hereford	Bullinghope	250	1,837	600	4,408	1,000	7347
	Whitecross	400	2,939	900	6,612	1,500	1,1020
	Three Elms	400	2,939	900	6,612	1,500	1,1020
	Holmer West	100	735	250	1,837	500	3673
	Brownfield/ Urban village	200	1,469	450	3,306	800	5,877
Leominster		400	2,939	900	6,612	1,700	12,489
Ledbury	Viaduct	350	2,571	700	5,143	700	5,143
Ross-on-Wye	Hildersley	350	2,571	350	2,571	350	2,571
Bromyard	Hardwick Bank	125	918	250	1,837	250	1,837
Totals			**18,918**		**38,938**		**60,977**

3.3.3 Alongside the housing development there will be new public and commercial services to support the residential growth and these will have an associated energy demand and carbon footprint. In order to comply with new building regulations this footprint will be considerably smaller than similar existing developments. The exact amount of commercial and industrial development associated with the planned housing is not known, nor has the location of any such non-residential growth been determined. However, as an estimate the same ratio of non-domestic heat demand to residential heat demand has been applied as to the existing situation. The total heat demand resulting from strategic development by 2026 is estimated to be 61GWh/yr.

3.3.4 In addition to the strategic development there are likely to be numerous isolated new builds and as well as start-up businesses across the County. Such developments will account for a significant proportion of the remaining 10,000 properties expected to be built in Herefordshire. Taking into consideration the heat demand arising from the full 18,000 new houses planned across the County, up-scaled to account for a proportional growth in the commercial and industrial sectors, demand is likely to increase by 131GWh/yr by 2026.

Heat maps

3.3.5 The methodology used in the heat mapping exercise is outlined in Appendix 1. Figures 2.7-2.10 (Appendix 2) show the maps produced detailing current consumption, focussing on the four largest urban areas; Hereford, Leominster, Ross on Wye and Ledbury. The data presented in these maps combines residential, commercial and industrial consumption.

3.3.6 As can be seen in Figure 2.7 there are several areas where no heat demand has been identified at all. Some of these 'empty spaces' can be explained legitimately by the existence of golf courses and brown-field sites, however, a significant limitation of the exercise has been the lack of information available on the heat and electrical demands of several potentially large heat and electricity consumers. These include sewage and water treatment works and mining and quarrying activities. Furthermore, as explained in the methodology, the mapping of non-residential heat loads has been necessarily conducted on a postcode basis. Where a business address has a postcode in one zone but an operational area stretching across another zone, the full heat load has been assigned to the postal address, potentially leaving the latter zone empty.

3.3.7 Appendix 3 contains breakdowns of the commercial and residential heat mapping for each of the four areas mentioned above.

3.4 Electricity

Current

3.4.1 Current electrical demand arises from both residential and commercial/industrial sources. Electrical energy is imported into the County to meet most of this demand but as the population increases and development is built to house, support and

employ that population it will be important to ensure that adequate energy resources are available to facilitate it.

3.4.2 As previously mentioned, there is a mix of housing stock within Herefordshire. The energy benchmarks applied to this housing stock have been scaled using the current average electrical usage per dwelling for the County, as estimated by DECC. This figure is 4,972kWh/yr[3]. The methodology used to map the electrical demand is described fully in Appendix 1.

3.4.3 As a result of the modelling of the total current electrical demand in Herefordshire is estimated to be around 731GWh/yr.

Projected

3.4.4 The increase in electrical demand as a result of strategic urban expansion has been calculated as described in the previous section on heat demand. The results are presented below in Table 3.2.

Table 3.2: Forecast Electricity Demand for Planned Strategic Urban Extensions

Location		Year					
		2015		2020		2026	
		Houses	Electric (MWh/yr)	Houses	Electric (MWh/yr)	Houses	Electric (MWh/yr)
Hereford	Bullinghope	250	1,462	600	3,510	1,000	5,850
	Whitecross	400	2,340	900	5,265	1,500	8,774
	Three Elms	400	2,340	900	5,265	1,500	8,774
	Holmer West	100	585	250	1,462	500	2,925
	Brownfield/ Urban village	200	1,170	450	2,632	800	4,680
Leominster		400	2,340	900	5,265	1,700	9,944
Ledbury	Viaduct	350	2,047	700	4,095	700	4,095
Ross-on-Wye	Hildersley	350	2,047	350	2,047	350	2,047
Bromyard	Hardwick Bank	125	731	250	1,462	250	1,462
Totals			**15,062**		**31,003**		**48,551**

3.4.5 Total electric demand associated with strategic development is estimated to be 48.6GWh/yr. Electric demand arising from the full 18,000 new properties expected to be built in Herefordshire by 2026 totals 105GWh/yr.

[3] Average gas and electrical usage from "2008 Sub-national authority electricity consumption statistics" published by DECC, Jan 2010

Electricity maps

3.4.6 The methodology used in the electricity mapping exercise is outlined in Appendix 1. Figures 2.11-2.14 (Appendix 2) show the maps produced detailing current consumption, focussing on the four largest urban areas; Hereford, Leominster, Ross on Wye and Ledbury. The data presented in these maps combines residential, commercial and industrial consumption.

3.4.7 Appendix 3 contains breakdowns of the commercial and residential electrical mapping for each area.

3.4.8 The DECC Energy Consumption Report dated 2007 provided an energy use value, which included transport, of 5,177GWh/yr.

3.4.9 The 2008 values provided by DECC identified gas consumption as being 1,345GWh/yr and electricity consumption as being 1,005GWh/yr. These came to an overall total value of 2,350GWh/yr.

3.4.10 A benchmarking exercise was undertaken which gave a heat load of 1,810GWh/yr and an electrical load of 731GWh/yr. This gave an expected total load of magnitude 2,541GWh/yr.

3.4.11 The benchmarking data that was undertaken used a number of assumptions which is attributable to the discrepancy of 200GWh/yr between the DECC value and our own. The value given is close to the DECC value, being less than 5% different, therefore we can conclude that the benchmark data was reasonably accurate despite the necessary assumptions.

3.4.12 The assumptions are explained in more detail within the Energy Demand Assessment Methodology, contained in Appendix 1.

3.5 CO_2 emissions

Current

3.5.1 In 2001 Transco produced a map showing census areas coded by percentage of postcodes with mains gas supply. Analysis of this data is shown in the Table 3.3 below which identifies the number of residential dwellings that fall in to each percentage band. It is clear from the figures below that a substantial number of

dwellings in Herefordshire are off the gas grid. Off-gas dwellings will typically rely on night storage heaters, oil or LPG-fired central heating or wood burning stoves to provide space heating. With the exception of wood burning stoves these methods of heating produce higher levels of CO_2 emissions.

Table 3.3: Consideration of gas connection	
Mains Connections (%)	**Numbers of Residential Dwellings**
0	20,171
1-24	5,343
25-49	4,228
50-74	9,223
75-100	44,115

3.5.2 Official figures from the UK's Department for the Environment, Farming and Rural Affairs (DEFRA)[4] indicate a carbon content for domestic heating oil (kerosene) of 0.245kg CO_2 per kWh, compared to figures of 0.214kg CO_2 per kWh for LPG and 0.184kg CO_2 per kWh for gas. Based on 2008 rolling average figures including transmission/distribution losses, the CO_2 produced by using electricity generated on the UK's National Grid is 0.542kg CO_2 per kWh.

3.5.3 In order to apply these figures to the residential dwellings it has been assumed that 46,600 dwellings are connected to mains gas for heating (by scaling the number of dwellings by the midpoint of the percentage band). This equates to about 56% of Herefordshire's dwellings. It is assumed that half of the remaining dwellings have night storage heating and half use oil. No information is available as to how many wood burning stoves or LPG fired heating systems are installed but these will slightly reduce the CO_2 emissions as they are effectively carbon neutral. The average CO_2 emissions for a residential dwelling's heating requirements are therefore assumed to be 0.276kg CO_2 per kWh. Emissions associated with electrical consumption are assumed to be 0.542kg CO_2 per kWh. For convenience the same figures have been applied to the commercial and industrial sectors.

[4] DEFRA 2010 Guidelines to Defra / DECC's GHG Conversion Factors for Company Reporting (*http://www.defra.gov.uk/environment/business/reporting/pdf/100805-guidelines-ghg-conversion-factors.pdf*)

3.5.4 Total annual CO_2 emission figures for Herefordshire, excluding those associated with transport, are estimated to be 895,000 tonnes, with 568,000 tonnes coming from residential properties and 327,000 tonnes from the commercial and industrial sectors.

3.5.5 Figures 2.15-2.18 show the CO_2 emissions density maps for each of the urban areas.

Projected

3.5.6 The increase in CO_2 emissions as a result of strategic urban expansion has been calculated by assigning the heating and electrical CO_2 contribution factors to the forecast increase in demand associated with strategic urban expansion. This may be an over-estimate because it is hoped that over the next 16 years some progress will be made towards a low carbon energy mix in the UK, however, assuming there is a similar mix to the current situation, the results are presented below in Table 3.4.

Table 3.4: Forecast CO_2 Emissions for Planned Strategic Urban Extensions

Location		Total	Heat (Tonnes/yr)	Electric (Tonnes/yr)	Total (Tonnes/yr)
Hereford	Bullinghope	1,000	2,043	3,171	5,214
	Whitecross	1,500	3,065	4,757	7,821
	Three Elms	1,500	3,065	4,757	7,821
	Holmer West	500	1,022	1,586	2,607
	Brownfield/Urban village	800	1,634	2,537	4,171
Leominster		1,700	3,473	5,391	8,864
Ledbury	Viaduct	700	1,430	2,220	3,650
Ross-on-Wye	Hildersley	350	715	1,110	1,825
Bromyard	Hardwick Bank	250	511	793	1,304

3.5.7 The total increase in CO_2 emissions associated with strategic development up to 2026 is estimated to be 43,227 tonnes per annum.

4 RENEWABLE & LOW CARBON ENERGY RESOURCE ASSESSMENTS

4.1 Wind

4.1.1 The following sections contain the wind resource assessments for large scale, medium scale (based on 225kW turbines under the Feed in Tariff) and small scale turbines. The assessment methodology applied is given in detail in Appendix 5. Note that these resource estimates at the final level of constraint considered here (6b) are mutually exclusive.

4.1.2 The wind resource layers associated with each scale of wind resource are also available in GIS format and can be broken down by postcode, parish or ward. The information has also been tabulated into CSV format.

Large Scale Wind Resource

4.1.3 Table 4.1 below shows the potential large scale wind resource for Herefordshire. As the levels progress and more constraints are introduced, the wind resource is reduced. It should be noted that the 'Total Energy Demand' column indicates the percentage of Herefordshire's total current energy use that could be provided by ensuring the maximum theoretical deployment of the relevant technology. This calculation is based upon DECC's "Sub-national Final Energy Consumption Figures, 2007", which include heat and electrical energy use but also the use of transportation fuels. Transport fuels have not been assessed within the remit of this report but it is quite possible that in future transportation will rely on electricity or biofuels. For Herefordshire this figure is 5,177GWh/yr. Appendix 4 contains maps which show the location of the raw resource (Figure 4.1) and break down the energy resource and energy resource density at level 6b based on postcode boundaries (Figures 4.2 and 4.3).

Table 4.1 – Large Scale Wind Resource

Resource Level	Area (km^2)	Capacity (MW)	Turbines	Energy (MWh/yr)	% of Total Energy Demand	CO_2 Saving (Tonnes/yr)
Level 6b	45	401	174	1,180,756	23	634,066

Level 6b Practically Accessible Resource (Landscape Constraints)

4.1.4 The potential annual energy production for large scale wind in Herefordshire at level 6b is 1,180,756 MWh following removal of landscape designated areas where, due to visual impacts, windfarm development of this scale is unlikely to be possible. This equates to approximately 174 2.3MW turbines.

Level 7 – MOD Considerations

4.1.5 The MoD have said they will be unable to offer any assistance in this area and therefore no results at this level have been compiled.

Medium Scale Wind Resource

4.1.6 Table 4.2 below shows the medium scale wind resource for Herefordshire based on turbines that are likely to be implemented under the newly introduced Feed in Tariff. As the levels progress and more constraints are introduced, the wind resource is reduced. Appendix 4 contains maps which show the location of the raw resource (Figure 4.4) and break down the energy resource and energy resource density at level 6b based on postcode (Figures 4.5 to 4.6), parish (Figures 4.7 to 4.8) and ward (Figures 4.9 to 4.10) boundaries.

Table 4.2 –Medium Scale Wind Resource

Resource Level	Area (km^2)	Capacity (MW)	Turbines	Energy (MWh/yr)	% of Total Energy Demand	CO_2 Saving (Tonnes/yr)
Medium 6b	101	91	403	227,131	4	121,970

Level 6b Practically Accessible Resource (Landscape Constraints)

4.1.7 The potential annual energy production for medium scale wind in Herefordshire at level 6b is 227,131 MWh following removal of landscape designated areas where, due to visual impacts, windfarm development of this scale is unlikely to be possible. This equates to approximately 403 225kW turbines.

Small Scale Wind Resource

4.1.8 Table 4.3 below shows the Herefordshire small scale wind resource. Appendix 4 contains maps which show the location of the raw resource (Figure 4.11) and break down the energy resource based on postcode (Figures 4.12 to 4.13), parish (Figures 4.14 to 4.15) and ward (Figures 4.16 to 4.17) boundaries. Each map contains a note which describes the constraints applied to the resource.

Table 4.3 –Small Scale Wind Resource			
Capacity (MW)	**Energy Resource (MWh/yr)**	**% of Total Energy Demand**	**CO_2 Saving (Tonnes/yr)**
291	266,496	5	143,108

4.2 Biomass

4.2.1 The following sections give the resource assessments for the various forms of biomass available within Herefordshire, which are also summarised in Table 4.4 below. The following types of biomass have been considered in this resource assessment:

- Forest residues.
- Energy Crops.
- Waste wood.
- Municipal and commercial waste.
- Animal wastes.

4.2.2 A GIS was used to estimate the resource potential for the first two of these. All tonnages are given in oven dried tonnes (odt), ie as if all the moisture had been removed from the biomass fuel. This allows the energy content of fuels with different moisture levels to be directly compared.

4.2.3 Full details of the methodologies used are given in Appendix 3.

4.2.4 Please note that the energy values quoted are the total energy content of the biomass fuel and not the electrical energy it might produce. CO_2 savings have therefore been based on offsetting natural gas. The use of biomass for electricity generation and combined heat and power (CHP) is considered in Section 4.6.

Forest Residues

4.2.5 There are currently 20,037 ha of woodland in Herefordshire. This could provide some 40,074 odt/yr of wood fuel if utilised as a biomass resource. This is equivalent to 206,382 MWh/yr which would meet 4% of Herefordshire's total energy demand. The estimated CO_2 saving would be 112,072 tonnes/yr. Figure 4.18 in Appendix 4 shows the forest residue resource distribution over Herefordshire.

Energy Crops

4.2.6 Three types of energy crop were considered in the resource assessment, Miscanthus, a fast growing C4 rhizomatatious grass, Short Rotation Coppice (SRC) eg willow and Maize. Miscanthus is the preferred option and is already being grown in some areas of Herefordshire. However, it does not do well in high windy locations, so SRC has been substituted in all areas where the annual mean wind speed at 10m agl (above ground level) exceeds 6m/s. Maize is considered as a direct alternative energy crop to miscanthus that could be adopted by Herefordshire farmers.

4.2.7 Approximately 120,116 ha within Herefordshire would be suitable for growing Miscanthus. This would potentially yield 2,152,454 odt/yr, which would produce 10,331,779 MWh/yr and give a saving of 2,107,683 tonnes of CO_2 per annum. This is equivalent to 199.6% of Herefordshire's current energy demand.

4.2.8 Approximately 6,711 ha would be suitable for growing SRC in Herefordshire. This would yield 66,468 odt/yr, which would provide 338,986 MWh/yr and give a saving of 69,153 tonnes of CO_2 per annum. This is equivalent to 6.5% of the current energy demand of the County.

4.2.9 The total potential energy crop resource is therefore 10,670,765 MWh/yr, some 206% of Herefordshire's annual energy demand, saving 2,176,836 tonnes of CO_2 per annum. Figure 4.18 in Appendix 4 shows the energy crop resource distribution over Herefordshire.

4.2.10 As a direct alternative energy crop to miscanthus, maize could be grown in Herefordshire on the same land. Approximately 120,116 ha would be suitable which would yield 2,408,711 odt/yr. This would produce 7,557,000MWh/yr and give a saving of 1,541,656 tonnes of CO_2 per annum. This is equivalent to 146% of the current energy demand of Herefordshire.

4.2.11 Whilst this is technically feasible to grow these quantities of energy crops, it is not practical, as a significant area of the land deemed suitable for energy crops is likely to be used for producing a range of alternative crops. However, a target of 10% utilisation of this resource is expected to be feasible in the near future.

Waste wood

4.2.12 The draft report from Bioregional Consulting in November 2009 entitled "Herefordshire Woodfuel Supply Chain" identified the quantity of wood fuel resource available within Herefordshire. It found that the amount of woodfuel amounted to 74,600 odt/yr. The majority of this comes from sawmills with the majority coming from Pontrilas Timber. The summary of the potential resources are shown below.

Table 9 Summary of potential wood chip resource in Herefordshire

	Low grade wood chip for biomass CHP					High grade wood chip						Totals				
Source	Potential available residues for low grade wood chip per annum (tonnes)[14]	Primary energy (MWh)	Potential installed boiler capacity (MWth)	Potential emissions saved per annum when replacing mains gas (tonnes CO2)	Potential emissions saved per annum when replacing oil (tonnes CO2)	Potential available residues for high grade wood chip per annum (tonnes)[14]	Potential available residues for high grade wood chip per annum (30% mc tonnes)	Primary energy (MWh)	Potential installed boiler capacity (MW)	Potential emissions saved per annum when replacing mains gas (tonnes CO2)	Potential emissions saved per annum when replacing oil (tonnes CO2)	Potential available residues for wood chip per annum (odt)[14]	Potential real energy output per annum (MWh) i.e. at respective moisture contents	Potential installed boiler capacity (MWth)	Potential emissions saved per annum when replacing mains gas and electricity (tonnes CO2)	Potential emissions saved per annum when replacing oil (tonnes CO2)
Tree surgeons	1,710	3,763	0.4	1,986	2,054	1,115	797	2,790	0.97	512	623	1,413	6,553	1.4	2,498	2,676
Orchards	8,000	17,600	1.9	9,288	9,606	0	0	0	0	0	0	4,000	17,600	1.9	9,288	9,606
Sawmills	77,027	269,595	28.85	142,267	147,137	470	470	1,647	0.57	302	368	54,248	271,241	29.4	142,570	147,504
Woodlands	4,966	10,926	1.2	5,766	5,963	12,088	8,643	30,250	10.55	5,554	6,752	8,527	41,175	11.7	11,319	12,715
Waste sites	8,000	32,800	3.5	17,309	17,901	0.00	0	0	0	0	0	6,400	32,800	3.5	17,309	17,901
Totals	-	334,683	35.8	176,615	182,660	-	9,910	34,686	12.1	6,368	7,742	74,587	369,369	48	182,983	190,402

Source: "Herefordshire Woodfuel Supply Chain"

4.2.13 The report specifically looked at the wastes being received at waste transfer stations and indentified some 8,000 tonnes of wood waste that might be available for low grade chip, in addition to 17,200 tonnes of wood waste going for chipboard and mulch. This includes the 2,658 tonnes from the Herefordshire Council recycling sites.

Commercial and Industrial Wastes

4.2.14 In 2009 Entec published a report for Herefordshire Council entitled "Herefordshire Minerals and Waste Planning Assessment". This document assessed the quantities of waste arising from a number of sources and assessed the likely waste arisings and how they might change over time. The methodology used was that recently adopted by the West Midlands Regional Assembly in their Phase 2 review of the Regional Spatial Strategy (RSS) which incorporated the objectives and targets of the National Waste Strategy (2007). It must be noted however that the RSS was abolished following the general election and so is no longer in use.

4.2.15 The following table from the report identifies the quantities of the various sources of waste. However, in 2009 a review of the Joint Municipal Waste Management Strategy for Herefordshire and Worcestershire indicated that the growth forecasts should be modified. The amended scenario uses the RSS forecasts but with lower municipal waste forecasts.

Table 4.4 - Projected Waste Arisings in Herefordshire 2003-2026 Herefordshire Amended Scenario (Tonnes)					
Waste stream	**2003**	**2010**	**2015**	**2021**	**2026**
Municipal	98,633	99,288	104,704	111,203	116,619
Commercial & Industrial	167,000	169,000	195,000	249,000	249,000
Construction, Demolition and Excavation	213,408	213,408	213,409	213,408	213,408
Hazardous	8,402	8,402	8,402	8,402	8,402
Agricultural	885,000	885,000	885,000	885,000	885,000
Total	**1,372,443**	**1,375,098**	**1,406,515**	**1,467,013**	**1,472,429**

4.2.16 The management facilities for wastes indicate that the commercial and industrial wastes are generally exported from the area by transfer stations and that it is likely that only a small proportion is handled by material recycling facilities in the County.

4.2.17 The table identifies the waste production rates however, not all these materials produced will be suitable for energy production. Municipal wastes are well known in terms of quantities and composition but C&I wastes have not been subject to the same level of analysis.

4.2.18 Research work includes work undertaken by SWAP for Humberside, by SLR and UrbanMines in Wales as well as by Viridis for Staffordshire and Stoke-on-Trent have attempted to identify the composition of general commercial and industrial wastes as well as construction and demolition wastes.

4.2.19 Generally the figures indicate that C&I wastes containing approximately 5% wood waste and C&D waste approximately 7% wood.

4.2.20 Applying these to the Herefordshire arisings gives the following figures.

Table 4.5 – Projected Wood Waste (Tonnes)					
Waste stream	**2003**	**2010**	**2015**	**2021**	**2026**
Commercial & Industrial	8,350	8,450	9,750	12,450	12,450
Construction, Demolition and Excavation	32,370	32,370	32,370	32,370	32,370
Total	**40,720**	**40,820**	**42,120**	**44,820**	**44,820**

4.2.21 If all this material was available and had a moisture content of 50% it would generate some 98,600MWh of energy.

4.2.22 Clearly this capture rate is unattainable even with Site Waste Management Plans for construction projects and a potential ban on biodegradable waste to landfill. As the materials will also be contaminated it would have to be treated at a WID compliant plant. Potentially this could be diverted to the proposed EfW (Energy from Waste) plant at Kidderminster although the planning application appears to exclude commercial and industrial wastes.

4.2.23 A realistic estimate might be that 25% of these materials might be captured giving a potential capacity requirement of 2.5 MW. This is a small renewable capacity compared to the other opportunities and may be an uneconomic proposition for the construction of a WID compliant facility.

Municipal and commercial waste

4.2.24 Herefordshire is working with Worcestershire in the development of the waste strategy for the municipal solid waste (MSW) generated within the two areas. A Joint Municipal Waste Management Strategy for Herefordshire and Worcestershire was produced in late 2004. This document was reviewed in November 2009 and updated to take account of legislative and cultural changes.

4.2.25 In December 1998, the joint authorities let a contract for the treatment of all MSW arisings in the area to Mercia Waste Management (a company wholly owned by FCC, a Spanish company) with the operation being carried out by Severn Waste Services, a company also wholly owned by FCC. This contract included the recycling, composting and treatment of all residual wastes for a 25 year period.

4.2.26 To deliver the landfill diversion element of the contract, it was intended that a facility, including an EfW plant, would be built in Kidderminster however, this was refused permission following a public enquiry in 2002. A further application for an EfW plant on Hartlebury Trading Estate near to Kidderminster was submitted in May 2010. The new plant has been designed to treat 200,000 tonnes of residual waste and produce some 15.5MW of electricity when it becomes fully operational which is planned for mid 2014. The facility would combust the waste to generate electricity,

of which approximately 60% would be renewable. As the plant will accept MSW from both authorities only a proportion of this energy would be generated from Herefordshire wastes. Indications are that approximately 30% of the residual waste arisings are from Herefordshire and so approximately 4.6 MW of electricity would be allocated to Herefordshire of which some 2.8 MW (60%) would count as renewable. (Source: 5.4.4 Environmental Statement)

4.2.27 The initial site concept and application does not intend that the plant will initially include heat takeoff but this will be pursued during the project development stage. The plant will be designed to include steam utilization and will have the capacity to produce approximately 370,000 MWh/yr of heat in the form of steam. No substantial users of heat have been identified and it is unlikely that a heat utilization scheme will be developed in the near future until emerging government policies on planning and fiscal measures for facilitating heat use come into force or are implemented

4.2.28 The plant is not intended to handle commercial or industrial wastes produced in the area. (Source: Planning Application document Volume 1.)

4.2.29 Should the new facility be granted planning permission then some 2.8 MW of electrical power with the potential for approximately 9.8MW of heat energy would be generated from renewable resources from Herefordshire's MSW. The plants capacity is limited to 200,000 tonnes per year and this represents the majority of Herefordshire and Worcestershire's residual waste. Once operational the plants energy outputs will not change significantly over the life of the facility.

Biogas (EfW)

Landfill gas

4.2.30 Landfill gas arises from the decomposition of the materials within the landfill site. Good practice is to extract gas and utilise it in a gas engine linked to a generator to produce electricity. Where appropriate the heat energy produced by the engines can also be utilised.

4.2.31 The Environment Agency landfill site capacity information indicates that there are no landfill sites operational within Herefordshire. It is not clear at this stage whether

any new landfill sites will become operational within the area and the types of materials that could be accepted. Without any significant new landfill capacity that can accept materials capable of generating landfill gas, there will be no additional contribution from this to renewable energy in the region. Data accessed is shown in Table 4.6 below.

Table 4.6 - 2009 Landfill site data

Site	LFG generation rate (m^3/yr)	Mass of methane emitted (tonnes/yr)	Potential Annual generation (MWh/yr)	% of total energy demand	CO_2 savings (tonnes/yr)
Stretton Sugwas	345	581.4	4,845	<1%	1191
Leominster	90	262.9	2,191	<1%	539
Strangford	27	78.9	657	<1%	162

4.2.32 All of these sites currently allow their methane emissions to escape to atmosphere or are captured and flared. A trial is underway at Stretton Sugwas to evaluate the potential for a gas turbine engine to be installed to generate electricity. If these trials are successful then the technology may be implemented formally, subject to a more detailed site investigation at each landfill site. Therefore at this time it is not known how much of the available methane may be captured, if at all, and so the actual contribution of landfill gas to Herefordshire cannot be calculated until further site specific studies have been completed.

Sewage gas

4.2.33 The sewage treatment capacity in the area is supplied by Welsh Water. The main treatment capacity for the Herefordshire area is at 5 locations within the County. These are at Worcester Road Leominster, Elgn and Rotherwas in Hereford, Ross on Wye and Ledbury.

4.2.34 Across the Welsh Water area there are 12 sites with combined heat and power schemes that capture and burn methane gas. Welsh Water also has a programme to introduce advanced digestion schemes that will convert waste water sludge to electricity. The site at Eign has been producing power since October 2009 and two further schemes will be introduced in Cardiff and Afan by 2011.

4.2.35 The facility at Eign has a gross installed generation capacity of 1,432kW.

4.2.36 Data provided by Welsh Water demonstrates that recent generation at Eign for the months of April to June totalled 909MWh. The breakdown of these months are as follows:

- April 2010 generated 286MWh.
- May 2010 generated 373MWh.
- June 2010 generated 250MWh.

4.2.37 These values give an approximate average sewage gas electricity generation value of 300MWh per month which equates to 3,600MWh/yr. This would give a saving of 886 tonnes of CO_2 per year.

Construction, Demolition and Excavation Waste

4.2.38 Whilst the figures for the majority of the wastes change over time, the figures for construction, demolition and excavation (CDE) as well as agricultural waste are static and for this reason warrant further investigation.

4.2.39 For CDE wastes the West Midlands Regional Assembly looked at the need for waste treatment capacity and identified the expected quantities of waste to 2021 using a scenario that took account of the levels of demolition and construction. Their predicted figures for Herefordshire are shown in Table 4.7 below.

Table 4.7 – Predicted Figures

	C&D waste to 2007 tonnes per year	C&D waste 2007-2011 tonnes per year	C&D waste to 2011-2021 tonnes per year
Herefordshire	351,267	260,498	255,615

4.2.40 The assumptions do not appear to take account of current recycling initiatives in the construction industry. BRE has produced data relating to the quantities of material produced from a variety of developments that relate to Standard Practice, Good Practice and Best Practice. For residential developments the quantity of waste (m^3 per $100m^2$) of development is shown in Table 4.8 below.

Table 4.8 – BRE $m^3/100m^2$ of Development

	Best Practice	**Good practice**	**Standard Practice**
Residential	<9.0	9.0 – 12.9	>12.9

4.2.41 Assuming that over the Plan period construction practice moves from Standard Practice to the mid range of Best Practice, this would show a decrease in waste arisings of some 15%. Using the WMRA figures and a move to better waste management gives an estimate of CDE waste arisings at around 217,000 tonnes post 2021. This is not dissimilar to the CDE wastes identified in the 2009 review for the end of the Plan period. Given that only a small proportion of these materials could provide renewable energy and the lack of detailed information it is reasonable to use the longer term 2009 review figures pending further accurate information.

Animal wastes

4.2.42 Agricultural wastes historically have not been controlled wastes and little information has been collated regarding quantities and trends. The regulations were changed in 2006 when farm waste became subject to the same controls that have been applied to other sectors for many years.

4.2.43 Data for livestock in Herefordshire in 2009 has been obtained from the DEFRA. This details the number of various categories of animals and poultry.

4.2.44 The figures for 2009 are shown in Table 4.9 below.

Table 4.9 - Livestock figures for 2009

Livestock category	Total numbers
Cattle	122,550
Pigs	30,069
Sheep	596,856
Goats	1,684
Horses	4,380
Poultry	8,998,723

Source: DEFRA survey 2009

4.2.45 There are various sources of research information that have identified the amount of manure that is generated by each category of livestock, however, much of this information is intended to identify the spreading rates for manure on land to prevent pollution on nitrate vulnerable zones.

4.2.46 There are a range of manure production figures produced depending on the age, size, and management system used for animal husbandry. The information on livestock numbers at County level does not go into sufficient detail to be able to use

specific values for the detailed information available and so a set values has been used that identifies the total annual production.

4.2.47 Manure production rates for Herefordshire have been estimated as shown in table 4.10 below.

Table 4.10 – Estimated manure outputs

Livestock	Number	No of animals to produce 1 tonne of organic waste /day	Annual total Tonnes
Cattle	122,550	30	1,491,025
Pigs	30,069	275	39,910
Sheep	596,856	550	396,095
Goats	1,684	550	1,117
Poultry	8,998,723	8,500	386,416

4.2.48 The most easily available manures will be those from dairy and beef cattle which will be housed in buildings during the winter period. The pigs and poultry will also be housed but generally on a year long basis. It should be noted that not all the manure can be collected during all the year as some animals will be outside during the summer months.

4.2.49 The calculation of a more exact manure production will depend on the specific details of the management systems for the animals and birds and the range of number of various categories of animals and poultry types in the area.

4.2.50 The methodology indicates that it is reasonable to assume that some 80% of the resource for animal manure is physically available and that the gas generation is $25m^3/t$ for cattle manure and $26m^3/t$ for pig manure.

4.2.51 At a rate of 8,500 birds per tonne of excreta per day gives a waste generation of approximately 386,416 tonnes per year. As the birds are kept indoors it is assumed that 100% of the materials produced are collected. The benchmark figure of 11,000 tonnes of excreta per MW gives a potential generation capacity of about 35.1MW, equivalent to an annual generation potential of 307,728MWh/yr.

4.2.52 The potential for gas generation from these resources is a follows:

Animal biomass – wet organic waste

Table 4.11 - Potential Power generation					
Material source	**Potential manure available (tonnes/yr)**	**Biogas generation (M^3/yr)**	**Potential annual generation capacity (MWh/yr)**	**% of total energy demand**	**CO_2 savings (tonnes/yr)**
Cattle	1,192,820	29,820,500	59,641	1%	14,672
Pigs	31,928	830,128	1,660	<1%	408
Poultry	386,416	-	307,728	6%	75,701

4.3 Hydro-electricity

4.3.1 The hydro–electric resource assessment was undertaken for Wardell Armstrong by Iain Beath of Renewable Power Ltd. The SQW Energy methodology recommends using the Environment Agency's (EA) recent report "Mapping Hydropower Opportunities in England and Wales (2009)" for the hydro-electric resource assessment. This was a mapping exercise of all barriers on watercourses that have potential for hydro-electric power production. These sites were graded in terms of potential power output, environmental sensitivity and whether they provide the opportunity for a "win-win" situation for both developers and environmental interests through for example, provision of a fish pass. By definition these sites are "low head" and a separate exercise was undertaken to identify potential high head sites. The results of the assessments are summarized below. Details on a site by site basis are available as spreadsheets or GIS layers. Full details of the methodologies used for both low and high head site assessments are contained in Appendix 5.

EA/Low Head Sites >10kW

4.3.2 A total of 63 low head sites over 10kW were identified in the EA data. Table 4.12 below summarizes the results. The spatial distribution of the sites is shown in Figure 4.19 in Appendix 4.

Table 4.12: Low Head Hydro Sites >10kW				
	Power (kW)	**Energy (MWh/yr)**	**% of total energy demand**	**CO_2 savings (tonnes/yr)**
Grand Total	13,661	53,853	1.04%	29,242
Total Low Sensitivity	0	0	0.00%	0
Total Medium Sensitivity	371	1,461	0.03%	794
Total High Sensitivity	13,291	52,392	1.01%	28,449
Total Win/Win	0	0	0.00%	0

4.3.3 A single site close to Symonds Yat near Monmouth accounts for 75% of this 10kW+ potential. This and the majority of the remaining sites, including 14 of the other 17 sites above 50kW have a high environmental sensitivity. It is recommended that the environmental sensitivity of this principal site and other high power potential sites is examined in more detail along with other pre-feasibility issues. There are no EA "win-win" sites in the 10kW+ bracket.

EA/Low Head Sites <10kW

4.3.4 A total of 91 low head sites under 10kW were identified in the EA data. Table 4.13 below summarizes the results. The spatial distribution of the sites is shown in Figure 4.20 in Appendix 4.

Table 4.13: Low Head Hydro Sites <10kW				
	Power (kW)	**Energy (MWh/yr)**	**% of total energy demand**	**CO_2 savings (tonnes/yr)**
Grand Total	448	1,767	0.03%	959
Total Low Sensitivity	125	493	0.01%	268
Total Medium Sensitivity	218	859	0.02%	466
Total High Sensitivity	105	415	0.01%	225
Total Win/Win	2	10	0.00%	5

4.3.5 There is a single site of very modest power potential, which the EA regards as a potential win/win.

High Head Sites

4.3.6 A total of 18 high head sites were identified. Table 4.14 below summarizes the results. The spatial distribution of the sites is shown in Figure 4.21 in Appendix 4.

Table 4.14: High Head Hydro Sites				
	Power (kW)	**Energy (MWh/yr)**	**% of total energy demand**	**CO_2 savings (tonnes/yr)**
Grand Total	525	2,071	0.04%	1,125

4.4 Solar

4.4.1 The following section gives the resource assessments for solar energy which are summarised in Table 4.15 at the end of this section. At a micro level, solar energy can be harnessed through either solar water heating (SWH) or solar photovoltaic (PV) technology. The suitability of both systems will be dependent upon the available

roof space and the orientation and exposure of the roof. In addition the suitability of SWH will also depend on the hot water demand on site. Generally there is high demand for hot water in domestic properties but a low demand in commercial and industrial properties. In this report it has been assumed that 50% of the domestic buildings deemed suitable for solar deployment will be installed with SWH and the remaining 50% with solar PV. Only solar PV has been considered for commercial and industrial buildings. Full details of the assessment methodology applied are given in Appendix 5.

Existing Domestic Buildings

4.4.2 There are 83,080 existing domestic properties in Herefordshire. This equates to 78,034 roofs, accounting for properties combined in a single building. 19,509 of existing roofs were deemed suitable for a solar system once the parameters recommended in the SQW Energy guidance were applied. 39 MW of solar capacity could be installed on existing domestic properties. This would generate 33,164 MWh/yr. This will provide an annual CO_2 saving of 4,072 tonnes from SWH systems and 8,964 tonnes from solar PV systems. The total saving is expected to be 13,035 tonnes of CO_2/yr from suitable existing domestic buildings.

New Domestic Buildings

4.4.3 Herefordshire Council expects 18,000 new homes to be developed in the County up to 2026. The SQW Energy guidance suggests that 50% of these properties will be suitable for the installation of solar systems, a total of 9,000 new dwellings. 18 MW of solar capacity could be installed on these new domestic properties. This would generate 15,300 MWh/yr. This will provide an annual CO_2 saving of 1,559 tonnes from SWH systems and 4,154 tonnes from solar PV systems. The total saving is expected to be 5,713 tonnes CO_2/yr.

Commercial Buildings

4.4.4 There are 5,457 buildings classified as commercial within Herefordshire. 2,182 of them were deemed suitable for a solar system once the parameters recommended in the SQW Energy guidance had been applied. 11 MW of solar capacity could be installed on existing commercial properties. This would generate 9,910 MWh/yr. This will provide a CO_2 saving of 5,381 tonnes CO_2/yr.

Industrial buildings

4.4.5 There are currently 2,205 buildings classified as industrial within Herefordshire. 1,764 were deemed suitable for a solar system once the parameters recommended in the SQW Energy guidance had been applied. 18 MW of solar capacity could be installed on existing industrial properties. This would generate 16,035 MWh/yr. This will provide an annual CO_2 saving of 8,707 tonnes CO_2/yr.

Summary

4.4.6 Some 68MW of solar technologies could be installed on existing buildings within Herefordshire, generating 59,109 MWh/yr and equivalent to a saving of 27,124 tonnes of CO_2 per annum. This would meet 1.14% of the County's total energy demand. New developments could provide an additional 18MW, generating 15,300 MWh/yr by 2026, some 0.3% of the County's energy demand and producing a saving of 5,713 tonnes of CO_2 per annum. By 2026 in total Herefordshire could generate 74,409 MWh/yr from solar technologies. This would save 32,837 tonnes of CO_2 per annum and meet 1.44% of the County's total energy demand.

Table 4.15: Summary of Solar Resource Assessments

	Installed Capacity (MW)	Potential Annual Generation (MWh/yr)	% of Energy Demand	CO_2 Savings (tonnes/yr)
Domestic				
Existing	39	33,164	0.64%	13,035
New Build (up to 2026)	18	15,300	0.30%	5,713
Commercial	11	9,910	0.19%	5,381
Industrial	18	16,035	0.31%	8,707

4.4.7 Note that the above does not include potential solar PV farms (5MW sites) as this is not part of the SQW Energy methodology. There may therefore be additional potential for energy generation from solar PV.

4.5 Heat pumps

4.5.1 The following section gives the resource assessments for heat pumps which are summarised in Table 4.16 at the end of this section. Both ground source heat pumps (GSHPs) and air source heat pumps (ASHPs) have been modelled along with their corresponding differences in CO_2 savings. Full details of the methodology employed are given in Appendix 5.

Existing Domestic Buildings

4.5.2 There are 38,402 existing domestic properties in Herefordshire that are not connected to a mains gas supply. All of these properties would be suitable for either a GSHP or an ASHP giving a potential installed capacity of 192MW.

4.5.3 The total potential annual energy output for heat pumps installed in suitable existing domestic properties located off the gas grid is estimated at 384,016 MWh/yr. This is approximately 7.4% of Herefordshire's annual energy demand. This will provide an annual CO_2 saving of 42,162 tonnes from GSHPs or 10,882 tonnes from ASHPs.

4.5.4 There are 44,678 existing domestic properties in Herefordshire that are connected to a mains gas supply. Approximately 60% of these properties were considered suitable for fitting a 5kW heat pump, which would add 132MW to the installed capacity. The total potential annual energy output for heat pumps installed in existing domestic properties located on-grid is 272,197 MWh/yr. This is approximately 5.3% of Herefordshire's annual energy demand. This will provide an annual CO_2 saving of 18,505 tonnes from GSHPs or -3,667 tonnes from ASHPs.

New Domestic Buildings

4.5.5 Herefordshire Council expects 18,000 new homes to be developed in the County up to 2026. The SQW Energy guidance recommends that 50% of these properties will be suitable for the installation of a heat pumps, a total of 9,000 new dwellings, giving an additional installed capacity of 45MW. The total potential annual energy output for heat pumps installed on new domestic buildings is 90,000 MWh/yr, some 1.7% of current total energy demand for the County. This will provide an annual CO_2 saving of 6,118 tonnes from GSHPs or -1,212 tonnes from ASHPs.

Commercial Buildings

4.5.6 There are 5,457 buildings classified as commercial properties in Herefordshire. 25% of these are likely to be suitable for heat pumps, a total of 1,364. This results in a potential installed capacity for heat pumps in commercial buildings of 136MW. The potential annual energy output would be 272,850 MWh/yr, some 5.3% of total existing energy demand. This will provide an annual CO_2 saving of 18,549 tonnes from GSHPs or -3,676 tonnes from ASHPs.

Summary

4.5.7 A total capacity of 465MW could be installed, generating 929,063 MWh/yr from heat pumps, equivalent to a saving of 79,216 tonnes of CO_2 per annum from GSHPs or 3,539 tonnes of CO_2 per annum from ASHPs.

4.5.8 New developments could provide an additional installed capacity of 45MW producing 90,000 MWh/yr by 2026, equivalent to a saving of 6,118 tonnes of CO_2 per annum from GSHPs or -1,212 tonnes of CO_2 per annum from ASHPs.

4.5.9 By 2026 Herefordshire could generate 1,019,063 MWh/yr from an installed capacity of 509MW of heat pumps. This equates to 19.7% of the County's current total energy demand and would save 85,334 tonnes of CO_2 per annum from GSHPs or 2,327 tonnes of CO_2 per annum from ASHPs.

Table 4.16: Heat Pump Resource

		Installed Capacity (MW)	Potential Annual Generation (MWh/yr)	% of Total Energy Demand	CO_2 Savings (tonnes of CO_2/yr)	
Domestic					ASHP	GSHP
Existing	Off-grid	192	384,016	7.4%	10,882	42,162
	On Grid	136	272,197	5.3%	-3,667	18,505
New Build		45	90,000	1.7%	-1,212	6,118
Commercial		136	272,850	5.3%	-3,676	18,549
Total		509	1,019,063	19.7%	2327	85,334

4.6 CHP, District Heating and Tri-generation

4.6.1 Combined heat and power (CHP) is the simultaneous generation of heat and power from a single generating plant, which can be run on either renewable or fossil fuels. Whilst a fossil fuel plant will still emit CO_2, savings will be made by the utilisation of heat, which is normally wasted through conventional methods of electricity generation, thereby providing a low carbon alternative energy source.

4.6.2 The SQW Energy guidelines suggest assessment of deployment opportunities for CHP is reliant upon economic benchmarks rather than technical ones. The viability of CHP schemes is determined by economic criteria which is based on a number of assumptions including cost of infrastructure, energy prices, building energy performance and consumer behaviour. The larger the CHP plant the better the economies of scale and therefore CHP deployment is most suited to areas with high

heat densities. The potential for CHP deployment is therefore assessed on the available heat demand and the density of demand. This is due to the costs and infrastructure complications associated with CHP and district heating developments.

4.6.3 The SQW Energy guidance does not provide set parameters for assessing the potential for CHP and/or district heating. The methodology suggests that the opportunities for low-carbon energy can be influenced by local factors and as such, should be assessed based on the following considerations:

- *Heat demand mapping – current and potential future demand, using the lowest special resolution level viable from data availability and technically analysis perspective*
- *Assumptions on the proportion of the heat demand met through low-carbon capacity*
- *Assumptions on the operation regime of the low-carbon plant e.g. running hours*
- *Strategic constraints on deployment e.g. relating to supply and storage of fuels.*

-SQW Energy

4.6.4 CHP deployment is most suited to new developments, where there is a significant heat load. This allows infrastructure to be put into place before development begins, minimising costs. Whilst it is not impossible to retrofit CHP and district heating schemes into existing buildings, it is significantly more expensive and is general only considered practical as part of a regeneration strategy.

CHP and District Heating for Herefordshire

4.6.5 The potential for CHP deployment for Herefordshire was based on current and future heat demands. Based on current levels of development it is considered too expensive to retrofit a CHP plant and district heating scheme anywhere in the County. A CHP and/or district heating scheme would be most suited to future developments, where there is significant heat demand to warrant the costs of a scheme.

4.6.6 There is limited information about planned future commercial development within Herefordshire although the Place Shaping Consultation Paper identifies that 40,000m^2 of non-food floorspace is likely to be created in Hereford by 2021 and a

further 20,000m^2 by 2026. It is assumed that this floor space will comprise a variety of business sectors, each with different benchmarks appropriate to estimate heat demand. For the purpose of this assessment a similar mix to that found in the commercial and industrial sectors across the rest of Herefordshire has been assumed. On that basis 60,000m^2 of non-food floorspace translates to approximately a 15.4GWh/yr of heat load. This heat load could potentially support a Combined Heat and Power plant, if the brown field sites considered for redevelopment are sufficiently close together and the required infrastructure can be installed during construction.

4.6.7 The most suitable areas for CHP and/or district heating installations would be future housing or mixed-use developments. Herefordshire has a target to develop approximately 18,000 new houses up to 2026. The majority of theses dwellings will be small rural developments, however, there are single strategic urban extensions planned for Hereford, Leominster, Ledbury, Ross-on-Wye and Bromyard. Table 4.17 below shows the target number of dwellings for each planned urban extension.

Table 4.17: Planned Single Strategic Urban Extensions

Location		Year			Total
		2015	2020	2026	
Hereford	Bullinghope	250	350	400	1,000
	Whitecross	400	500	600	1,500
	Three Elms	400	500	600	1,500
	Holmer West	100	150	250	500
	Brownfield/Urban village	200	250	350	800
Leominster		400	500	800	1,700
Ledbury	Viaduct	350	350	0	700
Ross-on-Wye	Hildersley	350	0	0	350
Bromyard	Hardwick Bank	125	125	0	250

4.6.8 The criteria for specifying a CHP plant differ from those for pure power generation in that, unlike electricity, it is not possible to export excess heat when it is not required and import it when on-site capacity is insufficient. CHP plants are therefore often sized to meet either the maximum or average heat demand. In the former case, a significant amount of heat will be wasted particularly at times where there is a high electrical demand and a low heat demand. In the latter case, an additional source of

heat, e.g. a gas boiler, will be required to meet above average demands. A variant on this is to size the plant above the average demand and accept that some of the heat will be wasted at certain times. This is less of a problem where the heat can be used on a 24/7 basis where the peak and average demands are close together, e.g. for industrial processes, however, space heating due to the diurnal and seasonal nature of the demand presents a particular problem.

4.6.9 CHP is suited to developments where there is a high heat demand. Current technically viable units range from 500kWe upwards. However, for CHP to be economically viable it is more suited to large applications incorporating residential and industrial developments.

4.6.10 The capital costs of a CHP plant will depend upon capacity and will incur running costs for the fuel consumption, operation and maintenance. This will depend upon the type of plant and fuel available in the area.

4.6.11 The projected heat demands for each planned urban extension in Herefordshire are taken from Section 3. The final (2026) peak heat capacities were estimated based on these heat demands and a typical heat usage of 2,000 hours per year. The base load capacity has been estimated based upon 60% of the peak load. These are shown in Table 4.18 below.

Table 4.18: Estimated Heat Demands for Planned Urban Extensions

Location		Total Heat Load (MWh/yr)	Total Electric Load (MWh/yr)	Heat Capacity (MW Peak)	Heat Capacity (MW Base load)	Electric Capacity (MW)
Hereford	Bullinghope	5,084	3,286	3.74	2.24	0.38
	Whitecross	7,626	4,929	5.61	3.36	0.56
	Three Elms	7,626	4,929	5.61	3.36	0.56
	Holmer West	2,542	1,643	1.87	1.12	0.19
	Brownfield/ Urban village	4,067	2,629	2.99	1.79	0.30
Leominster		8,643	5,587	6.36	3.81	0.64
Ledbury	Viaduct	3,559	2,300	2.62	1.57	0.26
Ross-on-Wye	Hildersley	1,779	1,150	1.31	0.79	0.13
Bromyard	Hardwick Bank	1,271	822	0.93	0.56	0.09

4.6.12 Gas CHP systems provide electricity to heat ratio of approximately 1:1 and can therefore be implemented to meet the relatively low heat demand. This would be the most suitable CHP option for these developments; however, this will still over produce electricity. Whilst this scale system is technically viable it is unlikely to receive high returns on investment due to low heat sales, and would therefore not prove particularly attractive to an investor.

4.6.13 Generally, biomass CHP plants below 2.5MW_e for district heating applications are considered highly expensive due to the amount of infrastructure required to support a relatively small heat load, providing minimal investment returns. Therefore none of these developments would warrant a biomass CHP scheme that could be considered economically viable. Installing a plant this size in any of the plant development would result in the generation significant amounts of excess heat. To overcome this, a high density heat demand would be required which could be found in the form of large industrial heat user close to the development site.

4.6.14 Table 4.19 below shows the potential large scale heat users located close to the planned urban extensions in Herefordshire. These were identified through mapping industrial buildings within Herefordshire and analysing those located close to the planned development areas.

Table 4.19: Potential Large Scale Heat Users

Development		Nearest Potential Large Scale Heat Users	Operator/Owner
Hereford	Bullinghope	Sewage Works	Severn Waste
		Eign Sewage Works	Welsh Water PLC
	Whitecross	Water Works	DWr Cymru Welsh Water
	Three Elms	Garden Centre and Nurseries	Wyevale
		Whitecross High School	Herefordshire Council
	Holmer West	No Large Users Identified	
	Brownfield/Urban village	No Large Users Identified	
Leominster		Supermarket	Morrisons
Ledbury	Viaduct	Commercial Poly-Tunnel	Unknown
Ross-on-Wye	Hildersley	No Large Users Identified	
Bromyard	Hardwick Bank	No Large Users Identified	

4.6.15 This table provides an indication of the potential high heat demand industries located near to the planned development sites. Further feasibility work should be

undertaken by the Council or the Developer to assess the heat demand of the industries and whether there is scope to incorporate them into a CHP scheme.

4.6.16 In order for CHP to be a commercially viable option in Herefordshire, the Council should encourage mixed use development in these growth areas and co-location of large heat industries with these planned residential developments.

4.6.17 Note: Tri-generation is not a suitable option unless CHP is viable and will only be commercially feasible if used to supply commercial and industrial business with large cooling demands.

Biomass Boilers and District Heating

4.6.18 Alternatively, each development could be heated by a biomass boiler and district heating scheme. Biomass boilers for heating are considerable cheaper than CHP plants and would therefore be more viable for smaller heat loads.

4.6.19 Dry biomass is converted to energy through combustion in a fuel boiler or through other thermal processes such as pyrolysis and gasification. There are a number of sources of suitable dry biomass material including waste wood, energy crops, crop residues and forest residues from managed woodlands. Properly managed biomass resources are renewable and sustainable. When they are growing they absorb CO_2 from the atmosphere and when they are burned it is released back into the atmosphere, thus locking up large amounts of CO_2 in a closed cycle and displacing CO_2 produced from fossil fuels. Burning biomass rather than fossil fuels can also reduce emissions of the gases responsible for acid rain, as well as cutting CO_2 emissions. At the domestic scale, modern combustion technologies are now available so that biomass energy production is clean, efficient and sustainable

4.6.20 Biomass boilers can provide both water and space heating. Boilers range in size from small scale units for single dwellings to large boilers supplying a district heating scheme. For large scale boilers there are three sizing options:

- Base load sizing provides the minimum required heat load with additional requirements being met by a second fossil fuel boiler.
- Peak load sizing provides the capability to meet the full heating demand through the biomass boiler.
- Optimum sizing provides a combination of both methods.

4.6.21 Optimum sizing is generally the most common system, providing 80 – 90% of heating demands from the biomass boiler with peak demand met by a conventional fossil fuel boiler. This reduces the capital expenditure and allows the biomass boiler to run constantly, as is the preferred method of operation without wasting heat.

4.6.22 Biomass boilers are typically fuelled by wood chips or wood pellets. Wood chips are cheaper (approx. £45/tonne) but have lower calorific value (/m^3) than pellets. Pellets cost approximately £160/tonne but require a smaller storage area and handling systems. Fuel costs decrease as the demand increases with the economies of scale on fuel processing and delivery.

4.6.23 The cost of biomass boilers vary depending upon the installed capacity and fuel requirement. Generally they are suited to applications with large space and water heating demands such as large housing or industrial developments. Drawbacks with biomass systems are the need for a reasonable amount of space on site for fuel storage (particularly in the case of larger wood chip systems) and/or regular fuel deliveries and the requirement to dispose of the ash generated.

4.6.24 Biomass boilers for the urban extensions in Herefordshire have been sized to meet optimum loading. This would mean that gas boilers would need to be installed on site to meet peak demand, this would also be necessary to assist the gradual development of the site over the 11 year development period. The required installed capacity for each biomass boiler and the associated fuel requirements and CO_2 savings are shown in Table 4.20 below.

Table 4.20: Biomass Boiler Sizing

Development		Heat Demand MWh/yr	Optimum Capacity (MW)	Wood Fuel Requirement tonnes/yr	CO_2 Saving tonnes/yr
Hereford	Bullinghope	5,084	2.2	968	1,036
	Whitecross	7,626	3.4	1,453	1,554
	Three Elms	7,626	3.4	1,453	1,554
	Holmer West	2,542	1.1	484	518
	Brownfield/Urban village	4,067	1.8	775	829
Leominster		8,643	3.8	1,646	1,761
Ledbury	Viaduct	3,559	1.6	678	725
Ross-on-Wye	Hildersley	1,779	0.8	339	363
Bromyard	Hardwick Bank	1,271	0.6	242	259

Summary

4.6.25 CHP and district heating schemes are primarily constrained by economic barriers. At present in Herefordshire there is not significant development or planned urban regeneration to warrant a large scale CHP scheme.

4.6.26 The planned urban extensions detailed by the Council are generally considered as small scale and therefore a CHP scheme would not be economic. This could be overcome by incorporating existing large scale heat users into the heating network.

4.6.27 Alternatively, the Council should seek to encourage biomass boilers and district heating networks for the planned urban extensions.

4.7 Other technologies

Hydrogen

4.7.1 Hydrogen is already used globally in many industrial applications. It is the most plentiful element in the universe but does not occur naturally as a gas on the Earth. It always appears combined with other elements; water for example (H_2O). Hydrogen is also found in many organic compounds, notably the *hydrocarbons* that make up many of our fuels, such as gasoline, natural gas, methanol, and propane. Hydrogen can be separated from hydrocarbons through the application of heat (*reforming)* or an electrical current can be used to separate water into its components of oxygen and hydrogen (*electrolysis)*. It should be noted that hydrogen is an energy carrier, not an energy source. Hydrogen is high in energy, but an engine that burns pure hydrogen produces almost no pollution. Most hydrogen is currently produced from natural gas by reforming but other sources such as bacteria that convert biodegradable organic matter into hydrogen and electrolysis methods using photovoltaics, solar cells or wind turbines are being developed.

4.7.2 Electricity can be produced from a fuel cell which combines hydrogen and oxygen to produce electricity, heat, and water. Fuel cells can be used to provide stationary power, transportation power and portable power as the technology is scalable. They can be used to produce quite small amounts of electric power for devices such as portable computers, higher outputs for cars and residential units, right up to very high power outputs for electric power stations. They are fundamentally more efficient than combustion systems achieving 40-50% fuel to electricity conversion

efficiency using hydrocarbon fuels such as natural gas and more than 50% efficiency using pure hydrogen. Hybrid systems using high temperature fuel cells and a turbine can achieve electrical efficiencies at up to 70%. If the fuel cell is located at the point of use then the waste heat can be used to provide hot water or space heating. In these situations efficiencies over 85% have been achieved. The use of hydrogen for transport and to power and heat commercial and residential properties is on the increase with ongoing research and development and deployment through funded schemes.

4.7.3 Systems for buildings are becoming more commonplace, an example is the Palestra building in Southwark housing Transport for London and London Development Agency staff. The building houses the UK's largest building housed hydrogen fuel cell and produces all it's off peak power and 25% of its peak power requirements.

4.7.4 Developments are progressing at a household level with British Gas and Ceres Power as well as Baxi Innotech developing fuel cells running on natural gas, producing both heat and power. The advantage of these smaller units is that they are anticipated to be useable by up to 14.5 million homes in the UK and would provide a bridge to hydrogen power as they can also operate on the fuel. These systems are designed to supply about 70% of the energy requirements for a typical single family home and have less than 50% of the CO_2 emissions of conventional boilers. Using the existing gas infrastructure they can deliver a significant reduction in carbon emissions (up to 2.5 tonnes per household per year) and household energy bills by 25% in the longer term. Fuel cells are predicted to develop into the dominant residential mass market CHP solution within the microgeneration sector due to their high energy efficiency and output matched to a home's requirements.

4.7.5 The use of hydrogen for transport is becoming more common with London developing 6 sites for a hydrogen vehicle refueling network by 2012 and a refueling station for buses to be operational by 2010. Car manufacturers are developing vehicles using fuel cells and hybrid buses and other vehicles are commonplace in cities worldwide.

4.7.6 If a hydrogen economy is to be developed the issues of production, storage and transport need to be addressed. It appears that hydrogen production can be

sufficient to meet the needs for heat and power as well as transport. Storage can be undertaken in a liquid or gaseous form but other chemical storage options are available including ammonia and metal hydrides. Underground caverns and depleted coal and oil fields can be used and can act as grid energy storage which is essential. For distribution, steel pipes are suitable but the PVC natural gas pipelines currently used are too porous.

4.7.7 The likely scenario to 2030 is that the hydrogen technology will continue to develop. However it will certainly not be to an extent where the natural gas grid is replaced by a hydrogen gas grid. Hydrogen will develop as a transport fuel but it will initially be restricted to small markets such as vehicle fleets and buses because of their fixed routes and depot bases. The introduction of fuel cells is likely to happen for new buildings at a household or community level but these will be natural gas fired using existing gas transport infrastructure. There will be some commercial buildings powered by hydrogen but these are again likely to be to some extent demonstrator projects. There will also be the development of the Hydrogen Mini Grid System model, again linked to specific demonstrator projects.

4.7.8 Whilst these developments can show a significant CO_2 reduction over current power provision, they will be at a small scale and are therefore unlikely to have any significant impact on overall CO_2 emissions in Herefordshire in the plan period especially as the current production of hydrogen is from fossil fuels.

Carbon Capture and Storage (CCS)

4.7.9 There are no large fossil fuelled power stations in Herefordshire. Therefore there is no option to utilise CCS technologies linked to power stations in the County.

Biochar

4.7.10 An alternative to conventional carbon capture and sequestration is the use of biochar. Sequestration using biochar is currently at the research stage and as yet there are no financial incentives for it.

4.7.11 Biochar is a byproduct of pyrolysis (an advanced thermal treatment technology) where waste and/or woody biomass is heated in an oxygen deficient atmosphere and the resulting volatile hydrocarbon compounds are captured for use as a gaseous

or liquid fuel. The remaining solid material, the char, is rich in carbon. This is the same process as traditionally used for producing charcoal.

4.7.12 The resulting biochar is returned to the ground as a soil conditioner. Because biochar is very stable, this effectively provides long time inert storage for the CO_2 captured by the plant material before it was pyrolyised.

4.7.13 Most commercially available advanced thermal treatment plants usually gasify (the Water Gas Reaction) the char produced in the pyrolysis phase immediately to produce a syngas (CO + H2) for use in boilers or gas engines along with the volatile compounds from the pyrolysis. In some cases some of the char is combusted to drive the pyrolysis phase. As diverting the biochar for sequestration purposes has a significant impact on the efficiency and cost effectiveness of any advanced thermal treatment plant, it will not be financially viable unless a significant subsidy is forthcoming. A watching brief on biochar research and legislation is therefore suggested.

5 RENEWABLE ENERGY POLICY DEVELOPMENT AND TARGET SETTING

5.1 Policy review

5.1.1 There is a clear framework through EU, national and local legislation for the inclusion of planning policies designed to encourage the implementation of suitable renewable energy schemes to help achieve European and national targets on CO_2 emissions and Climate Change. Below is a summary of national through to local spatial scale policies which will help inform renewable energy policy development in Herefordshire.

National Policy/legislation

5.1.2 The Government has set challenging targets to mitigate and adapt to the impacts of climate change. The strategy to achieve these challenging targets is set out in the UK Low Carbon Transition Plan and the Renewable Energy Strategy. These national targets alone provide sufficient justification for setting stringent energy policies in development plan documents.

UK Low Carbon Transition Plan (2009)

5.1.3 The UK Low Carbon Transition Plan is an overarching document which plots how the UK will cut emissions by 18% on 2008 levels by 2020. In addition it sets out how the UK will generate 30% of electricity from renewable energy by 2020. The Plan also illustrates how CO_2 emission reductions in key sectors including power and heavy industry; transport; homes and communities; workplaces and jobs; and farming, land and waste could enable 'carbon budgets' to 2022 to be achieved. A number of additional, more detailed, documents were published alongside the Plan including a Greener Future (DfT), the UK Low Carbon Industrial Strategy (BIS and DECC), and the UK Renewable Energy Strategy (DECC).

Renewable Energy Strategy (2009)

5.1.4 As part of EU-wide action to increase the use of renewable energy, the UK has committed to sourcing 15% of its energy from renewable sources by 2020. This document published in 2009 sets out the comprehensive action plan required to deliver this increase in renewable energy sources. The three main elements of the plan revolve around the following strategic points:

- Achieving a balance of fuels and technologies.
- The Government's strategic role in leading delivery of renewables targets.
- The opportunities for individuals, communities and businesses to harness.
- Renewable energy and contribute to action against climate change.

The Energy Act 2008

5.1.5 The aim of the Energy Act 2008 is to implement the legislative aspects of the Energy White Paper 2007: 'Meeting the Energy Challenge'. The important contributions of the act are detailed below.

5.1.6 **Renewable Obligation**: The act strengthens the Renewables Obligation (RO) to increase the diversity of electricity supplies, improve the reliability of energy supplies and help lower carbon emissions from the electricity sector. The RO works by placing an obligation on licensed electricity suppliers to source a specified and annually increasing proportion of their electricity sales from renewable sources, or pay a penalty.

5.1.7 **Feed-in tariffs**: Feed-in tariffs (FITs) enable the Government to offer financial support for low-carbon electricity generation in projects up to 5 megawatts (MW). The aim is for generators to receive a guaranteed payment for generating low-carbon electricity. FIT schemes were introduced through changes to electricity supply licences. The Feed-in Tariffs (Specified Maximum Capacity and Functions) Order 2010 ("the FITs Order") came into effect on 1 April 2010.

5.1.8 **Renewable Heat Incentive**: RHI is a proposed financial support programme for renewable heat generated from a range of sources, from large industrial sites to individual households. Heat generated from renewable sources accounts for approximately 1% of total heat demand although this may need to rise to 12% to meet EU regulations. Following a consultation period, the outgoing Government aimed to introduce Renewable Heat Incentive Schemes by April 2011.

Climate Change Act 2008

5.1.9 The UK has passed legislation which introduces the world's first long-term legally binding framework to address the impacts of climate change.

5.1.10 The Climate Change Act creates a new approach to managing and responding to climate change in the UK, by:

- Setting ambitious, legally binding targets.
- Taking powers to help meet those targets.
- Strengthening the institutional framework.
- Enhancing the UK's ability to adapt to the impact of climate change.
- Establishing clear and regular accountability to the UK Parliament and to the devolved legislatures.

The Local Government (Miscellaneous Provisions) Act 1976 as amended by the Electricity Act 1989

5.1.11 Following an extensive consultation period the Government has seen fit to make the necessary legislative changes to section 11(3) of the Local Government (Miscellaneous Provisions) Act 1976 for England and section 170A(3) thereby enabling Local Authorities to sell electricity generated from renewable sources as of the 18 August 2010 in England, Wales and Scotland.

5.1.12 These legislative changes will give Local Authorities a greater opportunity to generate additional revenue whilst continuing to meet their Climate Change targets. The changes could also serve to encourage the use of technologies such as solar power which otherwise may not have been economically viable; improve energy efficiency and promote innovative solutions to meet current energy issues.

PPS1: Sustainable development (2005)

5.1.13 *Planning Policy Statement 1: Delivering Sustainable Development (PPS1) (*2005) places an emphasis on promoting more sustainable development, with a supplement to PPS1 on climate change published in December 2007. It advises planning authorities to provide a framework to encourage low carbon and renewable energy generation in their local development documents and confirms that there are situations where it is appropriate for LPA to expect higher standards than building regulations. However, care must be taken to demonstrate that requirements are viable, will not have a negative effect on housing development and will not inhibit the provision of affordable housing.

PPS12: Local Spatial Planning (2008)

5.1.14 Planning Policy Statement 12 (PPS12) published on the 4th June 2008 explains the basis of local spatial planning, and how the planning framework it introduces benefits communities. The guidance sets out what the key elements of local spatial plans are and government policies on how they should be prepared. PPS12 should be taken into account by local planning authorities in the preparation of development plan documents and other local development documents.

5.1.15 The production of core strategies of core strategies should follow the Government's principles for community engagement in planning. The production of 'sound' and 'locally distinctive' policies must be 'justifiable'; therefore founded on a robust and credible evidence base and be the most appropriate strategy when considered against reasonable alternatives, and also 'effective' meaning that they are deliverable, flexible and able to be monitored.

PPS22: Renewable Energy (2004)

5.1.16 The current Government target for electricity generated through renewable energy is 10% by 2010, increasing to 15% by 2015. Planning Policy Statement 22 (PPS22) published on the 19 August 2004 sets out the Government's national planning

policies which it hopes will help deliver its renewable energy targets by encouraging proposals for the use of renewable energy resources such as biomass, onshore wind power, active solar systems, small scale hydro-electricity schemes and energy from waste combustion and landfill gas, subject to an assessment of their impact using criteria-based policies.

"….. local development documents should contain policies designed to promote and encourage, rather than restrict, the development of renewable energy resources…"

Planning for renewable energy: A companion guide to PPS22 (2004)

5.1.17 The Planning for renewable energy companion guide, published on the 19th December 2004, provides practical advice on the best ways to implement renewable energy provisions through LDD's. Key guidance provided includes the identification of broad geographical areas suitable for renewable energy developments; building design and layout; detailed amenity issues; use of renewable in local authority property and through procurement, and guidance on how local distinctive renewable energy polices should be included in LDDs. The companion guide also presents best practice examples to help inform local policy development.

National Building Regulations

5.1.18 Building Regulations set standards for design and construction which apply to most new buildings and many alterations to existing buildings in England and Wales. These standards have an important role to play in improving energy efficiency and reduce CO_2 emissions in the UK.

Zero-Carbon Homes post 2016

5.1.19 Substantial, and cost-effective, reductions in carbon emissions from buildings will be an essential aspect of the Government's ambitions for a low-carbon and eco-friendly economy. Much of that reduction will come from retrofitting the existing housing stock, with new-build homes also playing a pivotal role. The Government is committed to improving the energy efficiency of new homes and as such aims to ensure that from 2016 all new housing will be zero-carbon.

5.1.20 The role of Local Authorities is central in achieving real reductions in carbon emissions. Important steps in achieving zero carbon homes by 2016 are as follows:

1) The introduction of a minimum standard for fabric energy efficiency based on that set out in the recent consultation on the Code for Sustainable Homes. This is due to be taken forward in future revisions of Part L of the building regulations.

2) A realistic national carbon compliance standard which takes into account cost will be established in building regulations. The Government has commissioned the Zero-Carbon Hub to re-examine the previously proposed level of 70% and suggest an appropriate level in line with current challenges.

3) The Government intends to explore the feasibility of developers meeting their obligations for carbon abatement through the funding of local energy projects, possibly via a local tariff mechanism. Local authorities will have a prominent role in the design and delivery of funds that may be made available through any such payment mechanism.

5.1.21 The Government is committed to ensuring that all new homes post-2016 can be zero-carbon while ensuring that the costs of new build do not prevent appropriate and sustainable development.

Local Policy

5.1.22 Herefordshire's Local Development Framework (LDF) has a vital role in ensuring future development is delivered in a sustainable manner. The Council's Core Strategy is the most important document within the LDF, setting out a long-term vision for Herefordshire over a period of at least 15 years, as well as spatial objectives and strategic planning policies to guide development in accordance with the strategic vision and objectives.

5.1.23 Until such time as the Core Strategy is formally adopted, the Unitary Development Plan (UDP) adopted on 23 March 2007 remains the primary policy framework used to determine planning applications. Under the Planning and Compulsory Purchase Act 2004 policies in the adopted Herefordshire UDP have now been 'saved' (24th February 2010) until they are superseded by other emerging Development Plan Documents in the Local Development Framework.

Herefordshire Council - Unitary Development Plan (UDP)

CF4 Renewable energy

'*Development proposals for the production of renewable energy will be permitted providing that:*

1. *They would not adversely affect the integrity of sites of international importance for nature conservation (such as Special Protection Areas, Special Areas of Conservation and Ramsar sites), except where there is no alternative solution and there are imperative reasons of overriding public interest, including those of a social or economic nature;*
2. *The objectives of the designation of nationally important sites and areas (such as Sites of Special Scientific Interest, National Nature Reserves, the Malvern Hills and Wye Valley AONB, Scheduled Ancient Monuments and other nationally important archaeological remains) will not be compromised and any significant adverse effects on the qualities of the area are clearly outweighed by the environmental, social and economic benefits;*
3. *Outside of nationally designated sites and areas, there would be no significant detrimental effect upon the character of the particular landscape qualities of that location; and*
4. *They would not significantly impact upon the amenity of neighbouring residents, including through noise, odour or electro-magnetic interference. In assessing proposals, regard will be had to the wider environmental, social and economic benefits to be gained from the use of renewable energy sources.'*

S11 Community facilities and services

'*supporting the use of renewable energy resources where they are economically and environmentally sustainable……*'

5.1.24 The saved Herefordshire Council renewables policies are in line with current national guidance as laid out in PPS22: Renewable energy. However, they are fairly limited in scope. Further consideration should now look toward specific opportunities for energy development.

Best Practice examples and how they relate to Herefordshire

5.1.25 There are various examples of innovative Planning Policy which encourage the use of renewable energy in locally distinctive ways. The London Borough of Merton created the so-called 'Merton Rule' (see below) and has informed Local Authority renewable energy policy nationwide. However, this policy is reliant of high density development in predominantly urban areas. This type of policy may not be appropriate in Herefordshire due to the relatively low population density however; this does not mean that variations of this premise would not be of benefit to the County.

<u>London Borough of Merton</u>

5.1.26 Integrated renewable energy policy (non-residential development) London Borough of Merton UDP (2003)

Policy E.11*: Environmental Improvements from Employment Development*
"To achieve environmental benefits, employment developments will be expected to be of high quality and layout. All new industrial, warehousing, office and live/work units outside Conservation Areas and above a threshold of 1,000sqm will be expected to incorporate renewable energy production equipment to provide at least 10% of predicted energy requirements…"

"…By expecting the installation of renewable power generation equipment in larger developments, it is … anticipated that the Council will be helping to generate sufficient levels of demand to enable manufacturers of appropriate renewable energy equipment to exploit economies of scale in the production of such equipment…" (UDP paragraph 3.132)

5.1.27 The recently published Stockport Core Strategy, June 2010 provides comprehensive yet accessible renewable and low carbon Policies. The DPD establishes a clear framework around which renewable energy technologies can be introduced, justifies why and how policies will be implemented and also how outcomes will be measured. A key component which underpins these planning polices is the '**Energy Opportunities Plan'** which identifies areas of potential Biomass production, Biocrop growth, medium to large wind energy and district heating within the Borough. A resource like the '**Energy Opportunities Plan'** could potentially be of great benefit to

Herefordshire in preparation of its Local Development Documents and could inform the production of effective, evidence based, local policy.

5.1.28 There are various other examples of best practice provided by Local Authorities such as Kirklees District Council, Leicester City Council and Woking District Council. It is important to note that the landscape characteristics of these Local Authorities are predominantly urbanised and as such it is important to review the renewable energy policies of rural Local Authorities with lower population densities in order to effectively compare approaches.

5.1.29 Cumbria provides an excellent comparison as it too has a low population density, rural characteristics, AONBs and economic pressures associated with agriculture and tourism. The following policy is taken from the 'saved' Cumbria Structure Plan 2001-2016.

Policy R44: Renewable energy outside the Lake District National Park and AONBs
Outside the Lake District National Park and AONBs proposals for renewable energy, including any ancillary infrastructure or buildings will be favourably considered if:

1. *There is no significant adverse effect on the landscape character, biodiversity and the natural and built heritage of the area either individually or cumulatively through their relationship with other utility infrastructure,*

2. *There is no significant adverse effect on local amenity, the local economy, highways or telecommunications,*

3. *The proposal takes all practicable measures to reduce any adverse impact on landscape, environmental, nature conservation, historical and local community interests. In considering applications for planning permission in relation to the above criteria, and other policies in this plan, the environmental, economic and energy benefits of renewable energy proposals should be given significant weight. There are additional requirements in the following cases:*

Wind Energy

4. *Measures should be included to secure the satisfactory removal of structures/related infrastructure and remediation of land following cessation of operation of the installation.*

New Plant for the commercial generation of energy from biomass

5. *Shall be sited on existing industrial/employment sites or previously developed land that is well related to the resource catchment. Where practicable, measures to transport fuel and waste by water or rail shall be made.*

Proposals for the recovery of energy from agriculture waste within existing farm units or sewage sludge

6. *Shall be well related to the activity, scale and character of the existing business enterprise and /or setting.*

5.1.30 This policy is locally distinctive to the rural nature of Cumbria but could also be applicable in Herefordshire as there are similarities between the two Counties. The Structure Plan also includes policy R45: Renewable Energy in the Lake District National Park and AONBs:

''In the case of wind energy, the development of more than one turbine or of a turbine with a ground to hub height of 25 metres or more is unlikely to be acceptable.''

5.1.31 Similar policies relating to renewable energy in AONBs could also be considered for the Wye Valley and Malvern Hills AONBs and be delivered either through DPDs or SPDs.

5.2 Renewable and Low Carbon Energy Targets

5.2.1 At this early stage of the process Herefordshire should aim to achieve minimal targets for renewable energy provision and reduction in CO_2 emissions in line with the following 'best practice' targets.

Code for Sustainable Homes CfSH)/BREEAM

5.2.2 Implementing BREEAM/CfSH regulations before building regulation L is updated in October 2010 will improve the sustainability of all new developments which in the long term will reduce CO_2 emissions, save energy and ultimately save the occupant (s) money. The implementation of high quality design features will not extensively impact developer expenditure and will increasingly make new developments more attractive to potential buyers.

5.2.3 All new residential developments such as those proposed at Three Elms, Holmer West and Whitecross, should adhere to code 3 of the CfSH which requires 25% improvements over the Target Emission Rate (TER) in accordance with *Circular 02/2010: The Building Act 1984, The Building Regulations 2000: Amendments relating to Approved Documents B and L 2006 Editions*.

Renewable Energy

5.2.4 Herefordshire should aim to reflect 'Best Practice' policy examples provided in the companion guide to PPS22 and set targets for renewable energy provision in new developments. The Council could encourage the incorporation of renewable energy by requiring proposals for non-residential developments exceeding 1,000 square metres gross floorspace, and new residential developments comprising 10 or more units, whether new build or conversion, to incorporate renewable energy production equipment to off-set at least 10% of predicted carbon emissions, except where:

i) The technology would be inappropriate;
ii) It would have an adverse visual or amenity impact that would clearly outweigh the benefits of the technology; and
iii) Renewable energy cannot be incorporated to achieve the full 10%.

5.2.5 Where the 10% requirement cannot be achieved on major developments, a planning obligation could be sought to secure savings through the implementation of other 'offsite' local renewable energy schemes. These targets could be readjusted incrementally to take account of success levels and renewable technology developments.

5.3 Potential policies

Spatial Distribution of Renewable Energy

5.3.1 Due to the rural nature of the County and relatively low levels of development there are opportunities to harness a balanced mix of renewable energy techniques in a variety of locations. By virtue of this fact, Herefordshire is in a position to be ambitious with its renewable energy targets and become a beacon of excellence for renewable energy in the UK.

5.3.2 The Wye Valley and Malvern Hills lie within the County and are designated as Areas of Outstanding Natural Beauty (AONB). These areas of outstanding natural beauty may not be suitable for wind turbines but could still benefit from other technologies described below.

5.3.3 Outside of these specified areas the County is well equipped to generate wind, hydro-electric, anaerobic digestion, biomass and solar energy. In light of the recent introduction of Feed in Tariffs (FITs) the County has the potential to have high levels of community/co-operative owned energy which could generate high levels of additional revenue/employment significantly boosting the local economy.

5.3.4 It is important to ensure that the rural character of the County is maintained and where possible enhanced. Renewable energy technologies must not harm the fabric of the County's green or built environments. An example of this provided by the cultivation of miscanthus, or maize, energy crops for biofuel which have the potential to produce large volumes of low carbon energy however, this must be balanced against supporting the production of agricultural crops and maintaining land for grazing.

Overview of Technologies

Large Scale Wind Energy

5.3.5 Herefordshire by virtue of being a relatively sparsely developed County with a diverse geographical range has the potential to harness good levels of wind energy. Levels of practically accessible wind resources at level 6b is 1,180,756 MWh and equates to approximately 174 2.3MW turbines after unsuitable areas for large wind farm development have been identified and ruled out. This potentially makes large scale wind energy a high priority in the short, medium and long term in relation to planning policy as the technology is already proven; it is a good vehicle for

community owned energy as it has good fiscal returns, and it can be implemented readily. However, the impact that large wind turbines can have on visual amenity must be acknowledged in Planning Policy to prevent inappropriate development.

Medium Scale Energy

5.3.6 The level of practically accessible wind resources at level 6b is 227,131 MWh and equates to approximately 403 225kW turbines after unsuitable areas for large wind farm development have been identified and ruled out. This makes medium scale wind energy a high priority in the short, medium and long term in relation to planning policy as the technology is already proven; it is a good vehicle for community owned energy as it has good fiscal returns, and it can be implemented readily. However, the impact that large wind turbines can have on visual amenity must be acknowledged in Planning Policy to prevent inappropriate development.

Small Scale Wind Energy

5.3.7 The level of practically accessible small scale wind resources is 266,496 MWh and equates to a total of 20,592 turbines made up from 1.5kW, 6kW and 15kW turbines. There may be opportunities for small scale residential wind turbines throughout the County which in turn may require the relaxation of GPDO through specific Area Action Plans (AAP). Small scale wind energy should be a high priority in the short, medium and long term in relation to planning policy as the technology is already proven; Feed in Tariffs offer improved returns, and it can be implemented readily. However, small scale wind energy is not always appropriate, especially in built up urban areas and can impact upon visual amenity in conservation areas.

WIND PLANNING POLICY OPTIONS

Planning Policy Option 1: Pioneering

Encourage large, medium and small scale wind farms in **Wind Priority Areas** which have been identified through locally distinctive, ward level and evidence based Area Action Plans, co-written by local communities. Promote community/ co-operative owned wind farms/turbines and maximise Council owned assets to harness wind energy.

Planning Policy Option 2: Pragmatic

Encourage wind energy as a means of achieving renewable energy targets. Development will be decided on a case by case basis with strong emphasis on community involvement.

Hydro

5.3.8 This study has identified 63 >10kW sites were identified with a potential combined energy of 53,853 MWh/ yr with one site near Monmouth accounting for 75% of the potential energy. This makes >10kW Hydro schemes a high priority in the short, medium and long term in relation to planning policy as the technology is already proven; it is a good vehicle for community owned energy, and it can be implemented readily. However, it is important to note that further feasibility studies are required to determine environmental sensitivity issues. The impact on river based ecosystems must be comprehensively researched to prevent any species decline or loss.

5.3.9 In addition to the above, 91 <10kW sites were identified with a potential combined energy of 1,767 MWh/ yr.

5.3.10 Further feasibility studies will be required to ensure environmental considerations are taken into account however; it is clear that hydro-electric energy has the potential to contribute to Herefordshire's renewable portfolio.

5.3.11 This makes suitable <10MWh Hydro schemes a high priority in the short, medium and long term in relation to planning policy as the technology is already proven; it is a good vehicle for community owned energy, and it can be implemented with relative ease.

HYDRO PLANNING POLICY OPTIONS

Planning Policy Option 1: Pioneering

Encourage >10kW and <10kW Hydro schemes in **Hydro Priority Areas** which have been identified through locally distinctive, ward level and evidence based Area Action Plans, co-written by local communities. Promote community/ co-operative owned hydro schemes and maximise Council owned assets to harness hydro energy.

Planning Policy Option 2: Pragmatic

Encourage hydro energy as a means of achieving renewable energy targets. Development will be decided on a case by case basis with strong emphasis on community involvement.

Biomass

Forest residues

5.3.12 There is currently 20,037 ha of woodland in Herefordshire. This could provide some 40,074 odt/ yr of wood fuel if utilised as a biomass resource and is equivalent to 206,382 MWh/ yr or 4% of Herefordshire's total energy demand. It will not be practicable to utilise the entire woodland coverage. However, there is significant potential that forest residues can become a significant resource as part of an integrated biomass energy programme. This should have high priority in the medium to long term.

Energy Crops

5.3.13 Three types of energy crops have been considered, Miscanthus, Short Rotation Coppice (SRC) and Maize. There is potential to generate high levels of energy these crop which are already being commercially grown in Herefordshire. There is potential that energy crops can become a significant resource as part of an integrated biomass energy programme. This should have high priority in the medium to long term and could potentially contribute additional revenue to the County if sold in other areas of the UK. However, a balance must be achieved between the cultivation of crops for energy and cultivation of crops for food/ livestock due to the national and regional importance of Herefordshire's agricultural output.

Animal waste

5.3.14 As Herefordshire is a rural County it is ideally placed to utilise domestic, agricultural and forestry waste for small scale AD plants and biomass units. However, the use of biomass CHP in urban developments may not be viable given the enormous volume of material required and investment needed to establish a CHP plant capable of efficiently handling biomass. At this stage Herefordshire does not have the supply infrastructure in place to make Biomass CHP schemes universally feasible however, this could be area of development for the Council. This should have high priority in the medium to long term.

5.3.15 All of the below biomass energy sources have significant potential to become a major resource as part of integrated biomass energy and recycling programmes. Biomass using the following fuel types should have high priority in the medium to long term.

Waste Wood

Municipal and commercial waste

BIOMASS PLANNING POLICY OPTIONS

Planning Policy Option 1: Pioneering

Encourage investment in energy supply infrastructure which enables increased use of biomass. Develop an **Integrated Biomass Plan** which will create a framework of biomass options for use in Herefordshire but also for export. Promote co-operative owned biomass facilities capable of meeting local energy demands, especially in rural locations.

Planning Policy Option 2: Pragmatic

Encourage biomass facilities as a means of achieving renewable energy targets. Development will be decided on a case by case basis with strong emphasis on community involvement.

Solar Energy

5.3.16 With the introduction of FITs, solar energy has the capacity to generate significant yields with relatively high return rates on investment. This technology could be encouraged on marginal/unproductive agricultural land, farm roofs, new developments and industrial units throughout the County to help achieve the Council's renewable target. Consideration would need to be made to the visual amenity of solar panels, especially in conservation areas of AONB. Solar power has the potential to generate 74,409 MWh/yr. Note that this potential to generate energy does not include solar PV farms (5MW) as this is not part of the SQW Energy assessment methodology. There may therefore be additional potential for energy generation from solar PV. This technology should have a high priority in the short, medium and long term.

SOLAR PLANNING POLICY OPTIONS

Planning Policy Options 1: Pioneering

Promote rural diversification by encouraging farm buildings to install photovoltaic's on significant barn roof space/ unproductive agricultural land. Relax General Permitted Development Orders in areas identified in **Solar Priority Areas** to encourage the uptake of solar energy in both rural and urban areas. Retrofit Council buildings to harness solar energy and reduce consumption of mains energy or alternatively rent roof space to co-operatives/ communities interested in installing solar photovoltaic's where the technology is not appropriate.

Planning Policy Option 2: Pragmatic

Encourage solar energy as a means of achieving renewable energy targets. Development will be decided on a case by case basis with strong emphasis on community involvement.

Combined Heat and Power (District Heating)

5.3.17 CHP requires certain levels of density to be cost effective. The residential growth points identified in the Herefordshire development plan would appear to have little scope for CHP due to their relatively small scale and sporadic nature. For CHP to succeed in the County a mixed use strategy is advised. By incorporating new residential development of sub critical mass with commercial and high energy use developments such as schools and hospitals may be possible to develop a feasible CHP district heating network. An alternative option is provided by the development of new CHP powered Eco-parks on a commercial scale, something Herefordshire may want to consider in the long term. This assessment suggests that CHP in Herefordshire should have low priority to begin with then increase to high priority in the medium to long term as current settlements are not immediately suitable. In the long term this technology may be able to utilise the emerging biofuel/biomass resources being developed to create more sustainable heating networks.

CHP PLANNING POLICY OPTIONS

Planning Policy Options 1: Pioneering

Develop a long term strategy to implement an extensive CHP district heating network in tier 1 and 2 settlements which uses locally produced biomass/ biofuels developed through the Integrated Biomass Plan. Encourage the development of Biomass powered CHP plants in areas with higher population densities such as Hereford or higher heating demands such as Hospitals and Schools.

Planning Policy Option 2: Pragmatic

Encourage all new developments to incorporate infrastructure that could connect to any future CHP district heating network that is introduced.

Ground Source Heat Pumps

5.3.18 Ground Source Heat Pumps have the potential to be implemented in all new residential buildings at a relatively low cost to the developer. Potential energy to be gained from heat pumps in existing and new domestic building, on and off the grid is 746,213MWh/yr with commercial buildings generating 272,850 MWh/ yr. This combined figure of 1,019,063 MWh/ yr would significantly contribute to reducing CO_2 emissions in the County. This technology is not location dependant however, it may not be as economically viable in existing buildings or established settlements as groundwork will be required. Heat pumps should be high priority in the medium to long term.

GROUND SOURCE HEAT PUMP PLANNING POLICY OPTIONS

Planning Policy Options 1: Pioneering

Ground (and air) Source Heat Pumps should be encouraged in ALL new development to offset energy consumption. The Council could also introduce a fiscal scheme to retrofit existing buildings with ground source technology as payback would eventually outweigh initial investment.

Planning Policy Option 2: Pragmatic

Encourage heat pumps as a means of achieving renewable energy targets. Development will be decided on a case by case basis.

Permitted Development Rights

5.3.19 Herefordshire Council could consider offering a relaxation of domestic Permitted Development rights in relation to renewable energy in areas of development to encourage their uptake. Central Government relaxed General Permitted Development Orders in relation to renewable energy technologies on the 6 April 2008. Nevertheless additional flexibility could be introduced at the Area Action Plan level to promote renewable energy within specific developments.

Draft 'Model' Policies

5.3.20 The policy options provided in this report are based on the assumption that current Government energy schemes remain in place namely Feed in Tariffs (FITs). The following policy options are based on current planning policy as it stands at the time of writing.

5.3.21 The production of 'sound' and 'locally distinctive' policies must be 'justifiable'; therefore founded on a robust and credible evidence base and be the most appropriate strategy when considered against reasonable alternatives, and also 'effective' meaning that they are deliverable, flexible and able to be monitored.

5.3.22 The following draft 'Model' Policies are in accordance with national policy guidance on Local Spatial Planning, Sustainability and Renewable Energy. The following polices are based on robust evidence from a range of quantitative and qualitative sources and are locally distinctive to the County of Herefordshire. Policies are set out as current and future objectives.

Short Term Policies

Policy 1: Renewable Energy & Diversification of the Rural Economy

5.3.23 Development of renewable or low carbon on agricultural farms which addresses diversification of existing rural enterprises, meets national CO_2 emissions targets and helps deliver national and local renewable energy targets will be encouraged where:

1. They would not adversely affect the integrity of sites of international importance for nature conservation (such as Special Protection Areas, Special Areas of Conservation and Ramsar sites), except where there is no alternative solution

and there are imperative reasons of overriding public interest, including those of a social or economic nature.

2. The objectives of the designation of nationally important sites and areas (such as Sites of Special Scientific Interest, National Nature Reserves, the Malvern Hills and Wye Valley AONB, Scheduled Ancient Monuments and other nationally important archaeological remains) will not be compromised and any significant adverse effects on the qualities of the area are clearly outweighed by the environmental, social and economic benefits.
3. Outside of nationally designated sites and areas, there would be no significant detrimental effect upon the character of the particular landscape qualities of that location.
4. They would not significantly impact upon the amenity of neighbouring residents, including through noise, odour or electro-magnetic interference.
5. Prime agricultural land is not permanently lost and marginal/unproductive land is used where possible.

Policy justification

5.3.24 Herefordshire is a predominantly rural County where agriculture forms an important source of employment. The Council understands (Core policy direction) the importance of diversifying the rural economy and is keen to promote a range of farm diversification projects including renewable energy schemes. Farms in the rural community are ideally placed to implement a range of renewable energy technologies including wind, solar and small scale Anaerobic Digestion and this policy encourages the uptake of these technologies. This is identified as a current policy so that applicants can take advantage of current Feed in Tariffs.

Policy 2: Community Owned Energy

5.3.25 The development of community/co-operative owned standalone or 'onsite' renewable or low carbon energy generation including wind, hydro and small scale AD which will play a part in reducing CO_2 emissions and increasing installed low carbon and renewable energy capacity will be encouraged by the Council where:

1. They would not adversely affect the integrity of sites of international importance for nature conservation (for example Special Protection Areas, Special Areas of

Conservation and Ramsar sites), except where there is no alternative solution and there are imperative reasons of overriding public interest, including those of a social or economic nature.

2. The objectives of the designation of nationally important sites and areas (such as Sites of Special Scientific Interest, National Nature Reserves, the Malvern Hills and Wye Valley AONB, Scheduled Ancient Monuments and other nationally important archaeological remains) will not be compromised and any significant adverse effects on the qualities of the area are clearly outweighed by the environmental, social and economic benefits.
3. Outside of nationally designated sites and areas, there would be no significant detrimental effect upon the character of the particular landscape qualities of that location.
4. They would not significantly impact upon the amenity of neighbouring residents, including through noise, odour or electro-magnetic interference.

Policy Justification

5.3.26 The Council recognises the important role that community owned energy generation including wind, hydro and AD energy will play in reducing CO_2 emissions and increasing installed low carbon and renewable energy capacity. One of the key challenges facing renewable energy provision in the UK is the extent to which communities accept proposals in their local area. By encouraging community/co-operative buy-in this will not only help meet local targets and national commitments but generate significant revenue for communities, particularly those in rural locations. This is identified as a current policy so that applicants can take advantage of current Feed in Tariffs.

Policy 3: Energy Efficient Design

5.3.27 All new development proposals must incorporate energy efficiency design principles which will contribute to national and local CO_2 emission targets by:

1. Maximizing the benefits of solar energy, passive solar gain, natural ventilation and the efficient use of natural light through siting, form, orientation and layout.
2. Using natural landscaping to optimize energy conservation.
3. Incorporate Heat Pumps/ Biomass Boilers/ District Heating where appropriate.

Policy Justification

5.3.28 This policy will not only ensure that reducing CO_2 emissions is at the heart of new developments in the County but it will also reduce occupants fuel costs thus helping to achieve the goals set out in Herefordshire's fuel poverty schemes.

Policy 4: Mitigating & Adapting To Current and Future Impacts of Climate Change

5.3.29 Development which positively addresses the current and future impacts of climate change, delivers a sustainable approach and reduces the County's carbon footprint will be encouraged.

5.3.30 The highest standards of energy and natural resource efficiency will be achieved by:

1. Requiring that all new development, as a minimum, complies with on-site or near site renewable or low carbon targets set out in national guidance.
2. Ensuring the use of sustainable construction methods which minimise the use of non-renewable resources and which maximize the use of recycled and locally sourced materials.
3. Ensuring all new dwellings achieve at least a three star rating under the Code for Sustainable Homes. The Council will consider introducing a requirement for development schemes to comply with higher sustainable construction standards where there is justifiable evidence to do so.
4. Requiring all new development to adapt to the negative impacts of climate change by incorporating Sustainable Urban Drainage Systems (SUDS) where appropriate, adhering to Policy 3 detailing standard adaptation considerations, protecting natural capital and biodiversity in rural areas, and developing habitat systems which are resilient to climate change in accordance with latest best practice.
5. Supporting local initiatives to address climate change such the Herefordshire Warm Front and Special Energy Efficiency Scheme (SEES) as well as other initiatives which may emerge.

5.3.31 Where these requirements are impractical and/or unviable, the onus will be on the developer to demonstrate that this is the case.

Policy Justification

5.3.32 Mitigation and adaptation of current and future impacts of climate change has become a central agenda for the Government. Despite being a predominantly rural County with relatively little intensive development, Herefordshire is still vulnerable to the impacts of climate change especially around the River Wye and Lugg. This policy seeks to integrate climate change adaptation techniques into planning considerations and as such has the potential to minimize economic, social and environmental concerns and create positive and robust developments.

Policy 5: Renewable and Low Carbon Energy Generation

5.3.33 The Council encourages and supports the provision of renewable and low carbon technologies, including micro-renewables secured through new and existing development subject to the proposals according with the other Core Strategy policies, national guidance and complying with the following criteria:

1. The proposal can be connected efficiently to existing national grid infrastructure, unless it can be demonstrated that energy generation would be used on-site to meet the needs of a specific end user.
2. The proposal demonstrates compliance with Herefordshire's energy location plans or can provide a justifiable evidence base.

5.3.34 The proposal should make provision for:

1. The mitigation of the real emissions/impacts arising from the installation of the renewable energy generation.
2. The removal of the facilities and reinstatement of the site, should the facilities cease to be operational.

Policy Justification

5.3.35 Herefordshire must adhere to national targets for climate change. This policy will help minimize the County's CO_2 emissions and adapt to future impacts of climate change.

Medium Term Policies

5.3.36 Medium Term Policies:

- Policies encouraging biofuel/ biomass resources or frameworks.
- Develop policies encouraging ground source heat pumps in new and then existing developments.

Long Term Policies

Policy 6: CHP District Heating (Network Development Areas) – Long Term

5.3.37 The Council will encourage viable opportunities to deliver decentralized CHP energy systems, including those powered by renewable or low-carbon sources, particularly in the strategic tier 1 and 2 growth locations of Hereford, Leominster, Ledbury, Bromyard and Ross-on-Wye. These locations have been identified as they may potentially support a large enough population to offer an opportunity to utilise an efficient district heating network, providing that design constraints are met.

Policy Justification

5.3.38 Herefordshire must adhere to national targets for climate change. This policy will help minimize the County's CO_2 emissions and adapt to future impacts of climate change. CHP is an efficient method of district heating (where networks exist) and can reduce typical energy costs.

5.4 Stakeholder consultations

5.4.1 The stakeholder consultation meeting was held on 16 September 2010 at the Kindle Centre. The following people were present:

Peter Yates (Herefordshire Council)
Kevin Singleton (Herefordshire Council)
Joanna Harthen (Herefordshire Council)
Dan Thompson (Herefordshire Council)
Tony Featherstone (Herefordshire Council)
Andrew Powell (Herefordshire Council)
Debby Klein (Herefordshire Council)
Kenton Vigus (Herefordshire Council)
Andy Tector (Herefordshire Council)

Trish Marsh (Herefordshire Council)
Philipa Lydford (Herefordshire Partnership)
Virginia Morgan (HCPRE)
Rob Garner (Bulmer Foundation)
Stephen Ainsleigh Rice (Hereford Hydro)
Catherine Hughes (7Y Business)
Andrew Nixon (Wye Valley AONB)
Kate Gathercole (New Leaf)
Jeremy Smith (RWE Npower Renewables Ltd)
Timothy Morgan.

5.4.2 Kevin Singleton (Team Leader - Strategic Planning) opened the event by explaining the requirements of the work undertaken, this being to develop the evidence base for the County to enable robust planning policies to be developed. He indicated policies would be out for consultation in October/November 2010.

5.4.3 The above provided a useful representation from across the County with Council Officers, Developers and other bodies (CPRE etc) being present.

5.4.4 During the presentation the renewable energy resource was identified in accordance with the SQW Energy Methodology and factors were applied to come up with a potential realisable resource. Using this data figures indicate that, by 2026 in the region of 30% of the current energy usage could be supplied by renewables. This was based on assumptions of percentage of deployment, none of which were challenged at the stakeholder presentation. Clearly these only provided an indication of the potential realisable resource but it does show the difference in importance as, for example, hydro electricity in the County has a very small potential and biomass has an enormous potential.

5.4.5 The key issues identified were:

- Requirement for biomass to consider maize as an alternative to miscanthus as the feedback was that farmers were more likely to want to plant maize. (NB: information has been included in this document to address this).

- A detailed explanation of the process used to identify the carbon savings when using ground source and air source heat pumps. (NB: Additional text has been included in the Executive Summary to explain this).
- Queries were raised with respect to the role of planning policy. It was explained that absolute numbers for renewable energy technology could not be set in detailed policy (ie 20 wind turbines required within certain areas etc). It was confirmed by Kevin Singleton that policy has to be written to guide the planning process to encourage and shape the appropriate development.

5.4.6 After the meeting two members of the Stakeholder Group requested digital copies of the presentation, these were provided. (Note; all those attending received booklets containing the slides used).

5.4.7 Two Stakeholders also requested copies of the SQW Energy Methodology document, these were also provided.

5.4.8 The conclusion to the evidence base work was that Herefordshire has a resource which, even with conservative values for exploitation, can contribute significantly to the energy usage within the County. Equally, policy direction has been provided on the back of the evidence base.

5.5 Policy and target recommendations

5.5.1 Key recommendations are as follows:

- Develop an energy opportunities plan in accordance with PPS22: Companion guide to identify key areas of renewable energy supply and also communities/co-operatives who would be interested in developing community owned energy.
- Develop cross cutting renewable energy policies/themes which empower rural communities to harness the diverse mix of renewable open to them.
- Relax GPDO through specific Area Action Plans, possibly linked to the energy opportunities plan.
- Develop a clear understanding of 'where the Council' wants to go with renewable technology.

6 CONCLUSIONS

6.1 Herefordshire has a rich and diverse landscape with abundant natural resources, particularly biomass. These resources provide an excellent opportunity to deploy a wide range of Renewable and Low Carbon Energy Technologies.

6.2 The main urban areas in Herefordshire are due to see significant expansion. As the County develops, it will become increasingly important to preserve the attractive rural characteristics and natural beauty of the region. The implementation of carefully thought out policies will enable the inhabitants of Herefordshire to utilise the natural resources in a sustainable manner.

6.3 This Evidence Base Study has shown where the technical resource exists and provides guidance as to how best to develop supporting LDF policies for the deployment of Renewable and Low Carbon Energy Technologies. Herefordshire Council is therefore in a much more knowledgeable position about how to make use of these technologies to meet, or potentially exceed, their energy obligations and targets to benefit the County's residents and businesses.

6.4 The table below shows a summary of the potential resource and deployment strategy for the range of Renewable and Low Carbon Energy Technologies for Herefordshire.

Table 6.1 -Potential Resource and Deployment Strategy for Renewable and Low Carbon Energy Technologies for Herefordshire						
Renewable Energy Technology	**Total Potential Energy (MWh/yr)**	**Suggested Deployment Target (% of resource)**	**Equivalent CO_2 savings (tonnes/yr)**	**Short Term Suitability (0-5 years)**	**Medium Term Suitability (5-10 years)**	**Long Term Suitability (10+ years)**
Wind – Large Scale	1,180,756 *	30	109,220	1	1	2
Wind – Medium Scale	227,131 *	20	24,394	1	1	1
Wind – Small Scale	266,496	20	28,622	1	1	1
Biomass – Forest residues	206,382**	30	33,622	3	2	2
Biomass – Energy Crops Miscanthus	10,331,779 **	5	105,384	2	2	1
Biomass – Energy Crops SRC	338,986 **	10	6915	2	2	1
Biomass – energy Crops Maize	7,557,000 **	10	154,166	2	2	1
Biomass – Waste Wood	369,369	70	128,088	2	2	1
Biomass – Municipal and commercial waste	98,600	25	-	2	2	1
Biomass – Animal Waste	369,028	10	9,078	2	2	1
Biomass – landfill gas	7,693	20	378	3	3	3
Biomass – sewage gas	3,600	20	177	3	3	3
Hydro – electric >10kW	53,853 ***	20	5,848	2	1	2
Hydro – electric <10kW	1,767 ***	20	192	1	2	2
High Head	2,071	20	225	2	1	2
Solar – Existing Domestic Buildings	33,164 **	20	2,607	1	1	2
Solar – New Domestic Buildings	15,300 **	25	1,428	1	1	2
Solar – Commercial Buildings	9,910 **	20	1,076	1	1	2
Solar – Industrial Buildings	16,035 **	20	1,741	1	1	2
Heat Pumps – Existing Domestic Buildings off grid	384,016	20	10,609	2	2	1
Heat Pumps – Existing Domestic Buildings on grid	272,197	5	742	3	2	1
Heat Pumps – New Domestic Buildings	90,000	75	3,680	2	1	1
Heat Pumps – Commercial Buildings	272,850	10	1,487	2	2	1
CHP and District Heating	-	10	-	3	2	2
Biomass Boilers and District Heating	-	10	-	1	1	1

	Good opportunities	*	At level 6.2	1	High priority
	Possible opportunities	**	Maximum possible – potentially unpractical	2	Mid priority
	Poor opportunities at current time	***	Further environmental feasibility required	3	Low Priority

ACRONYMS

AD	Anaerobic Digestion
ALC	Agricultural Land Classification
AMWS	Annual Mean Wind Speed
AONB	Areas of Outstanding Natural Beauty
ASHP	Air Source Heat Pumps
BERR	Business Enterprise and Regulatory Reform
BIR	Building Integrated Renewables
CfSH	Code for Sustainable Homes
CHP	Combined Heat and Power
CLG	Communities and Local Government
COP	Co-efficient of Performance
DECC	Department for Energy and Climate Change
EfW	Energy from Waste
FIT	Feed in Tariff
GIS	Geographical Information System
GSHP	Ground Source Heat Pumps
LDF	Local Development Framework
MSW	Municipal Solid Waste
ODT	Oven Dry Tonnes
ORED	Office for Renewable Energy Deployment
PPS	Planning Policy Statement
PSD	Passive Solar Design
PV	Photovoltaic Electricity
RHI	Renewable Heat Incentive
SRC	Short Rotational Coppice
SSSI	Sites of Special Scientific Interest
SWH	Solar Water Heating
WMRA	West Midlands Regional Assembly