Planning for

Renewable Energy

in Worcestershire

TECHNICAL RESEARCH PAPER

Energy from:

wind, water, the sun and biomass

This working paper is intended to give an initial summary of the significant issues surrounding energy in the County and to help determine how future energy policy can be shaped.

January 2009

worcestershire countycouncil

Worcestershire County Council is a Beacon Authority for Tackling Climate Change 2008-2009

TECHNICAL RESEARCH PAPER

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Executive Summary

Generating energy through renewable sources is an alternative to the burning of fossil fuels. Using renewable energy has environmental, social and economic benefits.

Worcestershire's potential for the generation of renewable energy has not been systematically evaluated, but it is evident that current levels of renewable generation in the County are significantly below what could theoretically be achieved. Worcestershire's land-locked location precludes off-shore generation, but there is nevertheless a large potential for renewable energy:

- The rivers, streams and watercourses that traverse the County could be exploited to provide hydro-electric power;
- Large areas of the County have average wind speeds sufficient for the generation of energy from wind turbines, with the greatest potential in Bromsgrove and Wychavon districts;
- Biomass energy has significant potential in Worcestershire, with substantial existing woodland and high potential yields from energy crops;
- Solar irradiation (the amount of sunlight falling on the ground) across the County as a whole is relatively high, and could deliver both electricity and hot water through the increased use of solar panels;
- Worcestershire falls within an area that is capable of utilising the heat of the ground, air and water to contribute towards heating energy needs.
- Energy from Waste' is not generally considered renewable, and is not considered in this paper. However, organic wastes, such as farm slurry, food waste, and landfill gas is considered renewable and can contribute a valuable renewable fuel source for biomass heat and/or power generation, and anaerobic digestion.

National and international targets are in place to ensure that renewable energy contributes to a reduction in the emissions of carbon dioxide into the atmosphere, therefore mitigating the damaging effects of climate change. The targets require a major expansion of current capacity, and Worcestershire will have its part to play in contributing to these goals.

As a County with extensive rural areas, Worcestershire has the potential to exploit renewable energy where conventional gas and electricity supplies may not be available. In this context, renewables could provide a viable alternative to oil-fired heating or petrol generators.

A concerted effort is required from all sectors in order to achieve the greatest carbon savings. This paper considers the role of the planning system and renewable energy in the built environment and seeks to establish the key facts about each of the technologies as they relate to Worcestershire.

It is recognised that renewable energy generation should be seen as a substantial component of what must be a combination of measures; the paper recommends an energy hierarchy whereby energy conservation and efficiency are the principal actions, with energy generation being considered only after these primary concerns have been addressed.

In order to develop further policies and guidance on renewables, the paper seeks to collate relevant baseline information, to allow an informed view to be taken on the need and support for an expansion in renewable energy capacity.

After every chapter of the paper, a summary is provided, together with any suggestions/recommendations for action. These summaries have been brought together and outlined below:

POLICY CONTEXT

- EFFECTIVE DEMAND MANAGEMENT AND CONSERVATION OF ENERGY SHOULD ALWAYS BE CONSIDERED AHEAD OF ENERGY GENERATION.
- AT THE LOCAL LEVEL, PROMOTION OF RENEWABLE ENERGY SHOULD BE INTEGRATED INTO COMMUNITY STRATEGIES, LOCAL DEVELOPMENT DOCUMENTS, AND SUSTAINABILITY APPRAISALS;
- REVISED TARGETS FOR RENEWABLES CAPACITY WILL BE DETERMINED THROUGH PHASE 3 OF THE RSS PARTIAL REVISION. LOCAL DEVELOPMENT FRAMEWORKS CAN SHAPE HOW DISTRICTS RESPOND TO THE NEED TO INCREASE RENEWABLES PROVISION.

COMMUNITY STRATEGIES/LOCAL AREA AGREEMENT

- THERE IS SCOPE TO INCREASE THE PRESENCE OF RENEWABLE ENERGY IN COMMUNITY STRATEGY REVISIONS AND ENSURE IT IS INCLUDED IN THE LOCAL AREA AGREEMENT.
- FURTHER RESEARCH IS NEEDED INTO THE POTENTIAL OF THE COUNTY TO DELIVER INCREASED RENEWABLE ENERGY, INCLUDING THE COMMISSIONING OF A COMPREHENSIVE STUDY INTO RESOURCE AVAILABILITY.

WORCESTERSHIRE'S VULNERABILITY TO CLIMATE CHANGE

- WORCESTERSHIRE'S VULNERABILITY TO THE EFFECTS OF CLIMATE CHANGE IS HIGH AND IS FORECAST TO INCREASE. THE SEVERITY OF 2007'S FLOODING HIGHLIGHTS THE COUNTY AS BEING AT PARTICULAR RISK.
- RENEWABLE ENERGY CAN CONTRIBUTE TO BOTH THE MITIGATION OF, AND ADAPTATION TO CLIMATE CHANGE BY REDUCING EMISSIONS THAT CAUSE CLIMATE CHANGE AND BY PROVIDING A MORE SECURE MEANS OF SUPPLY.

RENEWABLE ENERGY AND THE ENVIRONMENT OF WORCESTERSHIRE

- RENEWABLE ENERGY INSTALLATIONS CAN BE APPROPRIATE AND JUSTIFIED DEVELOPMENTS AT BOTH THE COMMERCIAL AND DOMESTIC SCALE.
- RENEWABLES ARE LIKELY TO BECOME MORE COMMONPLACE FEATURES AS THE NEED FOR CLEANER ENERGY ACCELERATES.
- IT IS VITAL TO ENSURE THAT LANDSCAPE CHARACTER, HERITAGE, BIODIVERSITY AND AMENITY CONCERNS ARE CONSIDERED FROM THE OUTSET IN ANY RENEWABLES PROPOSALS.

SOCIAL BENEFITS OF RENEWABLE ENERGY IN WORCESTERSHIRE

- CONSIDERATION SHOULD BE GIVEN TO THE ESTABLISHMENT OF ENERGY SUPPLY COMPANIES (ESCOS), TO ALLOW LOCAL PEOPLE TO MAXIMISE THE BENEFITS FROM RENEWABLE TECHNOLOGIES LOCATED WITHIN THEIR AREA.

- OPPORTUNITIES TO ENSURE THE BENEFITS OF RENEWABLE ENERGY ARE COMMUNICATED THROUGH EDUCATION, FOR EXAMPLE THROUGH THE EDUCATION FOR SUSTAINABLE DEVELOPMENT PROGRAMME, SHOULD BE MAXIMISED.

RENEWABLE ENERGY AND THE ECONOMY IN WORCESTERSHIRE

- DEVELOPMENT OF RENEWABLE ENERGY IN WORCESTERSHIRE OFFERS THE OPPORTUNITY OF SECURING REAL ECONOMIC BENEFITS.

- THERE ARE ALREADY RENEWABLE ENERGY BUSINESSES WITHIN THE COUNTY, AND ENCOURAGEMENT SHOULD BE GIVEN TO PROMOTE TRAINING, EMPLOYMENT AND BUSINESS OPPORTUNITIES ARISING FROM A GROWTH IN RENEWABLES.

COMMUNITY AND STAKEHOLDER CONSULTATION

- PUBLIC CONSULTATION HAS INDICATED AN ENTHUSIASM FOR TACKLING CLIMATE CHANGE AND INCREASING THE USE OF RENEWABLE ENERGY.

- AT THE LOCAL LEVEL, CONSULTING ON INDIVIDUAL PROPOSALS AT AN EARLY STAGE COULD ESTABLISH POTENTIAL LEVELS OF SUPPORT OR OPPOSITION IN THE COMMUNITY, AND ALLOW FOR AN INFORMED DIALOGUE TO TAKE PLACE BEFORE SCHEMES ARE FORMALLY SUBMITTED FOR PLANNING PERMISSION.

BASELINE DATA AND FORECASTS

- WORCESTERSHIRE'S DOMESTIC AND INDUSTRIAL & COMMERCIAL EMISSIONS ARE HIGH. DOMESTIC CO2 EMISSIONS, IN PARTICULAR, HAVE BEEN ESTIMATED TO BE HIGHER THAN BOTH THE REGIONAL AND NATIONAL AVERAGES, AND THERE IS A RECOGNISED NEED TO REDUCE THEM. RENEWABLE ENERGY HAS A VITAL ROLE TO PLAY IN SECURING THESE REDUCTIONS.

TECHNOLOGICAL ISSUES FOR RENEWABLE ENERGY IN WORCESTERSHIRE

- IN ORDER TO ASCERTAIN A VIABLE INDICATION OF RENEWABLE ENERGY PROSPECTS IN THE COUNTY, A DETAILED STUDY OF CAPACITY MAY BE REQUIRED, FOCUSING ON THE MOST SUITABLE LOCATIONS AND TECHNOLOGIES AND THE POTENTIAL OUTPUT.

- POTENTIAL FOR RENEWABLE GENERATION WILL VARY BY LOCATION. APPENDICES TO THIS PAPER PRESENT CONSIDERATIONS FOR APPROPRIATE AND VIABLE TECHNOLOGIES.

INFRASTRUCTURE REQUIREMENTS

- RENEWABLE ENERGY INSTALLATIONS, ESPECIALLY THOSE OF A LARGER SCALE, WILL REQUIRE INFRASTRUCTURE TO BE IN PLACE, OR BE PROVIDED, IN ORDER TO OPERATE SUCCESSFULLY.

MONITORING AND FURTHER WORK

- EFFECTIVE MONITORING OF RENEWABLES DEVELOPMENTS WILL BE CRUCIAL. NATIONAL, REGIONAL AND LOCAL TARGETS CAN ONLY BE EFFECTIVE IF THEY ARE MEASURABLE. LAA INDICATORS WILL ALSO PLAY AN INCREASINGLY IMPORTANT ROLE AND MAY DEPEND ON ACCURATE RENEWABLES DATA.

- MONITORING SHOULD BE USED EFFECTIVELY TO ENSURE THAT ANY RENEWABLES POLICY IS ACHIEVING ITS AIMS. EFFECTIVE MONITORING WILL ENABLE EARLY ACTION TO BE TAKEN, WHERE REQUIRED, TO ADDRESS ANY DEFICIENCIES THAT MAY COMPROMISE THE POLICY OUTCOMES.

- A COMPREHENSIVE RESOURCE ASSESSMENT OF THE COUNTY'S CAPACITY FOR RENEWABLE ENERGY WOULD PROVIDE A BETTER-INFORMED PICTURE OF THE TECHNOLOGIES AND AREAS THAT MAY BE MOST SUITABLE FOR DEVELOPMENT.

1. Purpose

1.1 This working paper is intended to give a summary of the significant issues surrounding renewable energy in the County, to bring together guidance and best practice and to help determine how future renewable energy policy can be shaped. The paper has been prepared in order to guide development of the County Minerals & Waste Development Framework, district Local Development Frameworks and Sustainable Community Strategies, and to help form a response to regional planning consultations, including Phases 2 and 3 of the partial revision of the West Midlands Regional Spatial Strategy (RSS).

1.2 This document has no material planning status beyond informing plan preparation. It has been developed in conjunction with a steering group of officers from the County Council and District Councils of Worcestershire, and has been subject to informal consultation[1]. It is anticipated that it will be re-drafted as further issues are identified and further information becomes available.

1.3 The main issues for local planning in the districts will be set out in the Core Strategies of those districts, including the way in which energy matters will be addressed. Different approaches to energy conservation and generation can lead to very different outcomes, not just for the environment, but also for the social and economic characteristics of the respective districts. The background information and baseline data collated in this paper should enable an informed decision to be made over renewable energy policy options suitable for Worcestershire.

1.4 The paper is structured so as to give an introduction to the reasons for its development, before looking in greater detail at the policy drivers that are determining the direction in which local planning must progress. Following this, issues of landscape, biodiversity and heritage are discussed, in relation to the possible tensions that may arise between their designation and the need for renewables. The social and economic impacts of renewables are also considered. The growing prominence of Community Strategies and Local Area Agreements, and their potential to help deliver renewable energy, is recognised. The paper also seeks to collate current evidence and baseline data, and presents relevant information in the Appendices.

1.5 It should be recognised that as knowledge and experience of renewables grows, this paper will seek to reflect emerging best practice and will be revised accordingly.

[1] A full list of consultees is provided at the end of this report.

2. Introduction

2.1 It is now widely accepted that the effects of climate change are having a dramatic and negative effect on the environment. In addition to the recognised social and environmental effects, the significant economic implications of failing to adapt to climate change have been illustrated in the Stern Report[2].

2.2 Alongside the compelling evidence of climate change, there is a need to take account of falling reserves of fossil fuels, and the UK's growing dependence on imported energy. Relying on foreign supplies of gas and oil could create increased risk in terms of security of supply. Providing greater renewable energy capacity will reduce this risk.

2.3 As a key contributor to mitigating climate change, renewable energy forms a major part of the sustainability agenda that is now established at European, national, regional and local level. Renewable energy is defined in PPS22[3] as "those energy flows that occur naturally and repeatedly in the environment - from the wind, the fall of water, the movement of the oceans, from the sun and also from biomass". This is therefore the definition that should be assumed in local planning documents. The technologies involved are wind-power, solar (both solar hot water and solar photovoltaic), hydro-power, biomass, biogas, and ground/air/water source heat pumps. Not all of these technologies will be viable within all areas of Worcestershire for technological, environmental and economic reasons; a detailed summary of their characteristics is provided at Appendices A and B.

2.4 Renewable energy schemes can take many forms and be of a variety of scales. This paper outlines the issues surrounding large, 'commercial scale' technologies, such as the wind turbines seen in wind farms, as well as smaller, domestic-scale applications. These smaller schemes fall under the term 'microgeneration', which refers to those installations delivering electricity at 50kW or below; or heat energy at 45kW or below[4].

2.5 The growing importance of energy conservation and generation, and their ability to help combat climate change, has been recognised in a host of policy documents and legislation. At a County level, there is scope for making substantial improvements to our collective carbon footprint. Having a pro-active and realistic energy policy will make a positive contribution towards reducing emissions, whilst giving certainty to developers, and helping to meet our national and regional targets.

2.6 Whilst this paper is concerned principally with the generation of renewable and low-carbon energy, it is recognised that energy conservation is, and should always be, the primary method of reducing emissions. The energy hierarchy should always be considered, whereby minimising the demand for energy is the first and most logical step. Effective demand management, together with greater energy efficiency, should be the first actions in seeking to reduce emissions, but both conservation and generation are required in order to make the most

[2] The Stern Report on the Economics of Climate Change, HM Treasury (October 2006)

[3] Planning Policy Statement 22: Renewable Energy, Department for Communities and Local Government (DCLG), (August 2004)

[4] Section 82(8)(a) and (b), Energy Act 2004

significant positive impact. Conservation of energy falls outside the scope of this topic paper, but is addressed through other planning and building-control legislation and guidance.

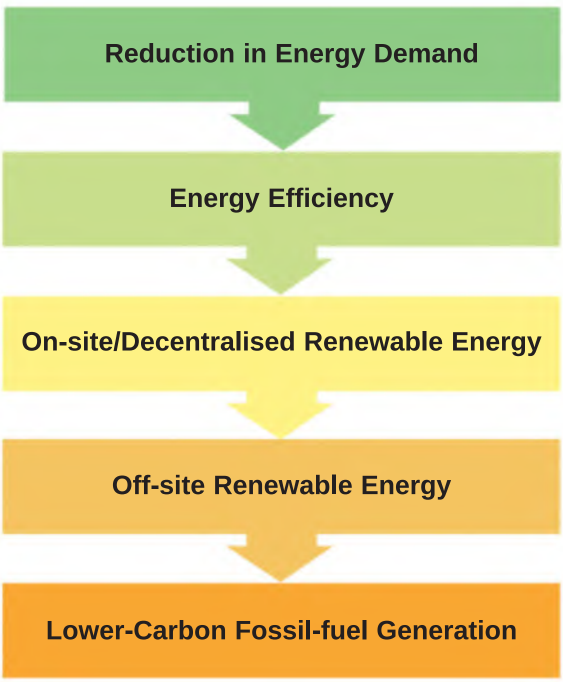
Worcestershire's energy consumption is drawn almost exclusively from fossil-fuel based sources, as indicated in Table 1. In order to reduce the carbon-emissions generated from this energy use, the County needs to move towards increasing the use of renewables.

TABLE 1. WORCESTERSHIRE'S TOTAL FINAL ENERGY CONSUMPTION (2006) in GWh

Energy Source	Amount consumed	Proportion
Coal	194	1%
Manufactured Fuel	111	0%
Petroleum Products	8331	50%
Natural Gas	5311	32%
Electricity	2759	16%
Renewables & Waste	58	0%
Total	**16,764**	**100%**

Source: *BBERR statistics, available at http://www.berr.gov.uk/files/file48643.xls*
A full district-by-district breakdown of consumption is provided at Appendix G.

FIG 1. RECOMMENDED ENERGY POLICY HIERARCHY FOR WORCESTERSHIRE



Adapted from the Energy Saving Trust

2.7 The benefits of renewable energy are principally environmental, but there are also key social and economic advantages to be gained from its increased use. The main reasons for the use of renewables are:

- Unlike fossil fuels, such as coal, oil or gas, energy generated from renewable sources produces no net carbon emissions. This makes generation 'cleaner'.
- Renewables help to diversify the UK energy supply, contributing to energy security in the context of rising prices and increasing dependence on energy exports from volatile political regions.
- Development of renewables contributes to targets set in national and regional policy, and is a key mechanism to ensure the UK is able to meet its international commitments to reducing carbon dioxide emissions.

- Renewable energy can be cost effective, especially when grant-assisted, and has the potential to help alleviate fuel poverty.

- Renewable energy generation can provide valued economic activity in the planning, production, supply and maintenance of equipment and materials.

2.8 There already exist successful examples of renewable and low-carbon energy projects throughout Worcestershire.

- At County Hall, a 700kW woodchip-fuelled boiler provides central heating, using locally-sourced woodfuel (see Fig. 2);
- A pilot project has been set up at Malvern's Chase Technology College to run a boiler on a 20% bio-diesel fuel mix (see Fig. 3);
- The Pumphouse Environment Centre uses ground-source heat pumps, photovoltaic panels and micro-wind turbines;
- Redditch's Arrow Valley Countryside Centre also boasts micro-wind turbines, solar hot water panels, and a wood-burning stove;
- Redhill School in Worcester, designed to be carbon-neutral, utilises ground-source heat pumps and micro-wind turbines to generate renewable energy.

2.9 The projects outlined above are, however, very much the exception, and uptake of renewables in the County at both individual building and community/decentralised levels has the potential to be greatly increased.

Fig. 2. At County Hall, a 700kW woodchip-fuelled boiler provides heating to the building, using locally-sourced woodfuel.

Fig. 3. A pilot project has been set up at Malvern's Chase Technology College to run a boiler on a 20% bio-diesel fuel mix.

INTRODUCTION SUMMARY

- EFFECTIVE DEMAND MANAGEMENT AND CONSERVATION OF ENERGY SHOULD ALWAYS BE CONSIDERED AHEAD OF ENERGY GENERATION.

3. Policy Context

National

3.1 An Energy White Paper, 'Meeting the Energy Challenge' was published in May 2007, following the draft Climate Change Bill of March 2007. These documents build upon the previous White Paper, confirming objectives of securing a 60% reduction in CO_2 emissions by 2050; having 10% of UK electricity supplied by renewable sources by 2010; and having 20% of UK electricity supplied by renewable sources by 2020. The draft Climate Change Bill seeks to make the 60% CO_2 reduction target legally binding, alongside a 26% to 32% target reduction by 2020.

3.2 Planning Policy Statement 22 (PPS 22): Renewable Energy - and its accompanying Companion Guide - forms the principal source of guidance for planners in developing policies for renewable energy. The PPS, published in 2004, signalled a significant shift in Government policy towards greater promotion of renewable energy projects. It makes clear that where viable (in terms of environmental, social and economic impacts) renewable technologies can be accommodated throughout England. A realistic approach is also encouraged, whereby the viability of schemes must be considered, and undue burdens must not be placed on developers.

3.3 The local planning process will continue to play a central role in ensuring that renewable technologies are given due consideration. The 2007 Energy White Paper states that, in spite of the increased support for renewables and more positive national policy, planning remains "...one of the most significant barriers to the deployment of renewables."[5] A more robust local policy framework could allow for greater progress, by specifying firm requirements for decentralised supplies and clear criteria for large schemes that may come forward.

3.4 The wider climate change agenda has included the publication of a PPS1 Annex on Climate Change[6], which recognises the role of renewable energy in mitigating and adapting to the effects that climate change is having on our environment. The importance of addressing climate change is made clear on page 1 of the PPS by stating that it is the policy in PPS1 that will take precedence over other policy where conflicts may arise.

3.5 Of particular significance at the local level is the requirement for local planning authorities to "set out a target percentage of the energy to be used in new development to come from decentralised and renewable or low-carbon energy sources" (Section 26(i)). Crucially, LPA's must " ensure there is a clear rationale for the target and it is properly tested".

[5] Extract from paragraph 5.3.64, Energy White Paper (2007)

[6] Planning Policy Statement: Planning and Climate Change, Supplement to Planning Policy Statement 1, DCLG (December 2007)

3.6 Delivering a percentage target for energy generation in new development is an established and successful means of securing reductions in carbon emissions. Many local authorities throughout the country have already adopted such a requirement, following the pioneering planning policy of the London Borough of Merton, which became known as the 'Merton Rule' [7]. It has now been established at a national level that those authorities without these requirements need to ensure that their LDFs make provision for such a policy:

> **"Planning authorities should [inter alia]:**
>
> **- expect a proportion of the energy supply of new development to be secured from decentralised or low-carbon energy sources".**
>
> *Extract from paragraph 20, PPS1*

3.7 Merton have estimated the cost of complying with the policy to be around 3-4% of the overall build cost. Homes with renewable energy technologies are able to offer an added attraction to house-buyers compared with other homes on the open market, and may be able to command premium prices.

3.8 Requiring on-site renewables ensures that energy efficiency is maximised, as it is usually cheaper to install energy efficiency measures than renewable technologies. By requiring a certain percentage of a building's carbon emissions to be met by renewables, it is logical that developers will seek to minimise these emissions from the outset. This should mean that energy efficiency is given greater consideration, as the target emissions reduction will decrease in line with the efficiency of the building.

3.9 The technical appraisal of on-site renewables schemes can be complex. Development of a toolkit that can be used by both developers and Local Authority Development Control officers can help make this process easier to understand by providing a systematic, step-by-step guide. Such a toolkit has already been produced for London authorities and offers a comprehensive guide to the process (see Further Reading, pages 75 - 77).

[7] "All new non residential developments above a threshold of 1,000sqm will be expected to incorporate renewable energy production equipment to provide at least 10% of predicted energy requirements" (Policy PE.13, London Borough of Merton Unitary Development Plan, adopted October 2003). The rule has since been adopted and modified by other local planning authorities and usually incorporates both residential and non-residential developments.

Regional

3.10 The West Midlands Regional Spatial Strategy (RSS), published in 2004, provides the overarching planning policy framework for the region. The RSS is undergoing a partial revision, which will allow certain topic areas, including energy issues, to be revisited. It is likely that the RSS will provide regional and sub-regional targets for renewable energy generation. One of the purposes of this research paper is to contribute to this process and to help inform what any sub-regional renewable energy targets might be.

3.11 Phase 2 of the partial revision of the West Midlands RSS seeks to establish potential housing figures up to 2026. The preferred option under consideration includes the potential for 36,600 new dwellings in Worcestershire between 2006-2026, which equates to 1,830 new dwellings within the County per year. It is clear that this level of new house-building will have a significant effect on carbon emissions, and an opportunity exists to ensure that energy is used more sustainably than in the past. Energy Saving Trust data[8] from 2006 provides the average annual emissions of CO_2 from typical dwellings of various sizes, assuming they are centrally heated by gas. This data is reflective of performance as dictated by the 2006 Building Regulations. If we compare these results with what is possible at the higher reaches of the Code for Sustainable Homes[9], then it is evident that there is potential for substantial carbon savings from new housing over the next 19 years.

3.12 Alongside the future housing numbers for the County, the RSS will also guide the amount of new commercial and industrial floorspace. This sector has a great deal to offer in terms of minimising energy usage and maximising use of renewables. Any policy in district Core Strategies requiring provision of on-site renewables should therefore apply to both domestic and commercial/industrial buildings.

3.13 Headline targets in the West Midlands Regional Energy Strategy[10] (RES) are: -

- Renewable generation equivalent to 5% of electricity consumption by 2010 and 10% by 2020.
- Heat from renewable sources providing 250 GWh (0.3% of consumption) by 2010 and 650 GWh (1% of consumption) by 2020.
- Production of 460 GWh of liquid biofuels per year (approximately 44 million litres - 2% of current diesel sales) by 2010.

Paragraph 4.3, West Midlands Regional Energy Strategy (November 2004)

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8 Data reproduced at Appendix E

9 The Code for Sustainable Homes, DCLG (December 2006) is a "standard for key elements of design and construction which affect the sustainability of a new home. It will become the single national standard for sustainable homes, used by home designers and builders as a guide to development, and by home-buyers to assist in their choice of home".

10 West Midlands Regional Energy Strategy, West Midlands Partnership Steering Group and Working Groups (November 2004)

3.14 Although the regional target of 5% renewable electricity by 2010 may at first appear to be only half of the Government's national target, the regional figure is a percentage of electricity actually used. This gives a challenging 'real term' target, as the region is a net importer of energy; whereas the national figure judges renewables as a percentage of electricity generated, the regional approach is intended to more accurately reflect the true scale of the region's needs. It was estimated in 2004 that Worcestershire supplied 5% of the region's renewable electricity[11], a proportion that could be increased through greater impetus in delivering renewables projects.

Local Development Frameworks

3.15 It is through the district Local Development Frameworks (LDF) that energy policy will be determined at the local level. Climate change and energy issues will form part of Core Strategies, from which further, more detailed policies can then develop. The detailed policies could be in the form of Development Plan Documents (DPDs) or Supplementary Planning Documents (SPDs).

[11] Worcestershire Climate Change Strategy (2004)

Sustainability Appraisals

3.16 Sustainability Appraisals (SA), prepared in parallel with Local Development Documents and Regional Spatial Strategies, are designed to ensure that full account is taken of the social, environmental and economic effects likely to arise from their implementation. At the local level, the SA forms a key mechanism to ensure that all opportunities for appropriate energy efficiency measures and renewable energy generation are considered.

3.17 Specific SA issues should recognise the importance of the need to adapt to climate change and to mitigate its effects, as well as recognising the important role of energy efficiency and renewables. The evolving joint SA framework for Worcestershire has the following objective for the issue of energy: "Promoting energy efficiency and energy generated from renewable energy and low carbon sources". Appropriate decision-making criteria must be developed to provide a clear indication of whether or not the plan or policy complies with these climate change and energy requirements. Monitoring indicators are then used to ensure that the SA objectives are not compromised by the plan or policy.

3.18 As local energy policy is further developed, it may be necessary to reconsider SA issues to ensure they remain in accordance with the most up-to-date good practice.

POLICY CONTEXT: SUMMARY/SUGGESTIONS

- AT THE LOCAL LEVEL, PROMOTION OF RENEWABLE ENERGY SHOULD BE INTEGRATED INTO COMMUNITY STRATEGIES, LOCAL DEVELOPMENT DOCUMENTS, AND SUSTAINABILITY APPRAISALS;
- REVISED TARGETS FOR RENEWABLES CAPACITY WILL BE DETERMINED THROUGH PHASE 3 OF THE RSS PARTIAL REVISION. LOCAL DEVELOPMENT FRAMEWORKS CAN SHAPE HOW DISTRICTS RESPOND TO THE NEED TO INCREASE RENEWABLES PROVISION.

4. Community Strategies, Climate Change Strategy and Local Area Agreements

4.1 Community Strategies set out a long-term vision of how an area should progress, in terms of social, environmental and economic development. Prepared by Local Strategic Partnerships (LSPs), they form an important function in seeking improvements for an area through a range of means. Whilst of significance to community strategies, planning issues are just one of a host of subjects that are addressed, which means the strategies are not limited in their scope, but are able to consider the wider aspirations of the community.

4.2 There are opportunities not only for community strategies to influence the outcome of planning documents, but also for planning documents to help shape the content of community strategies. In this regard, it is important to ensure that revisions of community strategies take full account of the latest energy policy, and encourage sustainable practices. This can include, for instance, procurement policies for partner organisations dictating that only 'green' energy should be used on their premises. LSPs have a key role to play in the promotion of renewables, and ensuring they are recognised in Community Strategies will be central to this role.

> **"Local planning authorities, regional stakeholders and Local Strategic Partnerships should foster community involvement in renewable energy projects and seek to promote knowledge of and greater acceptance by the public of prospective renewable energy developments that are appropriately located".**
>
> Key principle (vii), PPS22

4.3 The Community Strategy for Worcestershire (Second Edition 2008 - 2013) is a County-wide document that helps to shape a broad range of policy development, including planning policy. The Community Strategy recognises the potential for renewable energy to play a bigger role and now includes the following Priority Outcome:

> **To increase energy efficiency and increase the proportion of energy generated from renewable sources.**

4.4 The Community Strategy's climate change priorities are explored in more detail in the Worcestershire Climate Change Strategy, which aims to raise awareness of the issue of climate change; to reduce harmful climate change causing gas emissions across the county; and to assist adaptation to the impacts of climate change in the county.

4.5 For the purposes of preparing Local Development Frameworks, the foremost objectives contained in the Climate Change Strategy are the need for partners to work together, in order to:

> **"Increase production of renewable energy from 5% to 12.5% of regional targets by 2010. This means meeting the following production targets:**
>
> **Electricity 155GWh by 2011**
> **Heat 30GWh by 2011**
> **Biofuel 5.5 million litres by 2011"**
>
> **"Ensure specific policies and guidance on the exploitation of renewable energy resources are included in all strategic and local development plans."**
>
> *Extracts from proposed objectives, pages 24/25, Worcestershire Climate Change Strategy*

4.6 Achieving the objectives set out in the Strategy will require decisive action from all of the partners. Ensuring the planning policies are in place to deliver the desired renewables capacity will be crucial in working towards these objectives.

4.7 The following examples provide a broad indication[12] of the renewable generation equipment necessary to deliver the 155GWh electricity requirement of these Climate Change Strategy targets:

30 large (150m tall to blade tip) wind turbines (2MW each)

Photograph taken from 'Wind Power in the UK', Sustainable Development Commission (May 2005)

OR

10 wood-chip biomass power plants (2MW each)

Photograph taken from 'A Woodfuel Strategy for England', The Forestry Commission

300 small hydro-electricity schemes (100kW each)

Photograph taken from 'Planning for Renewable Energy - A Companion Guide to PPS22', ODPM (2004)

OR

25,000 solar PV roof installations (10kW each)

Photograph taken from 'Planning for Renewable Energy - A Companion Guide to PPS22', ODPM (2004)

[12] All figures have been rounded and assume capacity factors as follows: 30% for wind turbines; 88% for biomass plants; 60% for hydro-electricity; and 7% for photovoltaics. Appendix C provides further information.

As mentioned elsewhere in this paper, it is currently impossible to accurately measure renewable capacity installed to date, which means it is not possible to measure progress against these targets. However, it is unlikely that one particular technology will be relied upon to deliver the entire target. A mix of technologies, each contributing to the overall target level, is more realistic, and might be achieved through many combinations of wind, hydro, solar and biomass power. One example of how the County's target might be met through a combination of technologies is indicated below:

6,200 Solar PV roof installations (10kW each)	+	20 small hydro-electricity schemes (100kW each)	+	6 large wind turbines (2MW each)	+	5 biomass power plants (2MW each)
37 GWh		**10 GWh**		**31 GWh**		**77 GWh**

= 155 GWh County renewable electricity target

Note: Target relates to that contained in the Worcestershire Climate Change Strategy. In above examples, values have been rounded. See Appendix C for full details, assumptions and calculations.

4.8 Alongside the County-level Community Strategy and Climate Change Strategy, Worcestershire's second Local Area Agreement (LAA) was agreed in 2008. The LAA sets out the priorities for the County, including:

> **To increase energy efficiency and increase the proportion of energy generated from renewable sources.**

A number of indicators are included within the LAA to monitor progress towards delivery of the priorities. Indicator NI186 considers "Per capita CO2 emissions in the LA area". An increase in renewable energy will have a clearly beneficial effect in delivering against this indicator.

4.9 Climate change is a central theme in both County and District Community Strategies, and the Local Area Agreement. This provides a strong direction for renewable energy policy development within Worcestershire, but there could also be a greater emphasis on the role of renewables within these documents.

RENEWABLE ENERGY AND COMMUNITY STRATEGIES /LOCAL AREA AGREEMENT: SUMMARY/SUGGESTIONS

- THERE IS SCOPE TO INCREASE THE PRESENCE OF RENEWABLE ENERGY IN COMMUNITY STRATEGY REVISIONS AND ENSURE IT IS INCLUDED IN THE LOCAL AREA AGREEMENT.
- FURTHER RESEARCH IS NEEDED INTO THE POTENTIAL OF THE COUNTY TO DELIVER INCREASED RENEWABLE ENERGY, INCLUDING THE COMMISSIONING OF A COMPREHENSIVE STUDY INTO RESOURCE AVAILABILITY.

5. Worcestershire's Vulnerability to Climate Change

5.1 Worcestershire is vulnerable to the effects of climate change. This vulnerability will differ from place to place, but County-wide predictions for Worcestershire include:

- An increase in average maximum temperature of up to 4.5°C by the 2080s;
- More frequent very hot summers and less frequent very cold winters;
- Summer rainfall to decrease by up to 12% by 2020s and up to 50% by 2080s;
- Winter rainfall to increase by up to 23% by 2080s;
- More short duration extreme weather events such as storms and floods.

Worcestershire Climate Change Strategy

5.2 Several areas of the County have been identified as being at particular risk from climate change. As part of the Climate Change Strategy, the impacts of the changes listed above were predicted in terms of the increased risk of flooding, subsidence and fire.

5.3 The predictions[13] suggest that flooding will be a major issue along the course of the rivers Avon, Salwarpe, Severn, Stour and Teme, with potentially serious consequences for Worcester City, as well as Upton-upon-Severn, Tenbury Wells, Pershore, Bewdley, and Stourport-on-Severn, amongst others. In July of 2007 for example, the Environment Agency recorded record flood levels in Tenbury, Upton and Worcester. New flood defences in Bewdley are a visible example of reactive adaptation to climate change, but proactive mitigation of effects through such measures as reducing damaging emissions, must not be overlooked.

5.4 Alongside the increased risk of flooding, climate change can also affect the risk of subsidence and the threat of outdoor fire. The Climate Change Strategy highlights that there is a heightened risk of subsidence of gleyed soil and clay for much of the County.

5.5 An increased risk of fire has been predicted for Hartlebury Common, Kempsey Common, the Lickey/Clent Hills, the Malvern Hills, and the Wyre Forest.

[13] The Impact of Climate Change on Worcestershire - G Cavan 2004, for Worcestershire Climate Change Strategy.

5.6 Maps indicating these predicted areas of increased risk are reproduced at Appendix D. There may also be vulnerability issues associated with renewable energy technologies. There exists, for example, the potential for flooding or drought to impact upon the growth of energy crops. These issues should be identified at the earliest stage so as to ensure that schemes are 'climate proofed' from the outset. Existing agricultural growers are already facing difficulties through droughts; the Vale of Evesham, in particular, is becoming increasingly at risk.

Alongside the risks identified in the Climate Change Strategy, new research suggests that it is also crucial to plan for potential changes to biodiversity and landscape.[13a] In Worcestershire this may include, for example, increased vulnerability of hedgerow trees to drought, and the consequent impacts on landscape character; and the impacts of both winter flood events and low summer river flows on Salmonid breeding habitats.

5.7 For those rural areas where grid-connected electricity or gas supplies may be unavailable or at risk under severe weather conditions, de-centralised, off-grid renewables could offer a far more secure means of supply. Extreme storm events can easily disrupt centralised distribution systems. For example, overhead power lines can be broken under windy conditions, and electricity sub-stations can be overrun by flood waters.

WORCESTERSHIRE'S VULNERABILITY TO CLIMATE CHANGE: SUMMARY/SUGGESTIONS

- WORCESTERSHIRE'S VULNERABILITY TO THE EFFECTS OF CLIMATE CHANGE IS HIGH AND IS FORECAST TO INCREASE. THE SEVERITY OF 2007'S FLOODING HIGHLIGHTS THE COUNTY AS BEING AT PARTICULAR RISK.
- RENEWABLE ENERGY CAN CONTRIBUTE TO BOTH THE MITIGATION OF, AND ADAPTATION TO CLIMATE CHANGE BY REDUCING THE EMISSIONS THAT CAUSE CLIMATE CHANGE AND BY PROVIDING A MORE SECURE MEANS OF SUPPLY.

[13a] Planning for Climate Change in Worcestershire Technical Research Paper, Worcestershire County Council, 2008.

6. Renewable Energy and the Environment of Worcestershire

6.1 Renewable energy schemes can have a visual and/or environmental impact on their surroundings and on Worcestershire's built and natural landscape and biodiversity. Smaller methods of micro-generation, such as roof-mounted solar hot water panels, can represent unobtrusive additions to the streetscape; however, the impact of a 2MW wind turbine is likely to have a greater effect, being visible from a considerable distance. The potentially damaging impacts resulting from technologies can also differ. Migratory patterns of birds, for example, may need to be considered in the siting and operation of a large wind turbine or wind farm, whereas the installation of solar panels on the roof of a house may require a survey to investigate whether a bat habitat would be at risk, as bats are a protected species.

6.2 Whilst it is generally recognised that large-scale projects can have significant effects on their surroundings, it is also crucial to consider the impact of smaller-scale installations. This applies to most of the technologies listed in Appendix A, and includes the need to assess the potential cumulative effect of a number of smaller systems.

6.3 Cumulative impact can arise when a number of renewable energy developments (or the constituent parts of a single development) combine to heighten the effect of the development(s) on an area. An area judged as suitable for accommodating a renewable energy development may not necessarily be able to accommodate further development of a similar type. Some renewables, such as large-scale wind turbines, may require extensive ancillary structures such as cabling, access roads, maintenance buildings and sub-stations. In combination these developments could result in a far greater impact on the landscape than a solitary turbine, and this should be considered for any such application. Similarly, whilst the growing of biofuels or biomass on a small scale may be accommodated without serious change to the landscape, the wholesale diversion of fields to the growing of oilseed rape, for example, could have dramatic impacts not only on the landscape, but also on biodiversity and amenity concerns. There is the potential for these impacts to be positive as well as negative.

6.4 It may be possible to limit the harmful effects on landscape, biodiversity or heritage by ensuring reversibility in renewables proposals. This would allow the site to be returned to its previous (or improved) state after the end of its design life or a specified period of time. This is a practice commonly encountered in the conditions of quarrying developments, and could theoretically be extended to renewable energy installations, to ensure a site is fully remediated.[14]

[14] In the case of wind turbines, the Sustainable Development Commission suggest, in 'Wind Power in the UK' (2005) that "There is a strong case for viewing wind developments as temporary structures, pending longer-term approval on landscape grounds. As full decommissioning is usually possible, lasting objections could potentially be remedied on a case-by-case basis by the eventual removal of the turbines at the end of their working lives".

6.5 Landscape, biodiversity and heritage designations exist at national, regional and local levels of policy-making, offering protection to valuable natural and built environments throughout the County. For the purposes of renewable energy, PPS22 offers guidance on technologies within International Designated Sites; National Designations; and Local Designations. Each of these designations conveys a different form of protection. There are currently two internationally-designated sites in the County (Bredon Hill in Wychavon and Lyppard Grange Ponds in Worcester), both of which are Special Areas of Conservation (SACs). In addition, there are a number of SACs and RAMSAR wetland sites which fall wholly or partly within the administrative boundaries of neighbouring Counties. In terms of national designations, there are two Areas of Outstanding Natural Beauty (AONBs) that extend into the County, the Malvern Hills to the south-west, and the Cotswolds to the south. Alongside these protected landscapes, a host of other designations apply across the County, including numerous Sites of Special Scientific Interest (SSSI); Special Wildlife Sites (SWS); Local Nature Reserves (LNR), sites of archaeological, architectural or historic interest recorded on the Historic Environment Record etc. Full schedules of these sites can be found in each district's adopted Local Plan or Local Development Framework.

6.6 National policy in 'PPS7: Sustainable Development in Rural Areas' and 'PPS9: Biodiversity and Geological Conservation' dictates how these various sites are to be protected. It is not possible to generalise the type of development that will or will not be appropriate within or adjacent to these sites, as each scheme must be considered on its merits, against set criteria.

6.7 The Government has stated in PPS22 that development that will adversely affect internationally-designated sites will not be permissible unless there are "imperative reasons of overriding public interest, including those of a social or economic nature".

6.8 For nationally-designated sites, the objectives of designation should not be compromised, and if "significant adverse affects" are identified then these must be "clearly outweighed by the environmental, social and economic benefits". Of particular relevance within Worcestershire, it is stated that Areas of Outstanding Natural Beauty should be able to accommodate small-scale developments[15], providing the environment is not significantly compromised[16].

6.9 Local designations are insufficient in themselves to preclude renewables, and criteria-based policies should be used to make a judgment in these areas. Examples of such designations in the County include Local Nature Reserves and Special Wildlife Sites.

[15] PPS22 does not provide a definition of "small scale", but it may be assumed from the definition of "large scale" within the Companion Guide to PPS22 as "producing over 0.5MW of electricity" that "small scale" is below this level.

[16] It should be noted that the AONBs have statutory Management Plans in place, to which regard should be had when considering development within their areas. In addition, the Cotswolds AONB Conservation Board have published a Position Statement on the Criteria for Renewable Energy, which should be considered when planning renewables projects within, or close to, the Cotswolds AONB.

6.10 Green belt designation covers a substantial area of Worcestershire. Development within the green belt must be judged against the principles of 'Planning Policy Guidance Note 2: Green Belts', in which there is a general presumption against development. Any harm to the green belt must be outweighed by very special circumstances if a scheme is to be approved. PPS22 states that these very special circumstances "may include the wider environmental benefits associated with increased production of energy from renewable sources".

6.11 The sensitivity of the County's historic environment (historic buildings, buried archaeology and historic landscapes) must also be considered when looking to accommodate both energy-efficiency measures and renewable technologies. Guidance from English Heritage[17] suggests that for large-scale installations, issues of visual dominance, scale, intervisibility between features, vistas and sight lines, movement, sound or light effects, and unaltered settings must be given due consideration when assessing siting and design. English Heritage also state that when considering projects or planning applications, consideration "should extend to both designated and significant undesignated sites and areas".

Proposals for renewable energy schemes should take into account any potential impact upon buried archaeological remains. These may exist as earthworks in pasture or be completely buried and invisible. They are a 'finite and non-renewable resource' (PPG16, para 6). The risk is of direct damage or destruction or an effect upon environmental conditions below ground (i.e affecting the local water table) which may degrade the long term survival of remains. Such remains are protected under the planning system via PPG16 and local plan policies, and depending on scale and potential impact, any proposals may be subject to the need for a Desk-based Assessment, Evaluation or a watching brief. Advice on specific proposals can be sought from the County Historic Environment and Archaeology Service.

6.12 Listed buildings are designated because of their special architectural or historic interest, and any changes that could threaten this special interest are unlikely to be allowed. This could potentially include certain renewable energy technologies. Similarly, buildings within conservation areas are subject to tighter planning controls. Alterations, especially those visible from the front of the building, may be resisted. Sensitive design is necessary to achieve workable solutions for protected historic buildings, and this includes the need to ensure that their setting is not compromised. Scheduled Ancient Monuments (SAMs) and Registered Parks and Gardens will also require a sensitive approach if their character is to be maintained.

[17] Wind Energy and the Historic Environment (October 2005); Biomass Energy and the Historic Environment, English Heritage (December 2006).

6.13 At a domestic scale, the provisions of The Town and Country Planning (General Permitted Development) (Amendment) (England) Order 2008 allow for most types of small-scale householder microgeneration to be developed without the need for planning permission (subject to specified limits to maintain amenity). This amendment arose from reforms recommended in the 2007 Planning White Paper, as a means of avoiding the confusion over the need for planning permission, and to foster greater uptake of householder renewables. The relaxations do not extend to listed buildings (any material alterations will require listed building consent) or to some parts of buildings within conservation areas". The English Heritage publication Microgeneration in the Historic Environment provides further guidance on installing small-scale renewables in historic buildings.

[18] Extract from paragraph 7.24, Planning for a Sustainable Future: White Paper (May 2007)

[19] 'A New Look at the Landscapes of Worcestershire' - Worcestershire Landscape Character Assessment, Environmental Policy Team, Worcestershire County Council (2004)

6.14 The 2007 Planning White Paper has considered permitted development rights as a whole, and not just in terms of domestic applications. The Government has stated its intent to, wherever possible: *"extend permitted development rights on microgeneration to other types of land use including commercial and agricultural development".*

6.15 It is envisaged that as part of the district LDF process, greater attention can be paid to minimising and resolving possible conflicts between the need for renewables and the protection of landscape and heritage assets. This could be achieved through the development of clearer guidelines and criteria for different types of renewable energy development. Possible means by which an assessment methodology may be developed include the Worcestershire Landscape Character Assessment[19], which divides the County into a number of different landscape types, and can be used to assess sensitivity to change; and revisions to Conservation Area Appraisals that consider the management of change.

RENEWABLE ENERGY AND THE ENVIRONMENT OF WORCESTERSHIRE: SUMMARY/SUGGESTIONS

- RENEWABLE ENERGY INSTALLATIONS CAN BE APPROPRIATE AND JUSTIFIED DEVELOPMENTS AT BOTH THE COMMERCIAL AND DOMESTIC SCALE.
- RENEWABLES ARE LIKELY TO BECOME MORE COMMONPLACE FEATURES AS THE NEED FOR CLEANER ENERGY ACCELERATES.
- IT IS VITAL TO ENSURE THAT LANDSCAPE CHARACTER, HERITAGE, BIODIVERSITY AND AMENITY CONCERNS ARE CONSIDERED FROM THE OUTSET IN ANY RENEWABLES PROPOSALS.

7. Social benefits of Renewable Energy in Worcestershire

7.1 Renewable energy can bring real benefits to local communities. Although the capital cost of installing some renewable energy technologies can be high, the running costs - especially of wind, water and solar technologies - can be lower than conventional fossil fuels. Whilst being primarily an economic benefit, this can help reduce fuel poverty. Grant assistance can further help to make renewables more financially attractive. Further information on grants is provided at Appendix H.

7.2 Community ownership or investment in renewable energy installations can provide benefits to local people[20]. By setting up an energy supply company (ESCO), residents local to the proposed development can directly invest in the installation, helping to fund design, construction and running costs. In return, investors are eligible for a share in any profits generated by the sale of renewable energy.

7.3 Encouraging young people to take a responsible attitude towards sustainable development is seen as crucial in combating climate change. Worcestershire County Council's Education for Sustainable Development (ESD) team works across the County's schools to communicate the need for, among other things, renewable energy. The ESD team have stated that:

> **"Worcestershire County Council recognises that climate change and energy is the greatest threat facing us in the 21st century. This theme underlies all of our ESD work with schools".**
>
> Draft Strategic Overview of ESD at Worcestershire County Council

7.4 Educating children through ESD on the issues surrounding renewable energy is just one part of a much wider need for effective education across the whole community. People must be properly informed in order to be able to comment effectively on projects that may concern them. Misinformation can be damaging and can portray renewables in too positive or too negative a way. Objective information can be cascaded from local authorities, local strategic partnerships, and national organisations, as well as groups such as Act on Energy.

[20] Case study 2B, PPS22

SOCIAL BENEFITS OF RENEWABLE ENERGY IN WORCESTERSHIRE: SUMMARY/SUGGESTIONS

- CONSIDERATION SHOULD BE GIVEN TO THE ESTABLISHMENT OF ENERGY SUPPLY COMPANIES (ESCOS), TO ALLOW LOCAL PEOPLE TO MAXIMISE THE BENEFITS FROM RENEWABLE TECHNOLOGIES LOCATED WITHIN THEIR AREA.
- OPPORTUNITIES TO ENSURE THE BENEFITS OF RENEWABLE ENERGY ARE COMMUNICATED THROUGH EDUCATION, FOR EXAMPLE THROUGH THE EDUCATION FOR SUSTAINABLE DEVELOPMENT PROGRAMME, SHOULD BE MAXIMISED.

8. Renewable Energy and the Economy of Worcestershire

8.1 Development of renewable energy presents significant opportunities for the Worcestershire economy in job creation, business growth, and agricultural diversification, amongst other benefits.

8.2 In rural communities not connected to mains gas or electricity, homes and businesses may rely upon costlier forms of energy including oil and liquefied petroleum gas (LPG). Moving towards renewable forms of energy could reduce this reliance on costlier fossil fuels. For business in particular, installation of renewable energies can help to improve the so-called 'green credentials' of companies.

8.3 A growth in renewables will require a commensurate growth in renewables designers, manufacturers, suppliers, distributors, retailers, maintenance engineers, etc. Whilst some of this business growth may fall outside the County, by encouraging Worcestershire's development in renewables there is a better chance that local people and local companies may benefit. Approximately £15-19 billion of capital expenditure would be required nationally to meet the 2020 renewable energy aspirations of the Energy White Paper[21]. With the assumption that economic activity related to renewables will remain constant throughout this period, between 17,000 and 35,000 jobs could be sustained by the industry at the national level. These estimates have been set conservatively and do not take into account recent government policy including the Code for Sustainable Homes or the Climate Change Bill. Furthermore, research has shown that for every £40,000 invested in renewable energy, one job is created[22]. The opportunity exists for Worcestershire to capitalise on this growing market.

8.4 In rural areas, the establishment of renewable energies can offer benefits not only through the provision of employment opportunities, but also through supporting landowners in both the agricultural and forestry industries. By stimulating the demand for renewable energy, it is evident that the expansion of the renewables market within Worcestershire will present economic opportunities for inward investment and employment, as well as in skills and training.

8.6 As an example, development of biomass heating or biomass CHP could create the following opportunities:

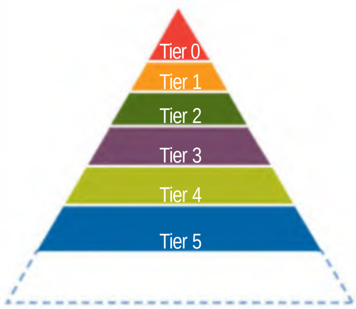
- Installation and maintenance of heating/CHP systems;
- Transportation - waste materials, wood materials;
- Agriculture - short rotation coppicing (willow/miscanthus);
- Facility staff - administration, management, handling, maintenance;
- Construction;
- Specialist skills - arboriculture, tree surgeons, etc;
- Technical advisors;
- Professionals - Architects, designers;
- Research and development.

[21] Renewable Supply Chain Gap Analysis, DTI (2004)

[22] West Midlands Regional Energy Strategy (November 2004)

8.10 The economic benefits of renewable energy can extend far beyond the developer of a project. There are a series of linked benefits that can be traced along a supply chain. The example here indicates some of the potential opportunities arising from a renewables energy installation (in this case a wind turbine):

EXAMPLE OF A SUPPLY CHAIN PYRAMID FOR WIND TECHNOLOGY



Examples:

Tier 0: Developer, turnkey contractor, operator

Tier 1: Suppliers of wind turbine, electrical systems,foundation and services etc

Tier 2: For wind turbine: suppliers of rotor, nacelle, tower, electronics and control systems and a sub-category of micro turbines

Tier 3: For the rotor: turbine blades, pitch control,bearings, nub and rotor shaft

Tier 4: For turbine blades: bolts and blades

Tier 5: For blades: blade material, resin and moulds

Renewable Supply Chain Gap Analysis, DTI (2004)

8.11 Biomass or biomass-CHP schemes currently provide the greatest opportunity for employment and training from the installation and maintenance of the technologies and the supply chains for fuels. In Worcestershire, woodlands have traditionally formed part of the local economy through a variety of arenas including the timber industry, recreational opportunities and wood burning for heat. In Herefordshire and Worcestershire the woodland industry is estimated to support in the region of 5,000 jobs in processing, manufacturing and other industries[23], with scope for this to increase as uptake of biomass fuels progresses.

8.15 If Worcestershire is to take advantage of the potential opportunities that an increased demand for renewable energy will create then it will be necessary to address skills shortages. There is an opportunity to increase the skills base of the local workforce and to increase the training infrastructure for young people, helping to deliver key objectives of the Economic Strategy for Worcestershire 2004-2014. One key mechanism for achieving this is through the development of partnerships with local training and education providers.

[23] West Midlands Forestry Industries Profiles, Forestry Commission

RENEWABLE ENERGY AND THE ECONOMY IN WORCESTERSHIRE: SUMMARY/SUGGESTIONS

- DEVELOPMENT OF RENEWABLE ENERGY IN WORCESTERSHIRE OFFERS THE OPPORTUNITY OF SECURING REAL ECONOMIC BENEFITS.
- THERE ARE ALREADY RENEWABLE ENERGY BUSINESSES WITHIN THE COUNTY, AND ENCOURAGEMENT SHOULD BE GIVEN TO PROMOTE TRAINING, EMPLOYMENT AND BUSINESS OPPORTUNITIES ARISING FROM A GROWTH IN RENEWABLES.

9. Community and Stakeholder Consultation

9.1 A national survey was conducted on behalf of the Department of Trade and Industry on 'Renewable Energy Awareness and Attitudes' in May 2006[24]. 85% of respondents supported the use of renewable energy, with 78% supporting the Government's policy of generating 10% of electricity needs from renewables by 2010.

9.2 The Worcestershire Citizens' Panel Survey of June 2007 included questions on climate change, energy efficiency and renewable energy. The results indicate a clear desire to help address climate change and to increase the use of renewable energy. The results show that, for Worcestershire residents:

90% either support or strongly support the generation of renewable energy within Worcestershire (Q12).

51% consider it a high priority that new development has a minimum amount of its energy generated renewably on-site, with just 9% feeling this is a low priority (Q13c).

65% consider improving energy efficiency in existing buildings to be a high priority. Only 4% feel this is a low priority (Q13a).

69% consider it a high priority to construct extremely energy efficient buildings. 4% feel this is a low priority (Q13b).

23% consider the installation of large wind turbines/wind farms to be a high priority, whereas 33% see this as a low priority.

46% consider generating hydro-electricity from the County's rivers and streams to be a high priority, with 11% feeling this is a low priority.

These results provide a useful indication not only of people's general support for renewables, but also of the kind of renewables technologies that they favour.

The responses indicated that people feel differently about building-mounted renewables depending on whether they're mounted on homes or on offices/industrial buildings. In the case of both solar panels and micro-wind turbines, residential buildings received fewer responses stating their installation was a 'high priority' than offices/industrial buildings (see Figs 1 and 2). These responses underline the necessity of ensuring that residential amenity remains a key consideration in planning for renewables. However, it must be recognised that under a revised householder permitted development scheme, certain microgeneration technologies will fall beyond local authority development control.

[24] Renewable Energy Awareness and Attitudes Research (DTI/NOP tracker survey published 24 May 2006)

Fig.1 – Responses to Questions 13(d) & (e), Worcestershire Citizens' Panel, June 2007

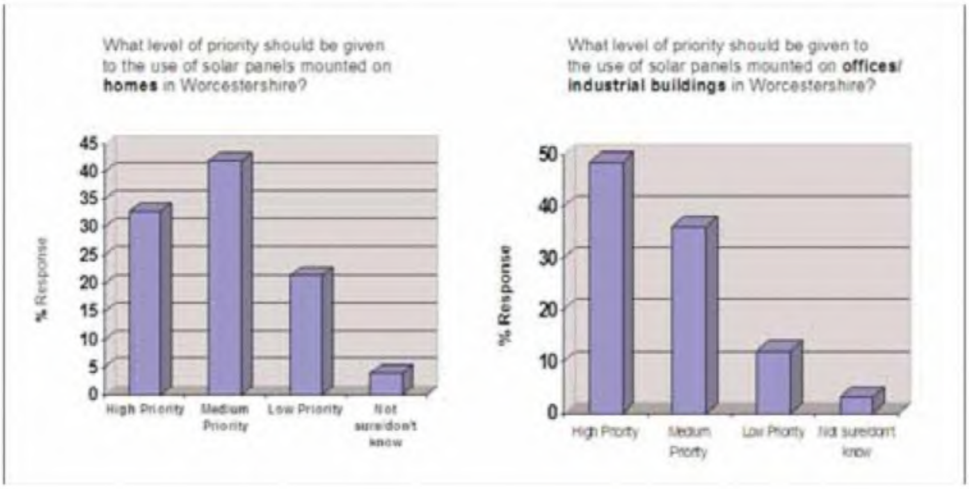
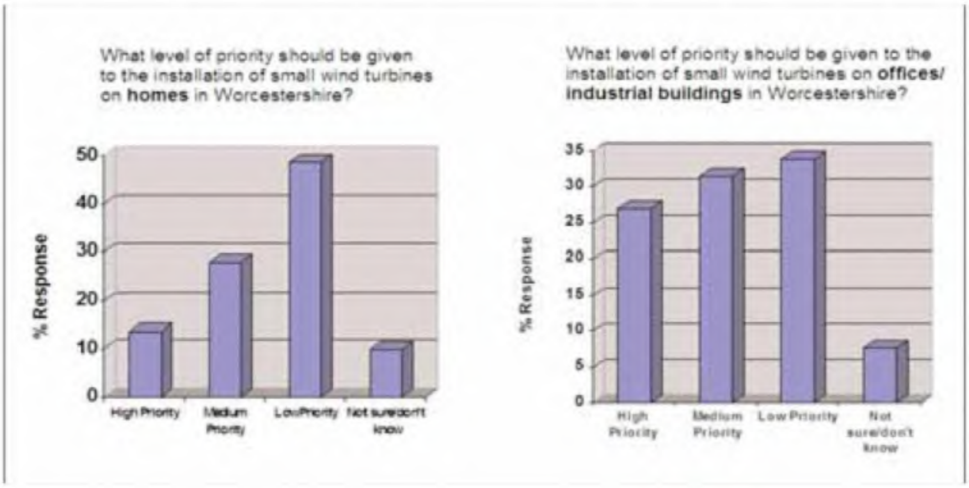


Fig.2 – Responses to Questions 13(f) & (g), Worcestershire Citizens' Panel, June 2007



9.3 In order to avoid misconceptions of renewable energy technologies, it is important to provide a clear indication of what each type of installation could mean, not merely in terms of the energy generated, but also in terms of the impacts it may have on people's lives. As mentioned elsewhere in this report, the landscape, biodiversity and heritage impacts of renewables are significant considerations when judging how appropriate a particular scheme may be. It is equally important to ensure that other localised issues of concern are given due consideration. There may be anxiety over noise pollution, smell, shadow flicker, traffic impacts, etc. The information at Appendices A and B seeks to provide a balanced account of the technologies and their impacts.

Community engagement from an early stage should concentrate on providing accurate and appropriate information to help people to develop informed opinions. As with many other development proposals, misinformation can be very damaging to potential schemes, and ensuring reliable information is available from the outset can help avoid these issues. It is anticipated that as awareness for environmental issues grows, then information on renewables will reach wider audiences, and appropriate channels should be explored for communicating this message. This could draw upon the resources of the Local Strategic Partnerships at both County and District level.

9.4 Community support will be of great benefit when planning/progressing a renewables scheme. Early consultation should enable an informed view to be taken. It may be possible for local people to become directly involved in a proposal, through investment; there exist examples throughout the country of community-owned or part-owned renewable energy schemes, whereby people invest a stake in the project's development and running costs, and receive a share of any profits from the sale of electricity, etc. This offers an innovative approach to help communities devise and deliver renewable energy schemes in their locality.

9.5 Schemes often involve extensive consultation exercises and, as with any planning application, comments on renewable energy schemes submitted to LPAs may be made by anybody concerned. If a scheme is larger than 50MW capacity, then responsibility for determining the scheme rests with central government. It should be recognised that only the very largest schemes will fall within this category (see Section 4 and Appendix C for capacity examples).

COMMUNITY AND STAKEHOLDER CONSULTATION:
SUMMARY/SUGGESTIONS

- PUBLIC CONSULTATION HAS INDICATED AN ENTHUSIASM FOR TACKLING CLIMATE CHANGE AND INCREASING THE USE OF RENEWABLE ENERGY.
- AT THE LOCAL LEVEL, CONSULTING ON INDIVIDUAL PROPOSALS AT AN EARLY STAGE COULD ESTABLISH POTENTIAL LEVELS OF SUPPORT OR OPPOSITION IN THE COMMUNITY, AND ALLOW FOR AN INFORMED DIALOGUE TO TAKE PLACE BEFORE SCHEMES ARE FORMALLY SUBMITTED FOR PLANNING PERMISSION.

10. Baseline Data and Forecasts

10.1 Worcestershire County and District Councils have a role to play in helping to create more sustainable patterns of energy use. In order to arrive at an energy policy that can make a meaningful contribution to reducing emissions, existing policy must be considered, along with any relevant baseline information, as well as issues emerging from consultation.

10.2 Whilst there exists a wealth of data used to monitor particular aspects of climate change and renewable energy provision at global, European, national, and regional level, there is relatively little available at the sub-regional and local level. For the purposes of Local Development Frameworks, the information must be of a relevant and measurable scale, and ideally specific to the District concerned. Other district policy documents, and especially the associated Sustainability Appraisals, can provide useful sources of baseline information.

10.3 Emissions data from the National Atmospheric Emissions Inventory has been mapped at County level in order to identify those areas responsible for the largest proportion of emissions. However, this mapping shows CO_2 emissions across all sectors, meaning that isolating those emissions resulting solely from the residential sector is not possible. These maps, reproduced as part of Appendix G, provide an indication of the change in emissions (from all sectors) between 2002 and 2004, and show that whilst some areas of the County have improved, there have also been marked increases in other areas. These patterns are generally concentrated not only on city/town centres, but also around the major road transport corridors.

10.4 Defra estimates that domestic CO_2 emissions for the County are approximately 1,398,000 tonnes per annum[25], which equates to roughly 2.6 tonnes of CO_2 per capita. This is slightly higher than the Regional and UK averages, at 2.4 and 2.5 tonnes per capita, respectively[26]. Domestic CO_2 emissions account for around 28% of Worcestershire's total CO_2 output, with industrial and commercial emissions accounting for around 30%. The greatest contributing sector is road transport, with 40% of the county's total CO_2 emissions.

10.5 Whilst the significance of road transport emissions is recognised, considering methods for reducing these emissions is beyond the scope of this document. This issue will, however, be considered elsewhere in national, regional and local policy. Specifically, reference is made to more sustainable travel options in the Worcestershire Local Transport Plan 2 (2006-11).

10.6 It is in the domestic and industrial & commercial sectors that this document may seek to improve emissions, including through greater use of renewable energy. Provisions requiring on-site renewable energy generation for residential and certain non-residential development have been implemented successfully, including in the London Borough of Merton.

[25] End User Local and Regional Estimates of Carbon Emissions, DEFRA (2005)

[26] Averages calculated from Defra estimates, as above.

10.7 Domestic emissions will be due, in a large part, to the existing housing stock's poor energy performance. Measures to encourage greater energy efficiency in existing properties may be considered, including retro-fitting insulation, etc., in other documents within LDFs. However, new properties can more easily allow for the integration of energy saving and energy generation measures.

10.8 The Defra emissions data by sector referred to above is a generally reliable indicator of CO_2 output resulting from housing. It must be noted, however, that the methodology behind this data has been refined over the past few years, and may continue to be refined. Whilst it is beneficial to have more accurate data, this continual process of modification causes certain problems, and direct comparisons to assess trends are not always possible. Nevertheless, we must collate the best and most relevant data available, and this has been included as part of the appendices to this document.

10.9 Current average household emissions for typical modern homes are published by the Energy Saving Trust, and are reproduced at Appendix E. The data suggests a range of emissions depending on house size, ranging from 2,278kg of CO_2 per year for a one-bedroom flat, to 8,260kg of CO_2 per year for a four-bedroom detached house.

10.10 In order to understand the possible methods of generating renewable or low-carbon energy, the characteristics of the County's resources must be assessed. The principal technologies likely to be considered will be wind-power, solar (both solar hot water and solar photovoltaic), hydro-power, biomass, and ground/air/water source heat pumps. Each of these technologies has different requirements in order to operate effectively. Resource capacity data within the County (for example wind speed and direction, biomass crop yield, water flow rates along rivers and streams, etc.) remains to a certain extent unknown, although there is partial coverage by existing regional surveys, principally *Renewable Energy Prospects for the West Midlands*[27]. Appendix F contains extracts of those elements relevant to Worcestershire.

[27] Renewable Energy Prospects for the West Midlands, Final Report, Halcrow Group Ltd for GOWM (November 2001)

BASELINE DATA AND FORECASTS:
SUMMARY/SUGGESTIONS

- WORCESTERSHIRE'S DOMESTIC AND INDUSTRIAL & COMMERCIAL EMISSIONS ARE HIGH. DOMESTIC CO2 EMISSIONS, IN PARTICULAR, HAVE BEEN ESTIMATED TO BE HIGHER THAN BOTH THE REGIONAL AND NATIONAL AVERAGES, AND THERE IS A RECOGNISED NEED TO REDUCE THEM. RENEWABLE ENERGY HAS A VITAL ROLE TO PLAY IN SECURING THESE REDUCTIONS.

11. Technological Issues for Renewable Energy in Worcestershire

11.1 When considering the type of renewable generation technology which may be most appropriate in a given location, there are many factors which must be taken into account, including the policy and community issues referred to elsewhere in this paper. A technological assessment of renewables is also required in order to understand what will or will not make an effective contribution to reducing emissions. A more detailed description of each technology is provided at Appendices A and B.

11.2 It is worth noting that CO_2 emissions resulting from electricity are considerably higher than those from gas or oil. For example, for a typical domestic heating system, CO_2 emissions are calculated as: 0.27 kg/kWh for oil; 0.194 kg/kWh for gas; and 0.46 kg/kWh for electricity[28]. This is because the electricity used in the home or workplace must be generated (usually off-site and from fossil fuels), and this results in significant CO_2 emissions. It is thus more efficient (in emissions terms) to heat water using gas than it is to heat it with electricity. This means that more renewable energy is required to offset electrical usage than gas. The Department of Trade and Industry give the following example to show the relative benefits of each:

4m2 solar water heating offsets 1,600kWh gas;
20m2 photovoltaics offsets 1,600kWh electricity

11.4 The greatest reduction in CO_2 will be achieved through a holistic approach, whereby energy is considered in all its forms and across all sectors. As stated in the introduction, this paper is concerned primarily with energy generation rather than conservation. However, it is important to recognise the range of existing built stock, and to appreciate that retro-fitting renewables and making existing homes and businesses more energy efficient could yield massive emissions savings. It is stated in the Government's consultation 'Building a Greener Future: Towards Zero Carbon Development', that "…by 2050 as much as one third of the total housing stock will have been built between then and now." This illustrates not only the scale of the challenge to influence that third of all housing that is to be built, but also the two-thirds of existing housing that could be upgraded.

[28] Figures taken from the University of Strathclyde's Energy Systems Research Unit. Information available at: http://www.esru.strath.ac.uk/EandE/Web_sites/01-02/heat_pump/auxiliary.html#top4

11.5 It is important to recognise that renewable energy measures will vary according to the needs and constraints of each particular site. A broad range of energy technologies may be possible, and meeting the targets set both nationally and locally is unlikely to lead to large wind turbines occupying every available site in the County. The scale of each renewable energy installation should be suited to its particular circumstances. As envisaged by the Government's 'Building a Greener Future: Towards Zero Carbon Development'[29] consultation, future energy requirements "will require some form of low or zero carbon energy use … This could be at the development level (e.g. CHP) or at the building level (e.g. solar hot water heating)".

11.6 As stated in the West Midlands RSS, "the location of renewable energy facilities is a cross-boundary, sub-regional and regional issue". In considering the potential that could be offered by renewables, it may be necessary to look beyond administrative boundaries. Renewable energy is likely to be addressed on a sub-regional basis in the Phase 3 revision of the RSS, and this paper will be revised in line with its outcomes.

[29] Building a Greener Future: Towards Zero Carbon Development, Consultation, DCLG (Dec 2006-Mar 2007)

TECHNOLOGICAL ISSUES FOR RENEWABLE ENERGY IN WORCESTERSHIRE: SUMMARY/SUGGESTIONS

- IN ORDER TO ASCERTAIN A VIABLE INDICATION OF RENEWABLE ENERGY PROSPECTS IN THE COUNTY, A DETAILED STUDY OF CAPACITY MAY BE REQUIRED, FOCUSING ON THE MOST SUITABLE LOCATIONS AND TECHNOLOGIES AND THE POTENTIAL OUTPUT.
- POTENTIAL FOR RENEWABLE GENERATION WILL VARY BY LOCATION. APPENDICES TO THIS PAPER PRESENT CONSIDERATIONS FOR APPROPRIATE AND VIABLE TECHNOLOGIES.

12. Infrastructure Requirements

12.1 Large-scale renewable energy technologies require appropriate infrastructure to operate successfully. This infrastructure may already exist and have sufficient capacity to facilitate the renewable energy technology, or it may need to be upgraded or even introduced as a direct result of the new energy development.

12.2 Renewable energy installations will have different infrastructure requirements depending on the technology employed, the location and operating conditions. Whilst a site may satisfy a number of important criteria in determining where a technology may be most suitable, if the necessary infrastructure is not available, or cannot be made available, then the development cannot be successful. Some of the infrastructure provisions that may generally be expected to be required are:

Access to the site for construction and maintenance
Some potential renewables sites may, by their nature, be remote. Sites for wind turbines, for example, will require adequate road transport links at the construction stage to enable large heavy goods vehicles to transport materials and plant. Further access will be required for maintenance and possibly decommissioning.

Grid connection
Large-scale (and some small-scale) renewables should be connected to the national electricity distribution network. This enables excess electricity generated to be fed back into the grid, whereas it might otherwise be lost. It may be that a potential site is a considerable distance from the network, or that the existing network is unable to handle the extra capacity. In these instances, it may be necessary for network improvements or extensions. The cost of any extensions can be prohibitively high, especially where power cables must pass through difficult terrain, and this should be considered at the outset. Electricity sub-stations will have a maximum capacity that could limit the connection of larger-scale renewables.

Access to fuel/fuel storage
Where biomass is concerned, a reliable fuel source must be identified to supply the plant into the future. For economic and environmental reasons, this fuel should ideally be sourced from within 25 miles of the biomass facility[30]. Beyond this distance, the benefits of biomass begin to decrease. A further consideration is to ensure a suitable fuel store is available that can accommodate the required volume of biomass, and can be accessed for deliveries by the supplier.

Appendix A provides further information on likely infrastructure considerations for each technology.

[30] Paragraph 38 of the Technical Annex within the Companion Guide to PPS22, ODPM (2004)

INFRASTRUCTURE REQUIREMENTS:
SUMMARY/SUGGESTIONS

- RENEWABLE ENERGY INSTALLATIONS, ESPECIALLY THOSE OF A LARGER SCALE, WILL REQUIRE INFRASTRUCTURE TO BE IN PLACE, OR BE PROVIDED, IN ORDER TO OPERATE SUCCESSFULLY.

13. Monitoring and Further Work

13.1 Monitoring will be undertaken on an annual basis to see how any renewable energy policy is working. It will be important to understand any shortcomings or missed targets, and the reasons for these, in further refining the policy content.

13.2 As and when new national and/or regional energy policy is published, the policies within the LDF must seek to reflect this.

13.3 As part of the local development framework, an Annual Monitoring Report (AMR) is produced. PPS12[31] states at paragraph 4.48 that the AMR should report on, inter-alia:

i) whether policies and related targets or milestones in local development documents have been met or progress is being made towards meeting them or, where they are not being met or not on track to being achieved, the reasons why;

ii) what impact the policies are having in respect of national, regional and local policy targets and any other targets identified in local development documents.

iii) the extent to which any local development order, where adopted, is achieving its purposes;

iv) whether the policies in the local development document need adjusting or replacing because they are not working as intended;

v) whether the policies need changing to reflect changes in national or regional policy; and

vi) if policies or proposals need changing, the actions needed to achieve this.

13.4 One of the challenges of energy policy is to ensure it is measurable. Developments which meet the criteria for renewable energy generation will need to be recorded, together with the type of generating technology employed, and the amount of energy generated/carbon saved. This information will allow for a detailed pattern to emerge of the particular technologies that are most commonly used, and may highlight where any market weaknesses exist. This information could be used to further develop the policy, and may lead to increased targets in the future.

13.5 As suggested above, baseline data, indicators and milestones must be devised for the purpose of monitoring. This will not necessarily mean a whole host of new information-gathering requirements, as some data that is already collected can be used for this purpose. One example of this is the monitoring of domestic CO2 emissions per capita, which are provided annually down to district level.

13.6 Monitoring of certain data concerning renewables, such as designed capacity, or number of micro-turbines installed, is likely to require input at the development control stage. This could have resource implications for development control officers that will need to be considered.

[31] Planning Policy Statement 12: Local Development Frameworks Office of the Deputy Prime Minister (now Department for Communities and Local Government) 2004

13.7 This research paper provides an outline of the key planning issues for renewables. Further work will be required to give a more accurate picture of the technologies and locations that may be appropriate for development, and to give a better understanding of the resource capacity within the County.

13.8 As mentioned elsewhere in this paper, a comprehensive assessment of capacity may be required, based on a robust methodology, to give a fuller picture of the County's likely resource. Any capacity study would need to take into account not only the physical possibilities afforded by potential renewables (including the practicalities of working with new or proposed infrastructure) but also the policy and wider planning issues identified in this paper.

13.9 In order to produce as complete a study as possible, it would be preferable to involve key stakeholders from an early stage, including energy providers and supply companies. This would help to ensure that the study was based on a realistic understanding of market forces and economic feasibility.

MONITORING AND FURTHER WORK: SUMMARY/SUGGESTIONS

- EFFECTIVE MONITORING OF RENEWABLES DEVELOPMENTS WILL BE CRUCIAL. NATIONAL, REGIONAL AND LOCAL TARGETS CAN ONLY BE EFFECTIVE IF THEY ARE MEASURABLE. LAA INDICATORS WILL ALSO PLAY AN INCREASINGLY IMPORTANT ROLE AND MAY DEPEND ON ACCURATE RENEWABLES DATA.
- MONITORING SHOULD BE USED EFFECTIVELY TO ENSURE THAT ANY RENEWABLES POLICY IS ACHIEVING ITS AIMS. EFFECTIVE MONITORING WILL ENABLE EARLY ACTION TO BE TAKEN, WHERE REQUIRED, TO ADDRESS ANY DEFICIENCIES THAT MAY COMPROMISE THE POLICY OUTCOMES.
- A COMPREHENSIVE RESOURCE ASSESSMENT OF THE COUNTY'S CAPACITY FOR RENEWABLE ENERGY WOULD PROVIDE A BETTER-INFORMED PICTURE OF THE TECHNOLOGIES AND AREAS THAT MAY BE MOST SUITABLE FOR DEVELOPMENT.

14. Technical Information and Glossary of Terms

TECHNICAL INFORMATION AND GLOSSARY OF TERMS	
Carbon (C) / Carbon Dioxide (CO_2)	Emissions savings can be expressed in terms of either Carbon or Carbon Dioxide, and for clarity it is worth making clear the difference between the two. Carbon Dioxide (CO_2) is Carbon (C) mixed with Oxygen (O_2). CO_2 is 3.67 times heavier than Carbon, which means that to save 100 tonnes of carbon emissions would be far more significant (3.67 times) than saving 100 tonnes of CO_2.
Watt (W)	Unit of power, equal to one joule of energy per second.
Kilowatt (kW)	One thousand watts. Typically, 1kW represents the energy used by a 1-bar electric fire left on for 1 hour.
Megawatt (MW)	One million watts (1,000kW). One megawatt of power is sufficient to supply the electrical needs of 1,000 average homes.
Gigawatt (GW)	One thousand million watts (1000,000kW).
Kilowatt-hour (kWh)	Unit of energy: 1 kilowatt of power for one hour.
Manufactured Fuel	Includes all manufactured solid fuels, benzole, tars, coke oven gas and blast furnace gas (DTI).
Sustainability/ Sustainable Development	The Government defines sustainable development as "enabling people throughout the world to satisfy their basic needs and enjoy a better quality of life without compromising the quality of life of future generations". It seeks to balance environmental, social and economic effects.
Carbon Footprint	The total set of greenhouse gas emissions caused by an individual or organisation, event or product. It should be expressed in carbon dioxide equivalent (CO_2e).
Building Regulations	Building Regulations exist to ensure the health and safety of people in and around buildings, and the energy effciency of buildings. Practical guidance on ways to comply with the functional requirements in the Building Regulations is outlined in a series of "Approved Documents" published by Communities and Local Government.
Low-carbon development	A *low carbon development* is one that achieves a reduction in carbon emissions of 50% or more from energy use on site, on an annual basis.

Appendix A. Characteristics and Appraisal of different Renewable Energy technologies in Worcestershire

Large-Scale Wind Turbines

Large-scale wind power, in the form of single wind turbines, or groupings of turbines in wind farms, currently has the greatest potential to help the UK meet its national energy targets. However, at the County level, it may not be the most appropriate means of delivering on emerging regional/sub-regional targets, for reasons of technical viability, and environmental/social/economic acceptability.

As a land-locked County, Worcestershire evidently has less capacity to generate wind energy than some coastal authorities. The practical and policy constraints that apply across the County will require any potential siting of large turbines to be carefully evaluated against a clear set of criteria.

Technical Constraints

The primary technical constraint when looking at wind power will be the availability of a sufficient wind resource. This means that information on the wind speed and 'wind profile' of any potential site should be available. Wind profiles provide details on the direction of the wind, and the different times in which it blows in particular directions. The successful operation of wind turbines relies on an average wind speed in excess of 6m/s (optimum speed is in the range 13-25m/s). Below this threshold, the mechanics of the turbines do not allow them to work efficiently, although the minimum operational wind speed is gradually decreasing.

The 2001 study 'Renewable Energy Prospects for the West Midlands' included some large-scale wind mapping that charted those areas with sufficient average windspeed for turbines to operate (see Appendix F). Based on this mapping, it seems Worcestershire has large areas capable of delivering wind power, predominantly in a belt stretching from the centre of the County to the south and the east. The maps show that approximately half of the County is covered by 'planning constraints', although it would be incorrect to assume that these are absolute constraints to wind development. It is important to note that any wind speed mapping must not be used to categorically exclude future sites. One of the Government's key principles in PPS22 makes clear that to exclude a potential renewable resource based solely on "assumptions about the technical or commercial feasibility" is unacceptable, and that "Technological change can mean that sites currently excluded as locations for particular types of renewable energy development may in future be suitable".[32] For this reason, wind turbines and wind farms proposed in areas outside of those identified on the wind resource map cannot be excluded from consideration, but it is recognised that in the current market, with current technologies, the likelihood of development proposals coming forward in these areas is minimal. The West Midlands Regional Urban Wind Capacity Study (June 2004) confirmed that wind speed is the principal consideration when looking for potential sites, stating that "As a rule, developers use this data as a guide and supplement it with on-site data prior to assessing the deliverability of sites".

[32] Paragraph 1(v), Key Principles, Planning Policy Statement 22: Renewable Energy, DCLG (2004)

Beyond average wind speed, other technical constraints exist that would need to be overcome before developing wind turbines. Access to any potential site is crucial not only in allowing the delivery and construction of the turbine(s), but also to allow maintenance and repair, as and when required. The current logistics involved in turbine development mean that access must be available for large vehicles. Similarly, for turbines to be connected to the national grid (which will almost certainly be the case for large-scale wind), adequate provision must exist to allow connection to the distribution network. It may not be possible to connect particularly remote and/or awkward locations to the grid system. In itself, this can be a major constraint; many potential sites that satisfy other technical and/or environmental criteria will be relatively isolated, and actually erecting the turbines could be so problematic as to effectively prevent projects going forward.

Potential funding assistance for wind-power projects could be secured through the Regional Development Agency (RDA), which is keen to promote renewables and low-carbon technology in the Rural Regeneration Zone, which includes Bewdley and its surrounds within its boundary. The RDA states that "…investment in wind power would enable local businesses to benefit from renewable energy, which would in turn increase the security and diversity of the Zone's energy supply and reduce carbon emissions". (Rural Regeneration Zone Annual Report 2005-06, Advantage West Midlands).

Environmental designations apply over large areas of the County. When considering sites for large wind turbines, the purposes of these designations must be taken into account. The wind resource mapping referred to above has collated together these designations to form what it terms 'planning constraints', as an indicator of those areas unlikely to be suitable for wind energy developments. The mapping has excluded these areas, together with the urban areas, to arrive at an area of 'deliverable resource'. Accepting this methodology leaves almost all of north Worcestershire as unsuitable for wind energy development. This approach appears outdated, and is not necessarily consistent with that of PPS22, which states that the various levels of designation can possibly accommodate renewables, subject to certain criteria. For internationally and nationally-designated sites, the onus is on the developer to prove that the potential development will not compromise the objectives of the designation. It is the responsibility of the LPA to set out criteria-based policies through which acceptability in these designations can be decided. Local designations alone are not considered sufficient reason for refusing renewable energy development, and criteria-based policies should again be employed.

In addition to landscape impacts, there are several other factors that will be of importance in assessing the viability of wind turbines in any given area. Among these are noise; shadow flicker; vibration; effects on radar and TV interference; and wildlife. A DTI study[33] investigated the noise associated with wind turbines, and concluded that "Noise from the wind farm should be limited to 5dB(A) above background for both day- and night-time … remembering that the background level of each period may be different". Further details of these issues - which may be termed amenity considerations - can be found in the Sustainable Development Commission's 2005 publication 'Wind Power in the UK.

[33] Paragraph 21, The Assessment and Rating of Noise from Wind Farms, report to DTI (September 1996)

Domestic Micro Wind Turbines

Domestic wind power has received significant media exposure in recent years, and its profile has undoubtedly been raised. Small turbines form part of a suite of micro-generation technologies that are increasingly gaining support from householders. The Government has introduced policy initiatives and grant-funding measures to encourage the take-up of micro-generation, but until recently the advice could appear to conflict with the system of development control. The householder consents review is likely to lead to some forms of domestic micro-generation gaining further acceptance as permitted development.

Small-scale wind turbines are only suitable in areas where the wind flow is largely uninterrupted, and is of a sufficient average speed. This can effectively preclude many locations in built-up urban areas. The effect on neighbouring properties must not cause a loss of amenity, be it through noise, visual blight, vibration, or shadow flicker.

The initial financial outlay for small-scale wind turbines can be significant (in the order of £2,000 for a 400W installation[34]), and because the generating potential is relatively low, the repayment period can be long.

As a largely rural County, Worcestershire could potentially make extensive use of micro wind turbines, particularly in those locations that are not connected to the national grid.

[34] Paragraph 1(v), Key Principles, Planning Policy Statement 22: Renewable Energy, DCLG (2004)

Biomass/Biomass CHP

The use of biomass heat and/or power plants as a means of generating renewable energy involves the burning of plant matter in order to create heat and/or electricity. The CO_2 absorbed by the plants during their life is equal to or greater than that released during combustion, ostensibly making the process carbon neutral. Transport and processing emissions must be kept as low as possible in order to ensure that the process is sustainable. The DTI's 'UK Energy in Brief 2006' states that domestic and industrial wood, together with co-firing of power stations, provided 25.7% of renewable energy used in the UK during 2005.

Combined heat and power (CHP) uses the heat from energy generation that would otherwise be wasted as a means of space heating. CHP can be powered by conventional fuels such as gas, or renewable biomass. CHP is most suitable for mixed-use developments, due to its characteristics of being most efficient when supplying a constant demand (rather than, say, the predominantly evening demand of most households).

Biomass is sourced from either forests and woodlands (short-rotation-coppice - willow or poplar harvested regularly - timber off-cuts, waste arisings, low value wood from thinnings etc.); or from energy crops such as miscanthus grass.

A key benefit of biomass is its versatility, in terms of both the variety of sources of fuel, and the variety of end uses for the heat and/or energy generated. The Government has stated that "There are a range of sources of renewable heat, but biomass is the only fuel that can be used over the whole range - from very small-scale domestic units to large-scale district heating systems". (Extract from paragraph 5.4, UK Biomass Strategy, 2007).

Biomass is still in its infancy, but there already exist successfully operating examples, including a boiler at County Hall in Worcester that operates on wood chips. In order to be a viable technology, the biomass boiler must have access to a reliable fuel supply chain. This must be based around locally-sourced biomass in order to remain low-carbon. The characteristics of biomass fuels are such that relatively large quantities are required to match the generating capacity of conventional fuels. Because biomass is stored on-site, there needs to be adequate storage space for the product, which could be difficult to accommodate in homes with little outside space. According to the Biomass Energy Centre, "For a primary central heating system for a domestic house a fuel store of at least 5-6 m3 is recommended, preferably larger for wood chips. This may require filling once or twice a year for pellets, or four to six times for wood chips". There must also be convenient access for deliveries of the fuel to the store.

A functioning woodfuel supply chain is critical to the establishment and continued success of biomass installations. Gaps in the supply chain should be addressed and interventions made where necessary. This extends beyond issues simply of sourcing and delivering the biomass, and includes a lack of specialist personnel (installers/engineers, etc) and, linked to this, a lack of training. Supply-chain issues are often funding-related, and means of assistance should be explored.

Biomass and wood energy is being publicised by a variety of bodies, and is gaining recognition as a viable energy technology. Local authorities can play a key role in ensuring full consideration is given to biomass as an energy source.

Indeed, one of the goals of the West Midlands Wood Energy Strategy Review 2006 is to "Lobby county councils and planning departments to obtain a requirement that all new housing and business developments consider wood fuel or combined heat and power plants".

Emissions from biomass-powered plants have been demonstrated to be well within acceptable limits (Effects of Renewable Energy Wood Fuel for Electricity and Heat, Stack Emissions, Air Quality and Health, DTI New & Renewable Energy programme). Local air quality around biomass plants will be monitored by the local authority or the Environment Agency

to ensure that levels remain acceptable. Because biomass generation relies on the use of a boiler to generate electricity, considerable water resources may be required. This means that biomass plants should incorporate high standards of water conservation and water recycling, and also that sites for biomass may ideally be situated in close proximity to an available water resource. The Environment Agency will be able to provide guidance on acceptable water usage, and can advise on whether an abstraction license is required.

Green Infrastructure is increasingly being recognised in Worcestershire as a means of ensuring multiple environmental and social benefits. The importance of Green Infrastructure can also extend to renewable energy, as there is the potential for new and existing woodland to contribute biomass resources.

Forests and Woodland

The potential of forests and woodland as a source of biomass energy is dependent on a number of factors. These are chiefly the availability of sufficient wood arisings; the ownership of the woodland; and the economic viability, which will depend on a continuing market demand.

There is a sizeable amount of waste wood arising from the management of woodlands, which together with unwanted wood from parks, hedges, etc., could form a vast potential resource in the County that could make a significant contribution to generating renewable energy and reducing carbon emissions.

Sustainable woodland management can also provide a significant increase in the quantity of low value wood, such as that arising from thinning. Where the demand for biomass fuel is the driver for bringing under-managed woodland into sustainable management, this can lead to wider benefits to biodiversity and recreation, as well as economic advantages.

Biomass has significant potential in community/district heating schemes, although there are no known schemes of this nature currently operating within Worcestershire. District heat networks are unlikely to be retrofitted within existing developments, but can be integrated into new developments at the design stage, and successful examples exist such as at Hoathly Hill Community, West Sussex.

Land ownership issues could present a difficulty when establishing wood energy sources. Across Herefordshire & Worcestershire, 15% of woodland over 2 hectares is under the ownership of the Forestry Commission, who have taken a particularly pro-active approach towards the possibilities of biomass for energy generation. This does, however, leave a remainder of 85% that is owned by others, made up of one or more of the following groups: personal; private forestry or timber business; other private business; local authority; other public bodies; charitable organisations; and/or community ownership or common land.

The Government has signalled that alongside the benefits of biomass production, creating more managed woodland would also benefit the environment, stating that: "Expanding the total area of woodland and bringing undermanaged woodland back into management will also improve local biodiversity". (Extract from paragraph 3.4, UK Biomass Strategy 2007)

The Regional Forestry Framework, Growing our Future, aims to move wood energy from a minor activity to a recognised niche market, and to make a significant contribution to West Midlands energy supply for business, public sector and domestic markets. These aims are being taken forward in Worcestershire through the Growing our Future Delivery Plan 2006-2009.

There already exists a local driver in the County in the form of the Wyre Forest Study Group, which was set up as one of four pilot projects to investigate market development. The group recommended "A Wood Energy Project to develop a sustainable heat system based on using wood fuel. This will be included in the design of the new Visitor Centre with further examples in the wider community such as heating systems in Community Halls. It is hoped that success here will create a market for these wood products that will result from the woodland reversion process throughout Wyre". (Management of Wyre Forest, Wyre Forest Study Group, Richard Boles).

It should be noted that in the 'West Midlands Non-Food Crops Opportunities' Draft report of July 2007, it states that: "…it is proposed to review the Rural Regeneration Zone plans to firmly align energy linked actions with priorities such as renewable energy for off gas grid areas; for biomass digestion and combustion CHP projects in public buildings; and links to the production of energy crops".

Short Rotation Coppice (SRC) and Energy Crops

Crops grown specifically for biomass energy generation include short-rotation willow or poplar coppice, and miscanthus grass. The crops are typically harvested on a one-year cycle (Miscanthus) or a three-year cycle (short rotation coppice willow). In terms of baseline information, it is difficult to assess the current level of energy crop production in the County.

One reason for this is that Natural England have received no applications for Energy Crop Scheme (ECS) planting grants from within Worcestershire, which would be the natural means by which uptake could be monitored.

There is an obvious loss in the field area available for food crops in developing this resource, but moving to energy crops can represent a more viable use for farmland. Indeed, energy crops and their associated supply chains can help to ensure a strong rural economy, much of which will depend on agricultural diversification. The NFU have asserted that significant energy could be generated from bioenergy crops without compromising food production, but this will have to be carefully considered and could be affected by an increase in the price of food imports.

The UK Biomass Strategy has recognised the potential for negative effects arising from the changes in land use from agriculture to energy crops, and it states that: "We are keenly aware of the environmental risks from unsustainable production and damaging changes of land use. We fully support the EU approach of linking potential increases in biofuel targets to sustainability criteria. It is acknowledged that increasing the supply of biomass will have implications for land use, biodiversity, the environment and the landscape." (Extract from page 6, UK Biomass Strategy, 2007). It should be recognised that whilst land is being used for the growing of energy crops, food crops cannot be grown; and the growing of energy crops can be water-intensive, which could have implications in the context of water shortages. Conversely, saturation from flooding could destroy any energy crops within a flood plain, and this will also need to be considered at the planning stages.

Regional encouragement for the use of SRC is found in the West Midlands Regional Spatial Strategy (RPG11) of June 2004, which includes Policy QE8.A(vii), stating that:

"Development plans, other strategies and programmes should encourage tree cover in the region to be increased, where it is appropriate to the character of the area, taking account of the Regional Forestry Framework, and in ways that reinforce and support the Spatial Strategy by:

> [inter alia]
>
> vii) promoting, where appropriate, opportunities for short rotation coppice as a raw material and where this can provide a renewable energy resource".

The 2001 Halcrow study referred to at page 27 indicates the potential capacity from energy crops throughout the region, based on a network of approximately 5x5km grid-squares. Relevant extracts are reproduced at Appendix F.

Defra released mapping in May 2007 to provide a broad indication of the ability of different areas to support the growth of energy crops[35]. The mapping is at a regional scale, and shows the probable yield of energy crops in terms of being high, medium, or low. Defra has also carried out landscape modelling of the likely impact of energy crops, in terms of their effect on the landscape. This study provides a rating of locations, at a regional scale, as either neutral; potentially beneficial; or potentially adverse. As discussed elsewhere landscape impact at the regional and local level will be an important consideration when looking to develop energy crops. Certain types of biomass will be inappropriate in certain landscapes within the County, and the Worcestershire Landscape Character Assessment should be used to help inform decision-making.

It is worth noting that the root systems of energy crops can be deep. This can be positive in terms of enhancing soil quality, and requiring relatively less ploughing than conventional food crops. However, there may also be negative effects, such as the disturbance of archaeological remains.[36]

Some locations within Worcestershire are designated 'smoke-free zones', and within these zones biomass boilers that are not on the register of 'exempt appliances' will not be permitted. For more information see **http://www.uksmokecontrolareas.co.uk**

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[35] See http://www.defra.gov.uk/farm/crops/industrial/energy/opportunities/jca/106.htm for further information.

[36] Biomass Energy and the Historic Environment, English Heritage (2006)

Solar Hot Water

Solar water heating is a proven technology, whereby the sun's energy is used to supplement the hot water in a building. The technical requirements for solar hot water (SHW) are minimal. A suitable, broadly south-facing surface is required on which to mount the collector system, and a separate hot water tank is needed, which may be difficult to accommodate. This effectively excludes most flats from using the technology. There are no noise or vibration implications of SHW, apart from those associated with installation and maintenance. Visually, SHW involves a large black area of collector plates (either flat-plate, or the more efficient - and more expensive - evacuated tubes). The surface area can vary, but typical installations are in the order of 3-5m2, with a relatively shallow depth. Typical systems should allow households to save 1,000-2,000kWh of energy per year[37]. Typical costs are £1800 - £2700 per standard domestic system; and £700 per square metre for commercial systems.

Solar Photovoltaic

Solar photovoltaic (PV) panels share many of the characteristics of solar hot water panels. Again, a south-facing (preferably sloping) surface, such as a roof, is needed. In appearance, both require a large surface area of black panels, although PV plates are now available in a variety of sizes, and can be made into roof tiles. PV panels are also of shallower depth than those used for SHW, as the technology does not require circulation space for water/liquid. The main drawbacks of PV as a renewable technology are that the panels produce a relatively low amount of electrical energy, and the costs, although falling, remain high. According to the Energy Saving Trust, a typical domestic PV system of 1kWp may be 10m2, and generate 800kWh of energy. Installed costs may be in the region of £4,000-6,000, which is a substantial sum for the average householder; indeed, the House of Lords report Renewable Energy: Practicalities'[38], states that "…without a major reduction in unit cost they are unlikely to contribute significantly to the United Kingdom's electricity needs". In the non-domestic sector, it has been suggested that solar panels may be a viable alternative to 'prestige' claddings on office buildings. Whilst this design solution may well be acceptable, its scope is likely to be extremely limited in Worcestershire.

Data suggests that irradiation in the County is good[39], with average production of 2.4kWh per day for a 1kW system located in Worcester city. Irradiation levels at other towns in the County are provided at Appendix F.

The domestic cost for PV is approximately £5000 per kW for roof-mounted, with a higher cost for roof-integrated. Non-domestic costs are approximately £4000 per kW for roof-mounted, again with higher costs for building-integrated.

[37] Renewable Energy Sources in Rural Environments, The Energy Saving Trust (March 2004)

[38] Renewable Energy: Practicalities, House of Lords Science and Technology Committee, July 2004

[39] European Commission Joint Research Centre, 2007, data available at: http://re.jrc.ec.europa.eu/pvgis/apps/pvest.php?lang=en&map=europe

Ground/Water/Air Source Heat Pumps

Ground source heat pumps (GSHP) extract the heat energy stored underground and use it to contribute to heating water, either through directly circulating water underground, or through circulating an intermediary fluid. A suitable area of land adjacent to the building is required in which the pipework can be buried. This can be done either horizontally (in which case a large land area will be needed), or vertically in a deep bore (depth of 15m-150m), which can be more expensive. One of the principal benefits of the systems is that they do not require any external conditions (e.g. strong direct sunlight) in order to work efficiently. Due to the near-constant temperature of the earth (c.10-12oC) at a depth of around 2m, the system can be used all year round, although it is unlikely to produce sufficient output to be the sole source of heat, especially during the winter. Typical costs for a horizontal system are £800 - £900 per kW; for a vertical system, costs may be in the region of £1000 - £1500 per kW

As a technology that requires excavations (either vertical or horizontal), there exists a risk with GSHP that archaeological remains could be disturbed or destroyed during installation/maintenance. The installation of GSHP is being included as householder permitted development, meaning that planning permission would not be needed, which could consequently reduce the likelihood of proposals being referred to archaeological officers for advice. It is therefore suggested that householders choosing to install a GSHP system take reasonable care that there will be no adverse archaeological impacts arising from the installation. If in any doubt, consultation with professional advisors is recommended.

Water-source heat pumps employ a similar principle to ground-source, but extract the heat energy from a body of water instead of from the ground. This method is unlikely to deliver significant returns County-wide, as it depends on a suitable body of water (such as a lake) being in close proximity to the building using the heat. Water-source systems are also less efficient during winter months (susceptible to freezing, etc).

Air-source heat pumps extract heat energy from the air outside a building and transfer it to be used as space heating inside. The air temperature in the West Midlands is probably insufficient to provide any major heating gains, but the system also allows cool air to be circulated inside a building, which can provide a more sustainable alternative to air-conditioning.

Ground, water and air-source heat pumps all rely on a small input of energy to power the pumping mechanism. The 'coefficient of performance' determines the relationship between the energy required to be input, and the energy gains from the system. For ground source, this equates to a ratio of approximately 3-4 units of heat energy received for every single unit of energy to run the system. Air-source pumps are less efficient.

Geothermal

Geothermal heat is extracted from the earth to provide direct heat energy, in the form of hot springs, etc. However, it is unlikely that this will be a suitable method of energy generation in the County, as the temperatures below the earth are too low. According to the Halcrow study, "…the geological structure of the region is such that temperatures are not sufficiently elevated near to the surface to allow the use of geothermal heat".

Large/Small-Scale Hydro-Power

Generation from tidal power is not possible in a County so far from the sea. However, the rivers running through the County, together with the various streams and brooks, have the potential to provide a valuable source of renewable energy. The West Midlands Energy Strategy states that "For reasons of topography all hydro developments in the Region will be small scale and, for the most part, "run of river" systems. The resource within the region is therefore very limited" Extract from Page 53, West Midlands Regional Energy Strategy (October 2004)

Micro-hydro schemes, with an output of 100kW or less, are more likely to have a stronger potential, but are unlikely to make a significant contribution to overall electricity generation. Disused water-mills are perhaps the most obvious opportunity for the use of hydro-power, but new facilities could also be installed, subject to environmental criteria, throughout the County.

Any development of a river-based renewable energy scheme could potentially have damaging effects on flaura and fauna, as well as having landscape impacts. Furthermore, interfering with the flow of any watercourse requires a sound knowledge of any implications, both upstream and downstream, which may arise from the works. The Regional Energy Strategy considers that "It is likely that all hydro developments in the Region will be incorporated into existing weirs and so will not involve the construction of impoundment dams or long penstocks". Extract from Page 53, West Midlands Regional Energy Strategy (October 2004)

It is worth noting that some hydro-power schemes can have beneficial effects in flood-prone areas. The Companion Guide to PPS22 states that certain schemes could have secondary potential for "reducing flooding and/or flood risk", and continues to advise that "hydro schemes can help to regulate river flows and minimise flooding".

Biogas (Anaerobic Digestion)

Biogas is a renewable fuel generated through the processing of biodegradable wastes. If the waste is not biodegradable, it is not considered renewable; thus, many incinerators which generate energy from burning waste are beyond the consideration of national renewables policy or the guidance in this paper [40]. Issues relating to non-renewable energy-from-waste will be addressed through the County Council's Waste Development Framework.

Landfill Gas

Nationally, landfill gas provides by far the largest contribution to renewable energy generation, accounting for 33.5% of all renewable energy generated in 2005 (according to DTI's UK Energy in Brief, 2006). In Worcestershire, there are currently energy from landfill generators at Throckmorton, Martley and Bromsgrove, with a total combined installed capacity of 4.85MW. This currently represents the largest renewable generating capacity in the County, but landfill gas cannot be expected to provide a long-term energy source, as best practice in waste management will see the resource being depleted in future years.

[40] It should be noted that the EU does not consider waste combustion to be 'renewable'. It does allow that the biodegradable fraction of industrial and municipal waste can justifiably constitute 'biomass', but states that "the incineration of non-separated municipal waste should not be promoted under a future support system for renewable energy sources, if such promotion were to undermine the [waste] hierarchy" (Paragraph 8 and Article 2(b), Directive 2001/77/EC).

Sewage Sludge

According to the 'Renewable Energy Prospects in the West Midlands' report, sewage sludge could yield 10.7 GWh/year of electricity in Worcestershire, based on a County population of 538,000 generating 13,450 tonnes of sludge per year.

The Companion Guide to PPS22 states at paragraph 3 that: "Energy from AD is also effectively carbon neutral in that the carbon it releases is approximately equal to the carbon absorbed from the atmosphere by the plants which constitute the origin of the organic waste".

"A study conducted for Defra in 2005 by AEA Technology (AEAT) and Future Energy Solutions concluded that the main challenge to anaerobic digestion in the UK was an economic one, resulting from market failure. Public intervention may therefore be necessary to pump-prime early adopters of the technology and to disseminate knowledge of its potential". (Extract from paragraph 140, DEFRA Draft Rural Development Programme 2007-2013)

Farm Slurry

Organic farm wastes (animal slurry) can be processed to produce a gas that can then be used to generate renewable heat and/or power. Anaerobic digestors can be operated on the relatively small, 'on-farm' scale to provide localised energy for the farm estate, or can be operated as ' centralised' anaerobic digestion, which takes in slurry from many different farms. Using slurry in this way can have environmental benefits beyond simply reducing carbon emissions, including avoiding the pollution watercourses.

Appendix B. Summary of Different Renewable Energy Technologies in Worcestershire

LARGE-SCALE WIND TURBINES	
Opportunities	**Constraints**
Large potential capacity from proven technology.	Restricted to locations with suitable wind speed/direction/flow. Indicative wind mapping suggests majority of County has insufficient windspeed for commercially-viable turbines.
National planning policy suggests turbines may be able to be accommodated on green belt land, if the generation of renewable energy is considered to constitute very special circumstances, and any harm to the green belt's purposes is overrided.	Landscape / heritage designations, including AONB; Green Belt; SSSI; RIGS; SWS; LNRs; Common Land; AGLV; SAMs; Listed Buildings; Conservation Areas; Parks & Gardens.
Strong private sector investment potential - not dependent on public sector funding. Potential economic benefits to the County in terms of job creation in manufacturing, maintenance, etc. examples of turbine businesses in County beginning to emerge.	Public perception of noise / radiation / wildlife impacts.
Community benefits, including possibility of direct investment and return on exported electricity.	Connectivity to national grid may not be technically or financially possible.
Not reliant on supply / transportation / storage of fuel stock.	Access for installation/maintenance may not be feasible.
Potential to be a valuable diversification of agricultural land.	Significant embodied energy in construction/transportation of equipment; Payback period has been suggested as between 3-10 months (DTI/Sustainable Dev. Commission) or just over one year (HoL Science & Tech. C'tee).
Installation can be removed when decommissioned with minimal trace.	

DOMESTIC MICRO WIND TURBINES	
Opportunities	**Constraints**
Few planning obstacles (fewer with revised GPDO).	Minimal power generation
Grants may be available.*	Sub-optimal wind-speed
Long-term cost savings.	Poor urban performance as airflow is interrupted by buildings, etc.
Awareness-raising.	Potentially contentious
Opportunity to feed back surplus electricity into national grid, with 'two-way metering'.	Unsuitable in some areas (CA/listed buildings)

* *See:* ***http://www.energysavingtrust.org.uk/housingbuildings/funding/database****/ for details of grants for various renewable energy technologies for different building types (homes, public & private sector, community etc)*

LARGE SCALE BIOMASS/CHP	
Opportunities	**Constraints**
Significant potential woodfuel resource (see Strategy, FC etc).	End-user must be close to source
Halcrow study suggests formula for energy crops of 'all set-aside land + 10% of arable land'.	Boiler systems physically larger and more expensive than fossil fuel equivalents
Long-term local job creation: production, distribution, installation, maintenance, etc.	Biomass fuel must be stored at the point of usage
Suitable for large buildings and housing developments	Delivery must be arranged and scheduled
Successful example exists in County (WCC boiler).	Inappropriate for flats unless on combined district heating scheme, due to space constraints.
Power can be supplied continuously - not dependent on weather conditions, etc.	More suited to supplying heat than power - electrical output can be low.
Funding streams have been identified, e.g. within Wyre Forest Landscape Strategy.	Likely to be reliant on road deliveries, which could be delayed or cancelled in extreme winter weather conditions, which would be when the fuel was needed most.
Marches Wood Energy Network & Midlands Wood Fuel Ltd already established and operational in Worcestershire. Developing wood-fuel process/delivery mechanism based around wood fuel 'depots' on farms.	Limited availability of contractors to undertake harvesting/processing.
Energy crop grants are available from DEFRA under the England Rural Development Programme (Energy Crops Scheme).	Creation of smoke may have air quality implications and may not be suitable in 'smoke-free zones'.

*See Research note on woodfuel in Wyre Forest:
http://www.english-nature.org.uk/pubs/publication/PDF/RIN711.pdf

DOMESTIC-SCALE BIOMASS/CHP	
Opportunities	**Constraints**
	Domestic-scale biomass CHP is probably unlikely, but biomass heating is appropriate and is used successfully in Europe.
Significant potential woodfuel resource (see Strategy, FC etc).	End-user must be close to source
Halcrow study suggests formula for energy crops of 'all set-aside land + 10% of arable land'.	Boiler systems physically larger and more expensive than fossil fuel equivalents
Long-term local job creation: production, distribution, installation, maintenance, etc.	Biomass fuel must be stored at the point of usage
Suitable for large buildings and housing developments	Delivery must be arranged and scheduled
Power can be supplied continuously - not dependent on weather conditions, etc.	Not generally appropriate for single dwellings (see above)
Biomass systems are most efficient when supplying a constant load, throughout the day and night, such as in a mixed-use development.	Inappropriate for flats unless on combined district heating scheme, due to space constraints.
	More suited to supplying heat than power - electrical output can be low.
	Likely to be reliant on road deliveries, which could be delayed or cancelled in extreme winter weather conditions, which would be when the fuel was needed most.
	Requires flue that extends above roof line.
	Biomass boiler requires more frequent cleaning than gas or oil boilers.
	More suited to supplying continuous loads (rather than, for example, the primarily evening-only requirements of most housing).

SOLAR HOT WATER (SHW) / PHOTOVOLTAICS (PV)	
Opportunities	**Constraints**
Consistent supply of sunlight.	Relatively low power generation.
Homeowner grants may be available.	Even minimal shading can dramatically reduce performance (Halcrow).
Solar Hot water can be cost efficient (in the region of £1800-£2700 per system)	Photovoltaics expensive. Scope for high-profile office users to incorporate PV panels as 'status' cladding is minimal in Worcestershire.
SHW Can supply 50% of hot water demand for low density housing, meaning a 10% carbon saving.	SHW requires hot water storage cylinder. Space is needed for this, and many properties are designed for combi-boilers, which do not need storage.
Visual impact is minimal and planning restraints would not normally apply unless on a listed building or within conservation area.	Inappropriate for flatted developments, as the roof area per dwelling is low, and only the top floors would receive benefits.
PV could meet 50%+ of electricity demand in new housing. (DTI conference) and save around 0.5 tonnes of CO_2 per year.	

GROUND/AIR/WATER SOURCE HEAT PUMPS	
Opportunities	**Constraints**
Economic alternative to electric heating for schools, etc.	Varies according to source.
Suitable for off-grid, remote buildings.	For ground-source, land must be suitably stable and free of underground utilities, and must be accessible to plant.
Grant assistance may be available.	Dependant on further power source to drive pump, although there is an opportunity for this source to be renewable.
Can also be designed to provide summer cooling.	Can provide heat but not power.
Minimal visual impact once installed.	Initial cost may be prohibitive.
	More suited to under-floor heating, which is a rarity and is expensive to install.
	Can remove the need for gas in a building- safer and reduces expense of annual safety checks.

LARGE/SMALL-SCALE HYDRO-POWER	
Opportunities	**Constraints**
Rivers including the Arrow, Avon, Severn, Stour, and Teme, run through the County, as well as numerous tributaries, brooks, etc, with potential to offer reliable source of renewable energy.	Dependent on water running past particular location. Majority of buildings not in this position.
Topography.	Potential landscape impacts
	Additional regulations (such as Environment Agency's extraction licence, and the need for an EIA) may be disincentive.
	Large-scale schemes involving dam(s) are unlikely and would require a suitable valley, massive investment and disruption.
	Small scale systems have a high capital cost (£20-25k for a typical 5kW domestic scheme).

BIOGAS	
Opportunities	**Constraints**
Valuable source of energy from waste.	Not all biogas recognised as truly renewable energy source by EU.
Prevents dangerous build-ups of gas or leakages of atmospheric pollutants.	
Sewage sludge could yield 10.7 GWh/year of electricity in the County, based on a population of 538,000 generating 13,450 tonnes of sludge per year. (Halcrow)	
Can be produced from agricultural & food waste (with a potentially valuable fertiliser by-product).	

Appendix C. Example calculations of Annual Renewable Electricity generated by different technologies

For the purposes of providing an estimate of how the renewable energy targets might be achieved, the following assumptions and calculations have been used.

To calculate the annual electricity generation, in GWh, for each technology, the installed capacity is multiplied by the number of hours in a year, and multiplied again by the 'capacity factor'. The capacity factor takes account of real-world scenarios, by ensuring that calculations include the sub-optimal average operation of the apparatus (e.g. wind turbines will not always be operating at full capacity due to wind speeds being too weak or too strong). With the exception of wind turbines, the capacity factors for each technology have been taken from South East Energy Statistics, which is led by the Government Office for the South East and funded through the South East England Development Agency and the South East England Regional Assembly. The capacity factor for wind turbines has been taken from the Companion Guide to PPS22.

Calculation:

Installed Capacity in GW		Number of hours per year		Capacity Factor of Appliance
(to convert from **KW** to **GW**, multiply by **0.000001** to convert from **MW** to **GW**, multyply by **0.0001**)	X	**24** x **365** = **8760**	X	e.g. **30%** or **0.3**

= **Electricity generated per year**

Solar PV:

The figure for solar photovoltaics (PV) is based upon a case-study example within the Companion Guide to PPS22, which illustrates a school building fitted with 10kW of photovoltaic tiles, which equates to 0.00001GW. It is considered that such an installation would be viable on many larger-scale public and private sector buildings throughout the County. The capacity factor for solar PV has been calculated as 0.07.

Each solar array of this scale would produce

0.00001 X 8760 X 0.07 =
0.006132 GWh/year.

To supply the entire renewable electricity target for the County, the number of solar PV arrays of this scale required would be

155 / 0.006132 =
25,277.234 ≈ 25,300 solar PV arrays

Hydro-Electricity:

The hydro-electricity example has been based on individual installations of 100kW, which is 0.0001GW. This figure is taken from the lower range provided in the Companion Guide to PPS22, which states (p.125) that: "there are a large number of sites with a potential in the range of 100kW (0.1MW) to 500kW (0.5MW) … which could be economically developed as grid connected schemes". The capacity factor for hydro-electric schemes is 0.6.

Each hydro-power scheme of this scale would produce:

0.0001 X 8760 X 0.6 =
0.5256 GWh/year.

To supply the entire renewable electricity target for the County, the number of hydro-electric schemes of this scale required would be:

155 / 0.5256 =
294.90 ≈ **300 hydro-electric schemes**

Large-scale Wind Turbines:

The wind turbines are assumed to have an installed capacity of 2MW (0.002GW) each, which is a commonly-used measure for large-scale turbines, and is referred to in the Companion Guide to PPS22. The capacity factor for wind turbines is 0.3.

Each wind turbine of this scale would produce:

0.002 X 8760 X 0.3 =
5.256 GWh/year.

To supply the entire renewable electricity target for the County, the number of hydro-electric schemes of this scale required would be:

155 / 5.256 =
29.490 ≈ **30 large turbines**

Biomass Plants:

Biomass plants are assumed to have an installed capacity of 2MW (0.002GW), which has been taken from industry figures for an AWM-supported scheme in the West Midlands, which can be viewed at http://www.talbotts.co.uk/bpower.htm. It is recognised that the capacity of biomass plants can vary enormously, but for the purposes of this example the 2MW has been used. The capacity factor for continuous-load biomass is 0.88.

Each biomass plant would produce:

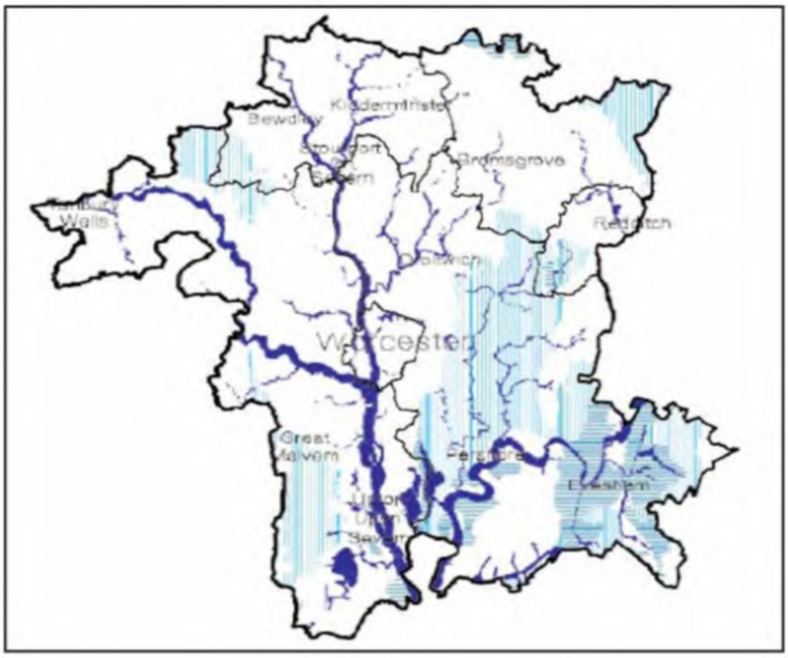
0.002 X 8760 X 0.88 =
15.418 GWh/year.

To supply the entire renewable electricity target for the County, the number of biomass plants of this scale required would be:

155 / 15.418 =
10.053 ≈ **10 biomass plants**

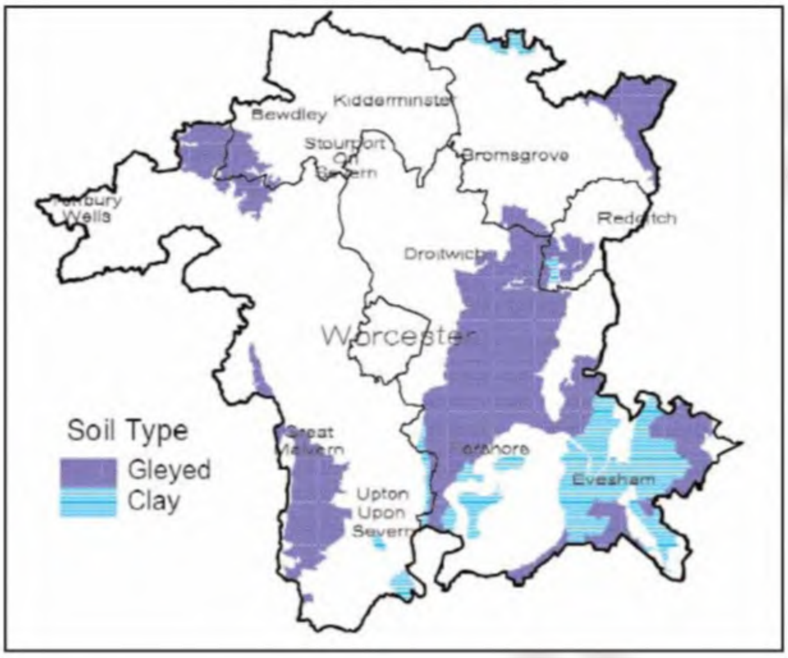
Appendix D. Maps of Predicted Increase in Risk to Worcestershire as a result of Climate Change

MAP OF INCREASED RISK OF FLOODING IN WORCESTERSHIRE



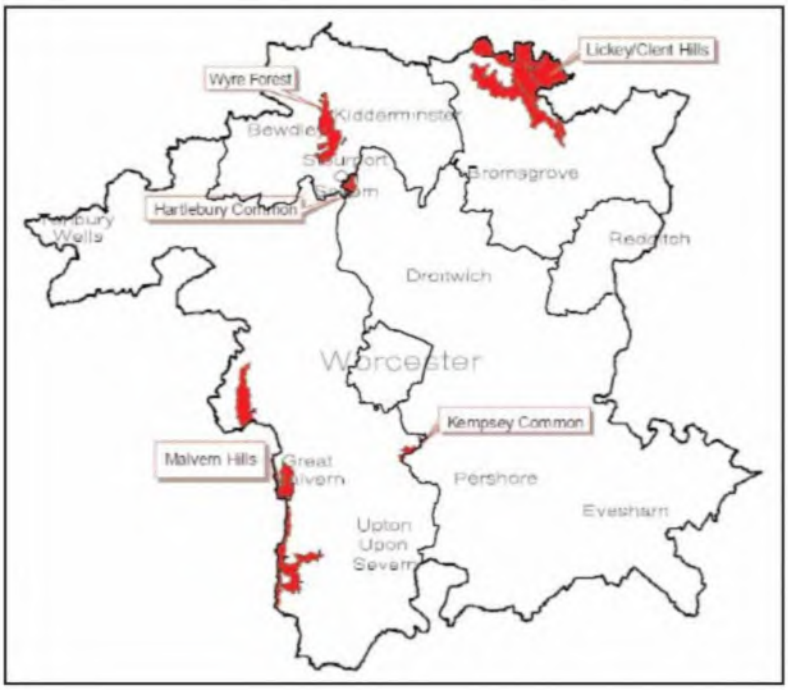
Adapted from The Impact of Climate Change on Worcestershire - G Cavan 2004, in Worcestershire Climate Change Strategy

MAP OF INCREASED RISK OF SUBSIDENCE IN WORCESTERSHIRE



Adapted from The Impact of Climate Change on Worcestershire - G Cavan 2004, in Worcestershire Climate Change Strategy

MAP OF INCREASED RISK OF FIRE IN WORCESTERSHIRE



Adapted from The Impact of Climate Change on Worcestershire - G Cavan 2004, in Worcestershire Climate Change Strategy

Appendix E. Energy Saving Trust table of typical emissions from a variety of house types (Assuming gas central heating) 2006

			Heating		Lights & Appliances		Cooking		kWh/m2	Total (kWh/yr)	Total (kg CO_2/yr)	10% energy saving (kWh/yr)	10% CO_2 saving (kg/yr)
Property Type	m2	Bedrooms	kWh/yr	kgCO_2/yr	kWh/yr	kgCO_2/yr	kWh/yr	kgCO_2/yr					
Flat	42	1	7,865	1,494	1,466	630	807	153	241	10138	2,278	1013.8	227.8
Flat	61	2	11,423	2,170	2,129	916	1,173	223	241	14725	3,309	1472.5	330.9
Flat	89	3	16,666	3,167	3,107	1,336	1,711	325	241	21483	4,827	2148.3	482.7
Mid Terraced House	63	2	11,693	2,222	2,109	907	1,008	192	235	14810	3,320	1481.0	332.0
Mid Terraced House	79	3	14,663	2,786	2,645	1,137	1,264	240	235	18571	4,163	1857.1	416.3
End Terraced House	63	2	15,138	2,876	2,117	910	1,008	192	290	18264	3,978	1826.4	397.8
End Terraced House	79	3	18,983	3,607	2,655	1,142	1,264	240	290	22903	4,989	2290.3	498.9
Semi-Detached House	77	2	18,373	3,491	2,589	1,113	1,136	216	287	22098	4,820	2209.8	482.0
Semi-Detached House	89	3	21,236	4,035	2,992	1,287	1,314	250	287	25542	5,571	2554.2	557.1
Semi-Detached House	102	4	24,338	4,624	3,429	1,475	1,505	286	287	29272	6,385	2927.2	638.5
Detached House	90	2	24,412	4,638	3,091	1,329	1,199	228	319	28702	6,195	2870.2	619.
Detached House	104	3	28,209	5,360	3,572	1,536	1,386	263	319	33167	7,159	3316.7	715.9
Detached House	120	4	32,549	6,184	4,121	1,772	1,599	304	319	38269	8,260	3826.9	826.0

This data is for new build dwellings built to Building Regulations 2006

Energy consumption includes Space and Water heating, Cooking, Lighting and Appliances. Energy use modelled using BREDEM-12 and assumes stock average dwelling characteristics, standard heating pattern and occupancy.

Grey shading indicates base case dwelling.

Assume a carbon conversion factor of:-

Gas 0.1
9 kgCO_2/kWh

Electricity 0.4
3 kgCO_2/kWh

Source:- *Guidelines for company reporting on greenhouse gas emissions, Defra*

BRE on behalf of EST 21/02/2006

Appendix F. Extracts from Studies of Regional and Sub-Regional capacity

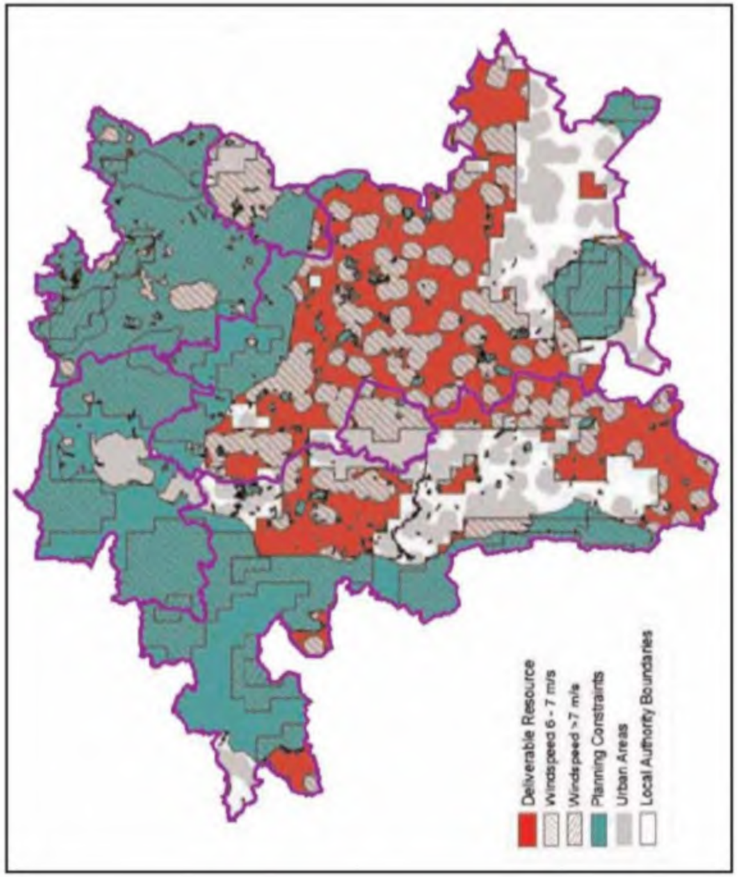
THEORETICAL, ECONOMIC AND DELIVERABLE RESOURCE IN HEREFORDSHIRE AND WORCESTERSHIRE

Technology		Theoretical Resource (GWh)	Economic Resource (GWh)	Deliverable Resource (GWh)	Deliverable Resource (MW)	Current Generation (GWh)	Planned Installed Capacity (Inc. NFFO contracts & DTI Field Trial) (GWh)	New Generation (GWh)
Wind	Large - Potential	67,976	46,704	15,591	7,119			
	Large- Probable	67,976	3,896	1,054	401			1,054
	Small	~	~	~	~			~
Biomass	Energy Crops	521	22	22	3			22
	Agricultural	104	6	6	1		2	4
	Forestry	38	17	17	2			17
	Wastes	463	106	51	7		108	-57
	Sewage Gas	14	2	2	0			2
	Landfill Gas	124	90	90	11	28	8	54
Solar	Photovoltaic	318	~	2	2	0		2
Hydro	Micro/Small	3	2	2	0		1	1
Total		**69,562**	**4,140**	**1,246**	**427**	**28**	**119**	**1,099**
1998 Consumption (population based)		3,458	3,458	3,458				
2010 Consumption (estimated)		3,973	3,973	3,973				
Resource as a % of 1998 Consumption		2011%	120%	36%				
Resource as a % of 2010 Consumption		1751%	104%	31%				

Symbol "~" Negligible (less than half of the final digit shown)
The Total row only includes the wind resource that is "probable"

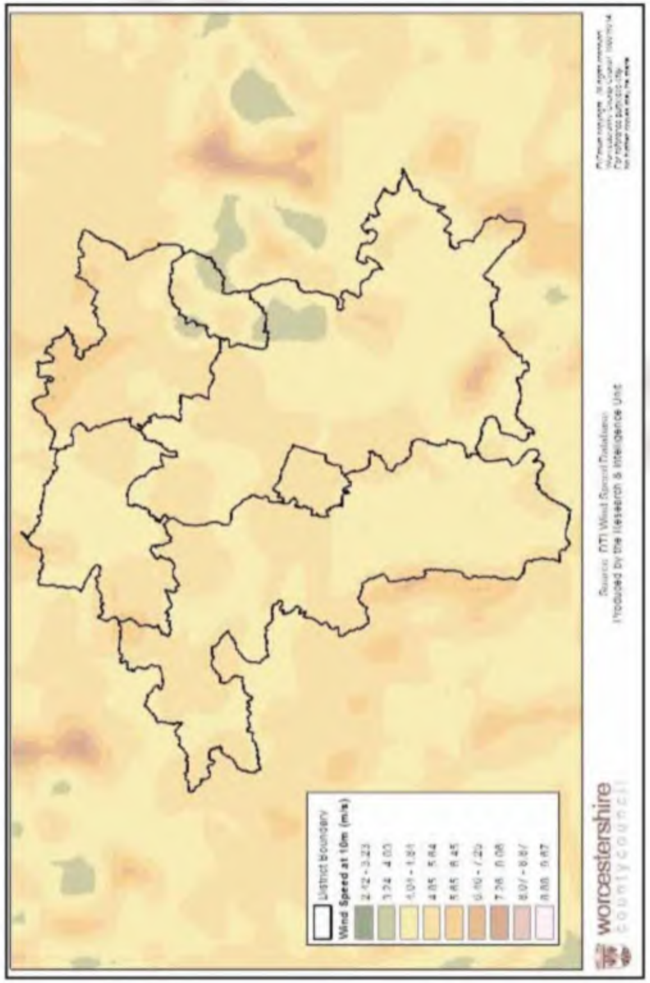
Adapted from Table 7.5, 'Theoretical, Economic and Deliverable Resource in Herefordshire and Worcestershire', in 'Renewable Energy Prospects in the West Midlands'.

MAP OF DELIVERABLE WIND RESOURCE IN WORCESTERSHIRE

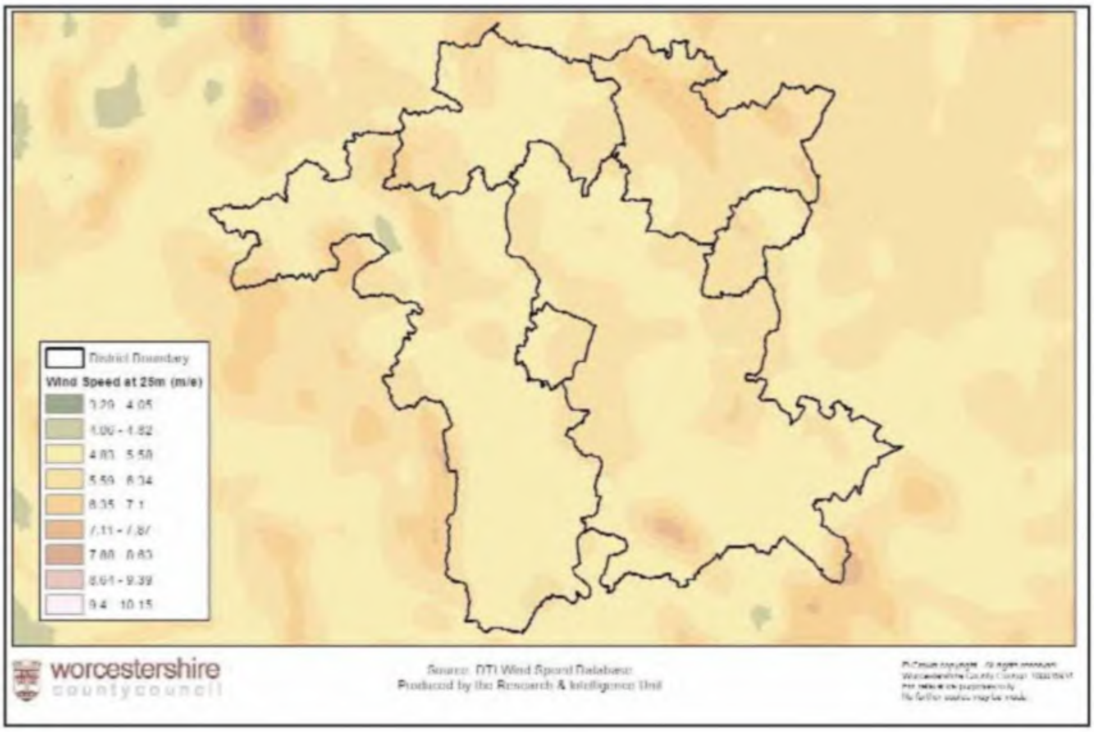


Adapted from Figure D.9, 'Deliverable Wind Resource in Hereford and Worcestershire', in 'Renewable Energy Prospects in the West Midlands'.

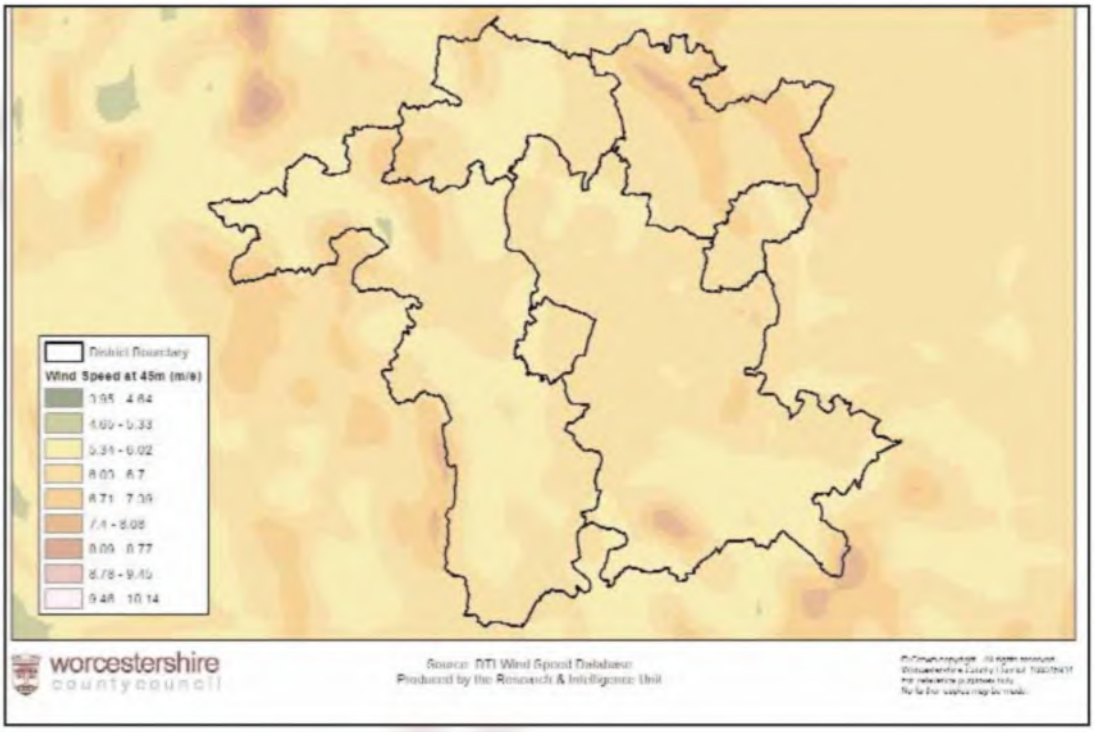
WORCESTERSHIRE WIND SPEED AT 10m ABOVE GROUND LEVEL



WORCESTERSHIRE WIND SPEED AT 25m ABOVE GROUND LEVEL



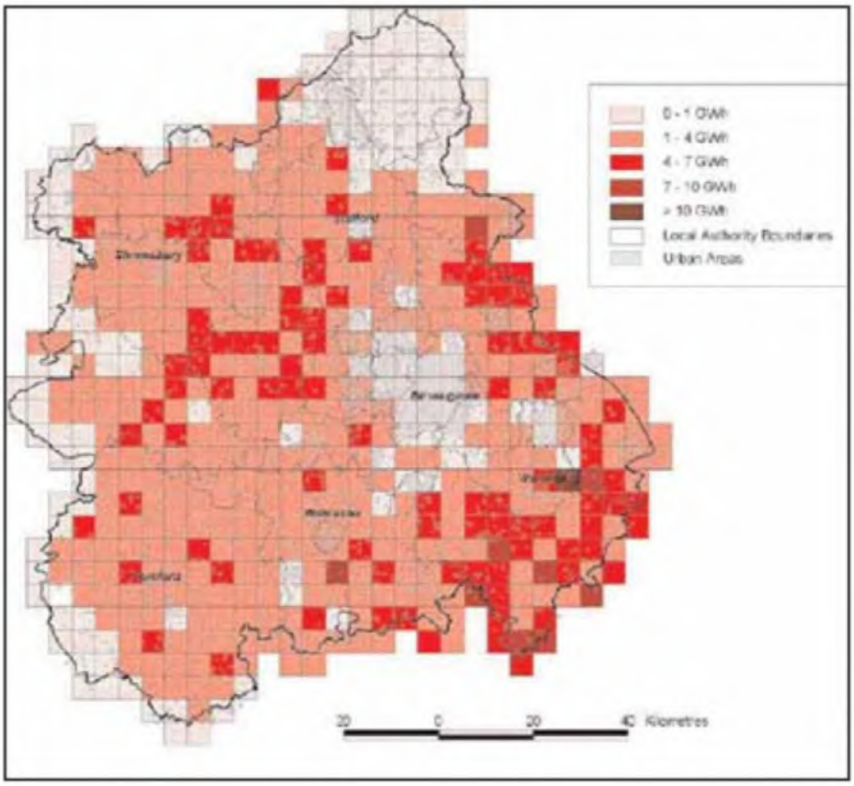
WORCESTERSHIRE WIND SPEED AT 45m ABOVE GROUND LEVEL



SOLAR IRRADIANCE AT DIFFERENT LOCATIONS WITHIN WORCESTERSHIRE	
Town/City	**Solar Irradiance (KWH/Year)**
Kidderminster	859
Bromsgrove	860
Redditch	861
Evesham	863
Worcester	864
Great Malvern	872
For comparison	
Glasgow	787
Manchester	843
Birmingham	855
London	878

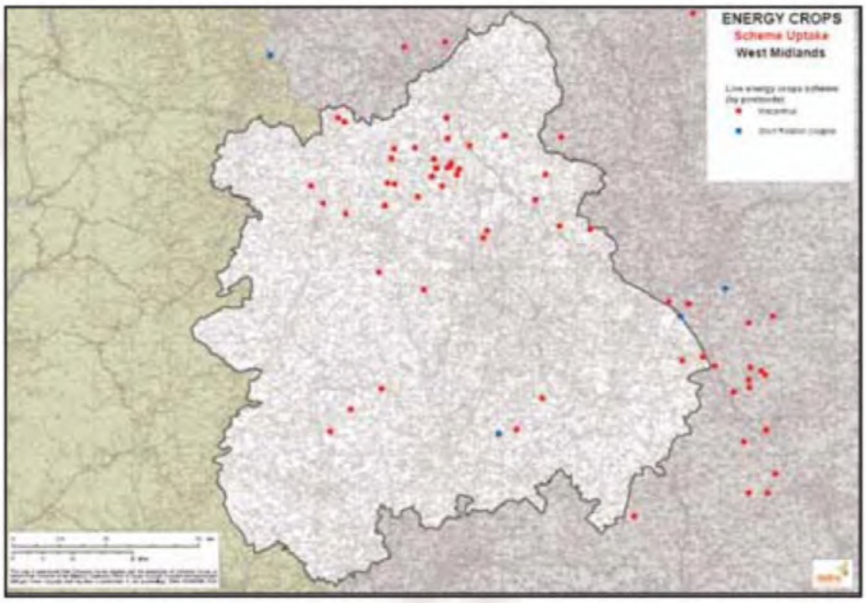
Source: *European Commission Joint Research Centre, 2007, data available at: http://re.jrc.ec.europa.eu/pvgis/apps/pvest.php?lang=en&map=europe*

MAP OF POTENTIAL GENERATION FROM ENERGY CROPS IN THE WEST MIDLANDS



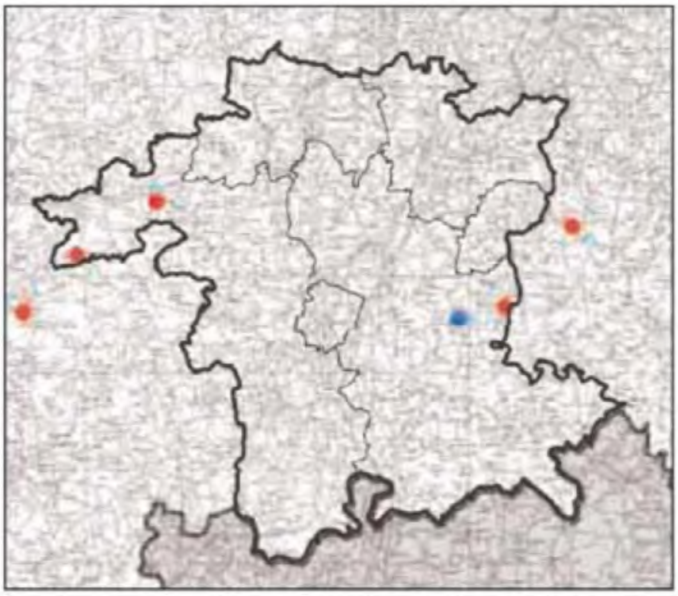
Adapted from Figure A2: 'Potential Generation from Energy Crops', from 'Renewable energy Prospects in the West Midlands'

MAP OF UPTAKE OF ENERGY CROP SCHEMES IN THE WEST MIDLANDS



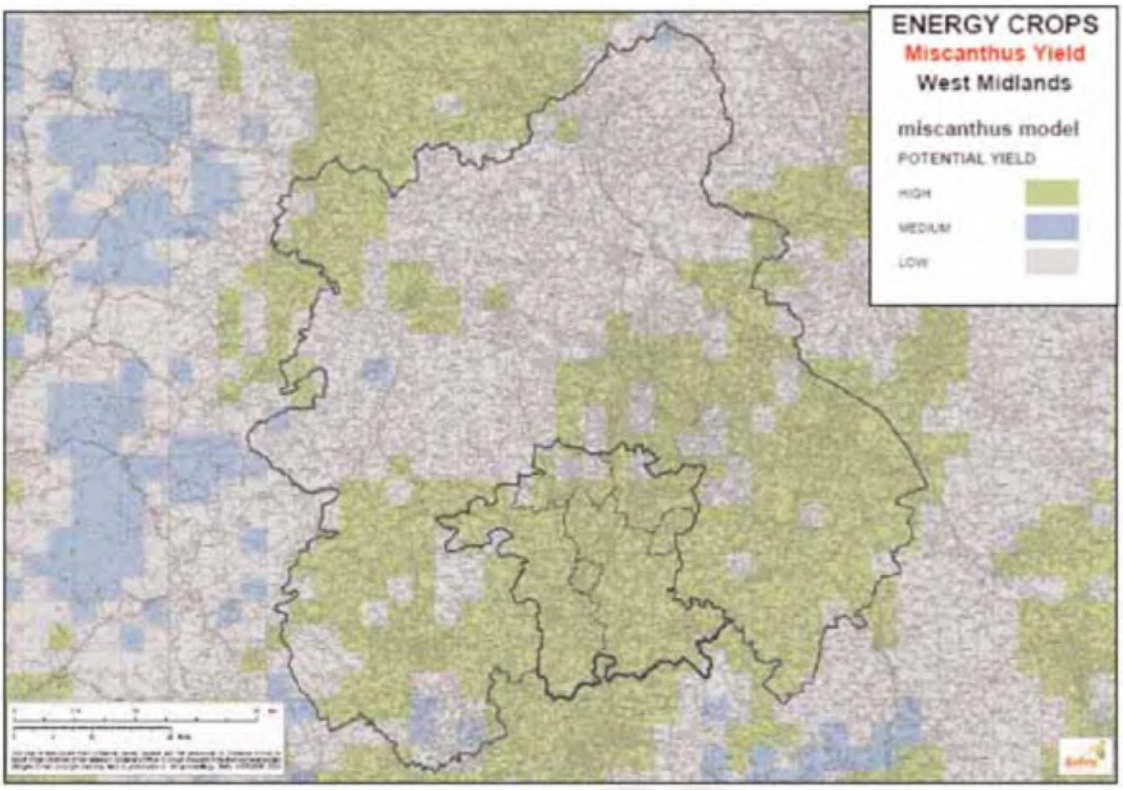
Taken from 'West Midlands Joint Character Areas' DEFRA, 2007

MAP OF UPTAKE OF ENERGY CROP SCHEMES IN THE WEST MIDLANDS - WORCESTERSHIRE EXTRACT OF ABOVE MAP



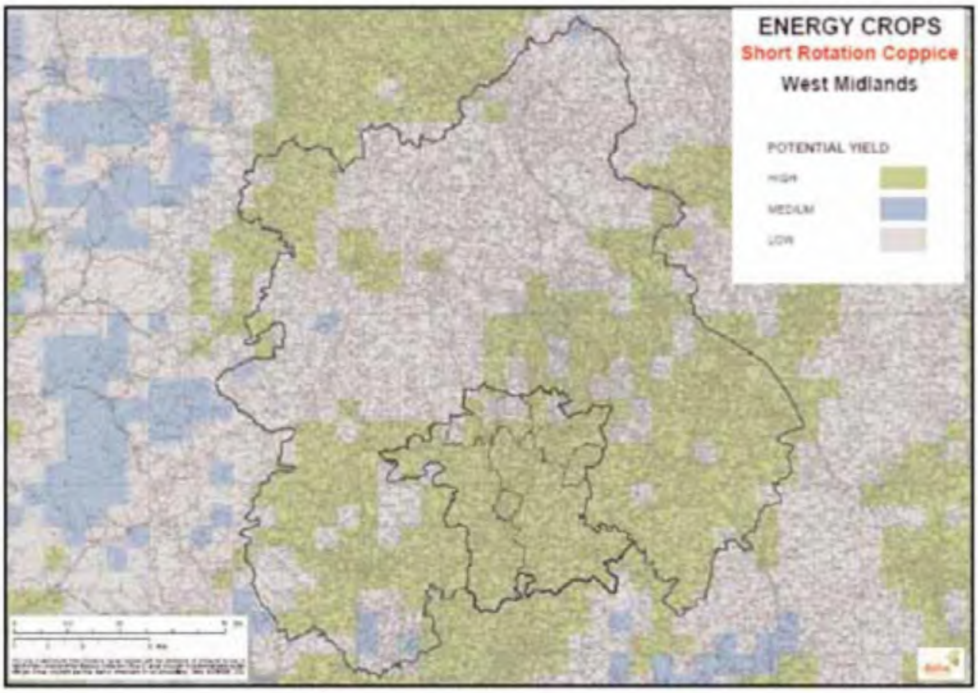
Taken from 'West Midlands Joint Character Areas' DEFRA, 2007

MAP OF POTENTIAL YEILD FROM MISCANTHUS CROPS IN THE WEST MIDLANDS ILLUSTRATING HIGH POTENTIAL YEILD ACROSS MOST OF WORCESTERSHIRE



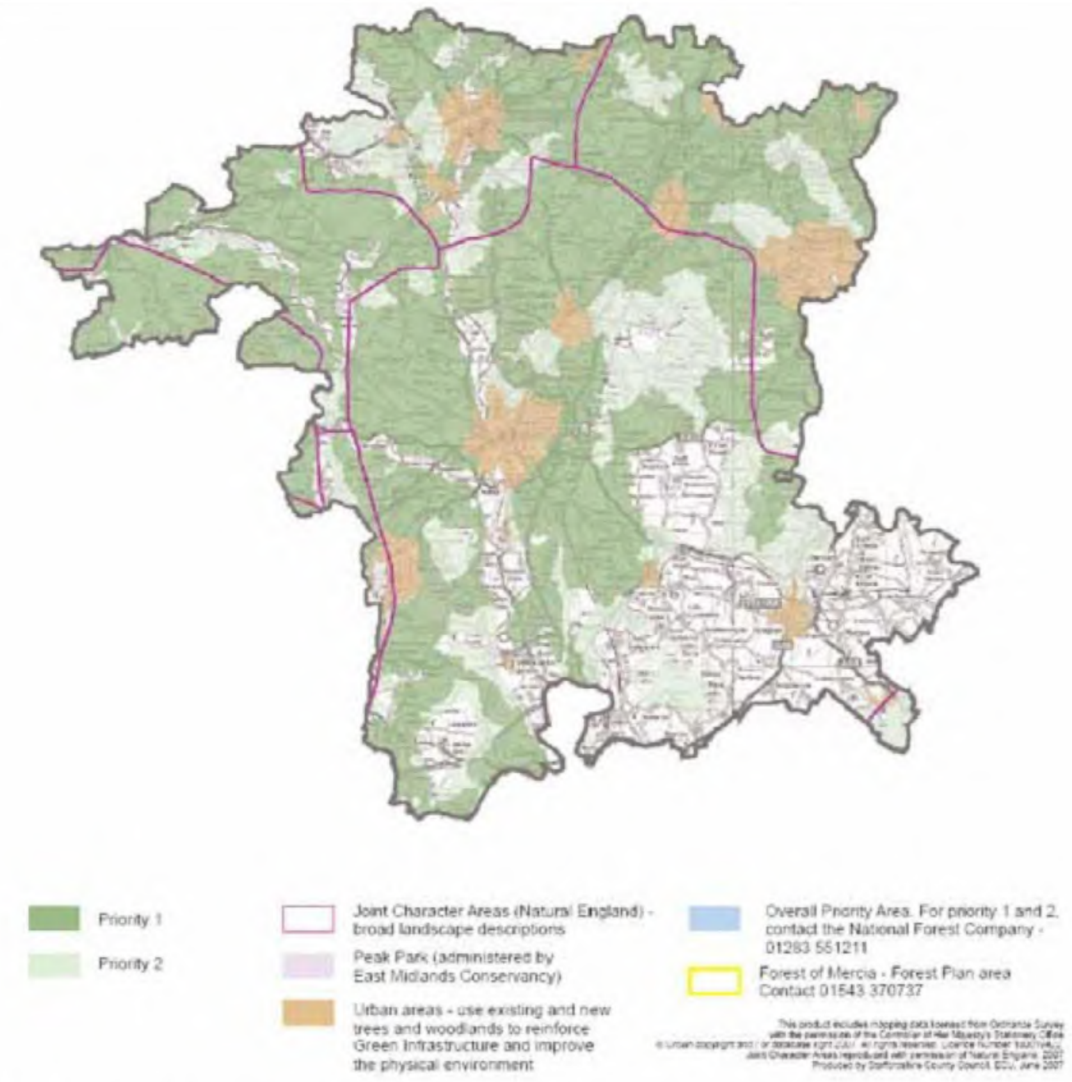
Taken from DEFRA, 2007

MAP OF POTENTIAL YEILD FROM SHORT ROTATION COPPICE IN THE WEST MIDLANDS ILLUSTRATING HIGH POTENTIAL YEILD ACROSS WORCESTERSHIRE



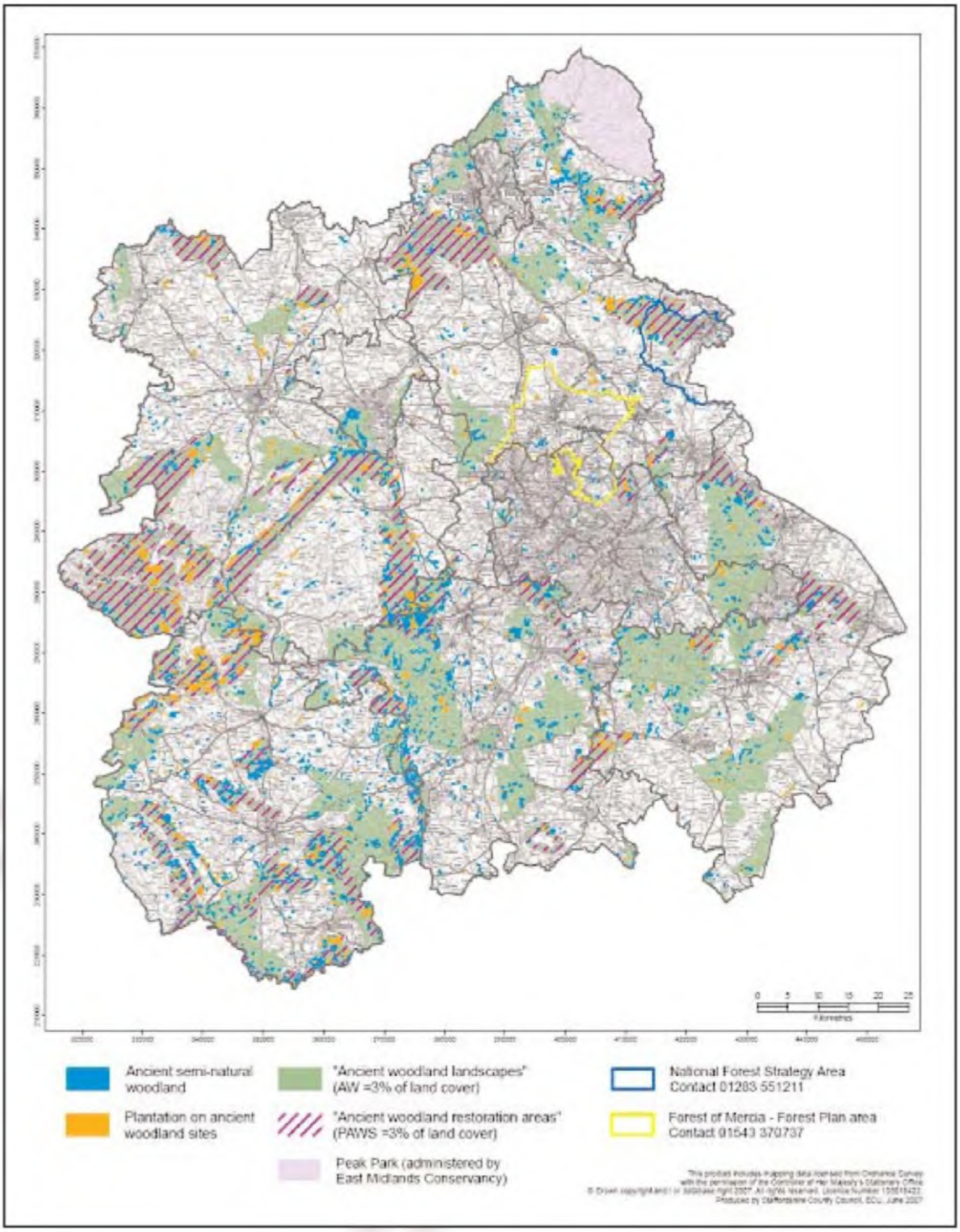
Taken from DEFRA, 2007

FORESTRY COMMISSION WOODLAND OPPORTUNITIES MAP: PRIORITY FOR WOODLAND PLANTING BASED ON DATA FROM THEMES: LANDSCAPE, BIODIVERSITY, CULTURAL, HERITAGE AND ACCESS

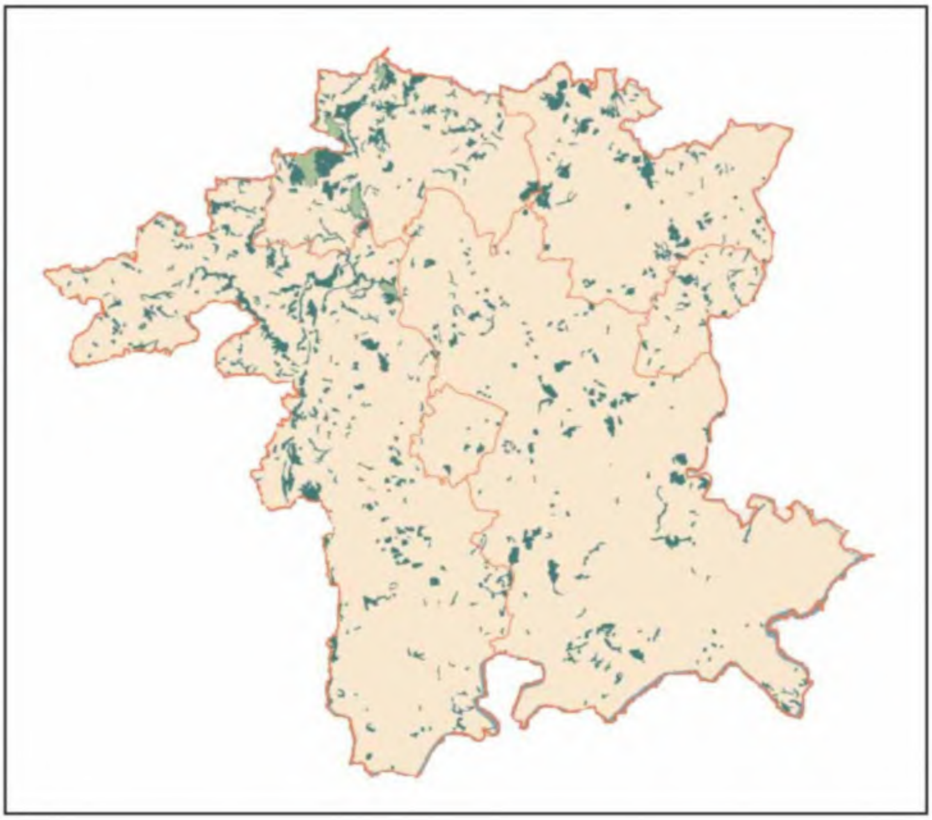


Taken from Forestry Commission's West Midlands Woodland Opportunities Map, Version 2, June 2007, available at http://www.forestry.gov.uk/pdf/westmids-wom-priority-march2007.pdf/$FILE/westmids-wom-priority-march2007.pdf?bcsi_scan_A6AF5382CFDFA77B=mTWmLQFEmBfEe9gPfKuUogUAAAAnqt0B&bcsi_scan_filename=westmids-wom-priority-march2007.pdf

FORESTRY COMMISSION ANCIENT WOODLAND RESTORATION MAP



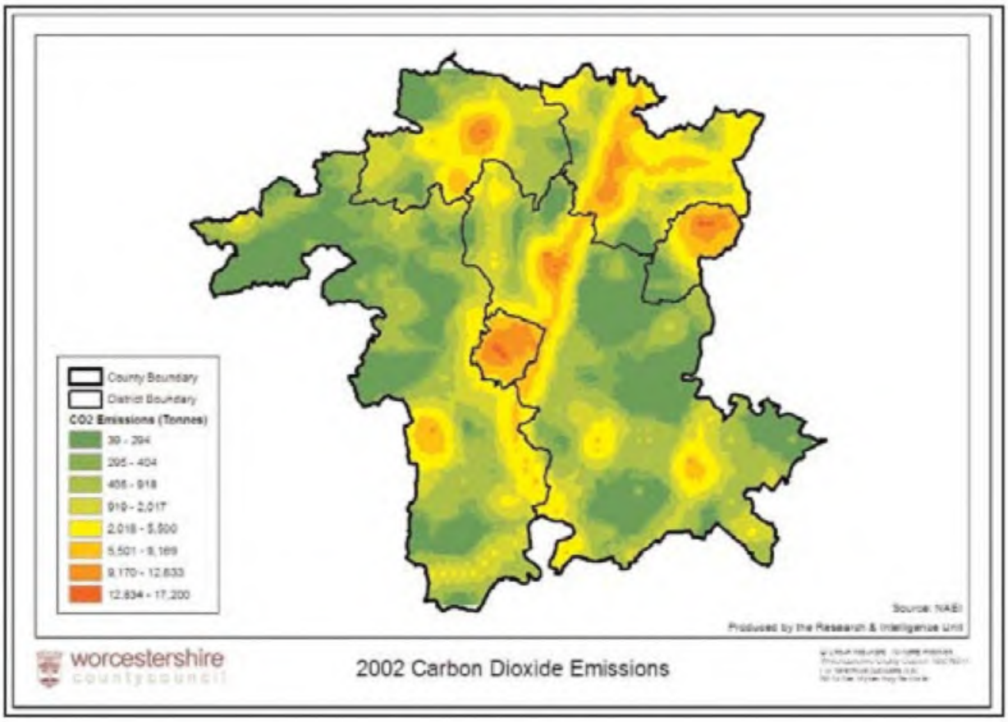
DISTRIBUTION OF WOODLAND OF OVER 2 HECTARES IN WORCESTERSHIRE, BY OWNERSHIP



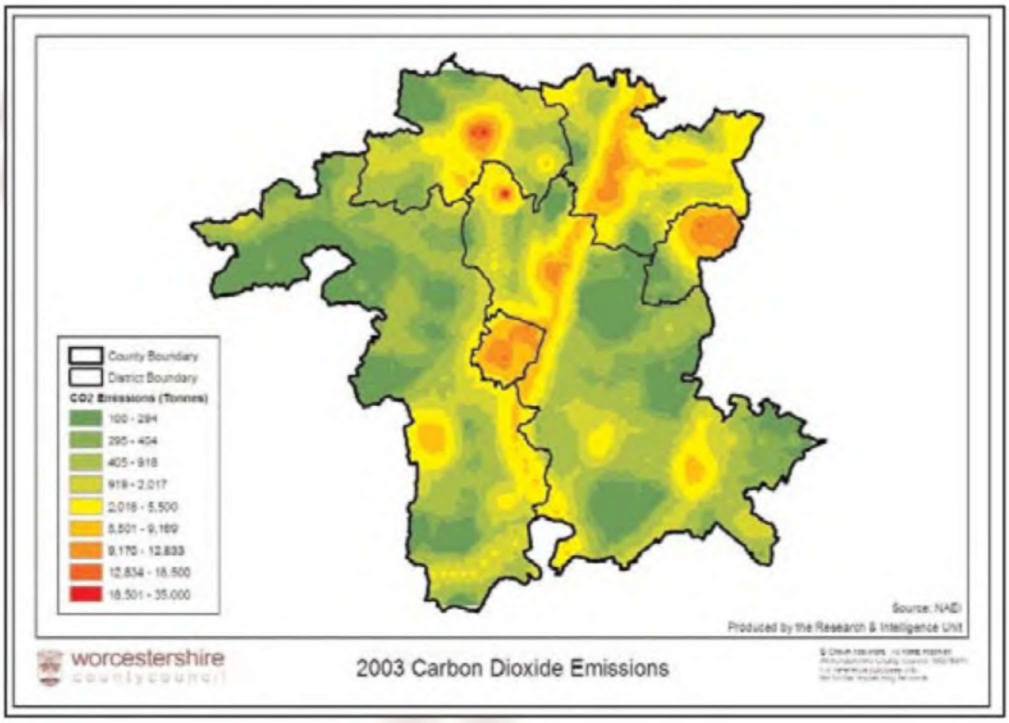
Source: *Adapted from Forestry Commission National Inventory of Woodland and Trees - County Report for Hereford & Worcester (2002)*

Appendix G. CO_2 Emmissions data and mapping and energy consumption data

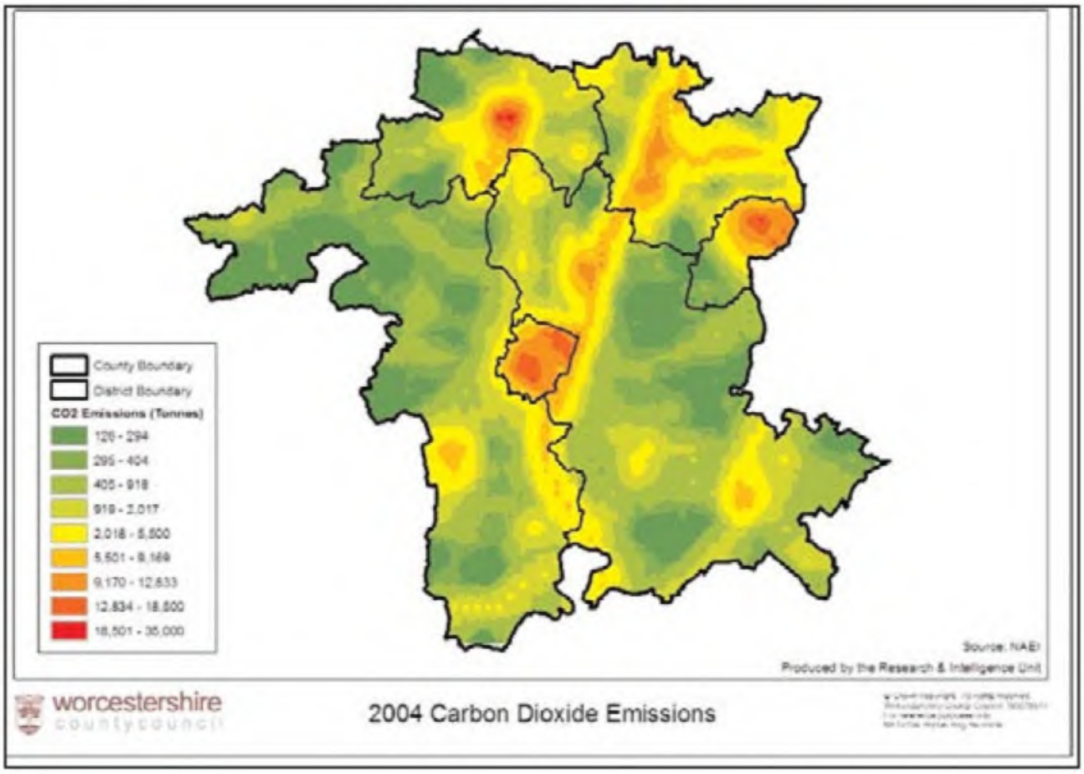
CO_2 EMMISSIONS IN WORCESTERSHIRE IN 2002 (ALL SECTORS)



CO_2 EMMISSIONS IN WORCESTERSHIRE IN 2003 (ALL SECTORS)



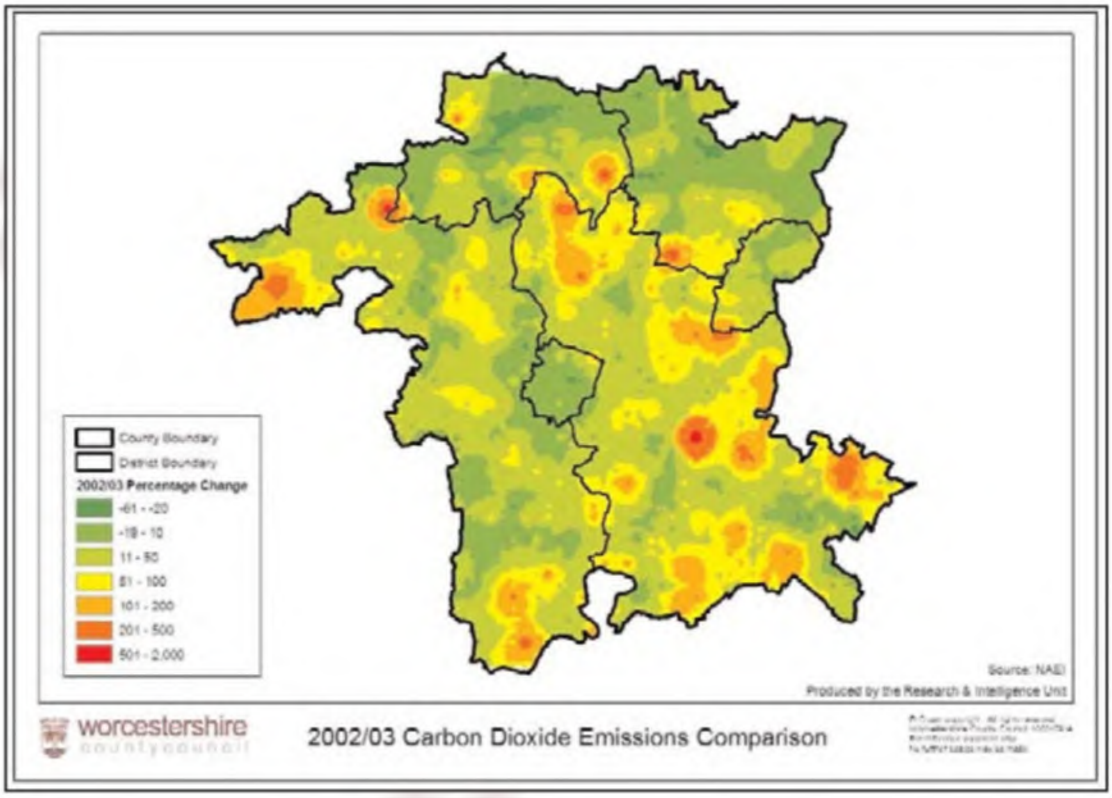
CO_2 EMMISSIONS IN WORCESTERSHIRE IN 2004 (ALL SECTORS)



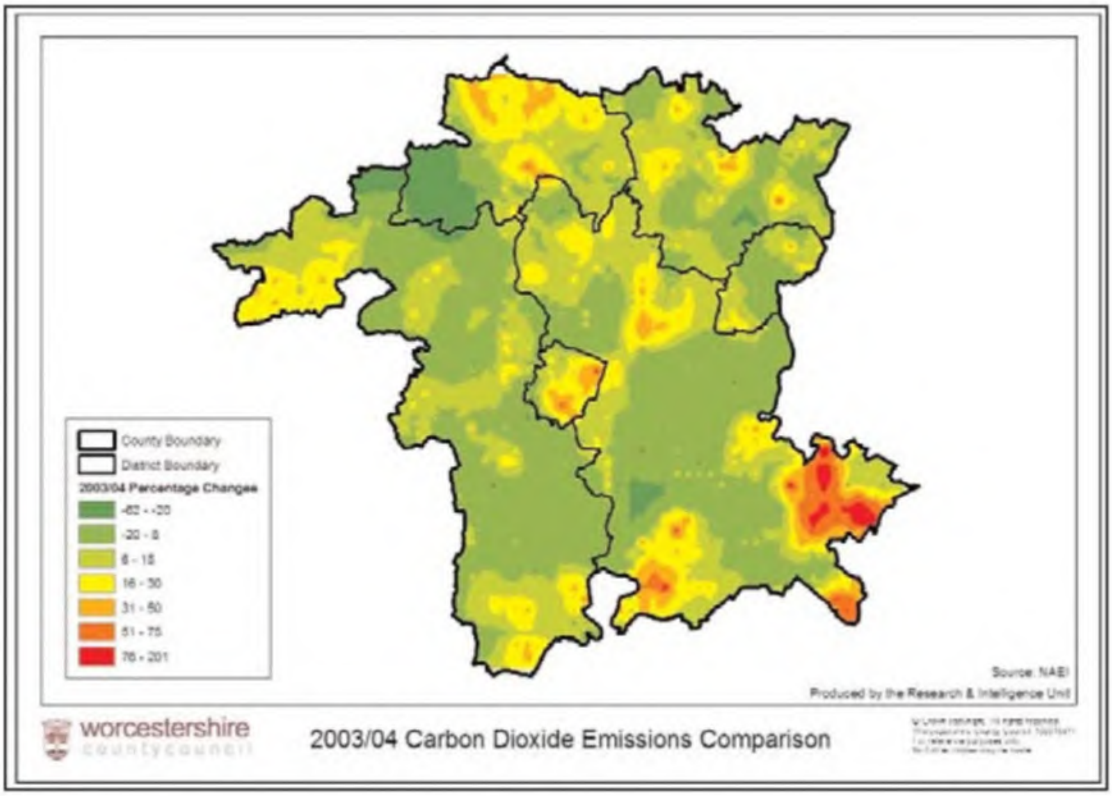
LOCATIONS OF THE 5 HIGHEST EMITTING SITES OF CO_2 IN WORCESTERSHIRE

THE 5 MOST SIGNIFICANT INCREASES AND 5 MOST SIGNIFICANT REDUCTIONS OF CO_2 EMISSIONS IN WORCESTERSHIRE BETWEEN 2002 AND 2003

CHANGE IN CO_2 EMISSIONS IN WORCESTERSHIRE BETWEEN 2002 AND 2003 (ALL SECTORS)



CHANGE IN CO_2 EMISSIONS IN WORCESTERSHIRE BETWEEN 2003 AND 2004 (ALL SECTORS)



END USER LOCAL AND REGIONAL ESTIMATES OF CO_2 EMISSIONS, 2006, DEFRA

Local Authority Area	CO_2 Emissions, (KT CO_2) 2006					
	Domestic	Industrial & Commercial	Road Transport	Land-Use Change	Total	Domestic per capita CO_2 (tonnes)
Bromsgrove District	251	161	528	9	949	2.7
Malvern Hills District	196	171	356	22	745	2.7
Redditch Borough	189	351	87	2	628	2.4
Worcester City	244	252	116	2	613	2.6
Wychavon District	308	512	582	28	1429	2.6
Wyre Forest District	244	225	145	6	619	2.5
Worcestershire County Total	**1432**	**1672**	**1814**	**69**	**4983**	**2.6**

http://www.defra.gov.uk/environment/statistics/globatmos/download/regionalrpt/local-regionalco2emissions05-06.xls

TOTAL FINAL ENERGY CONSUMPTION AT LOCAL AUTHORITY LEVEL, 2006, IN GWh

	Coal			Manufactured Fuels			Petroleum Products					Natural Gas			Electricity			Renewables & Waste	Total	Consuming Sector		
	Industry & Commercial	Domestic	**Total**	Industry	Domestic	**Total**	Industry & Commercial	Domestic	Road Transport	Rail	**Total**	Industry & Commercial	Domestic	**Total**	Industry & Commercial	Domestic	**Total**	Total		Industry & Commercial	Domestic	Transport
Bromsgrove	6.1	7.7	**13.8**	0.0	0.5	**0.5**	109.8	38.2	1891.6	24.1	**2063.6**	193.3	720.5	**913.8**	158.2	191.4	**349.6**	**6.0**	**3346.3**	472.4	958.3	1915.7
Malvern Hills	15.4	17.8	**33.3**	0.0	1.1	**1.1**	217.6	102.4	1276.6	8.2	**1604.7**	114.6	363.0	**477.6**	150.4	172.0	**322.4**	**12.0**	**2451.1**	510.1	656.3	1264.8
Redditch	73.9	3.8	**77.8**	5.5	0.2	**5.8**	431.4	13.0	314.4	0.0	**758.8**	262.4	559.7	**822.1**	280.6	147.8	**428.4**	**14.4**	**2107.2**	1068.3	724.4	314.4
Worcester	1.8	0.3	**2.2**	5.6	74.2	**79.9**	95.2	20.3	418.1	4.9	**538.5**	266.0	621.5	**887.4**	309.8	178.4	**488.2**	**3.2**	**1999.3**	681.6	894.8	422.9
Wychavon	33.2	23.1	**56.3**	5.5	11.6	**17.0**	369.6	130.3	2086.5	71.9	**2658.4**	690.0	628.3	**1318.3**	453.2	263.3	**716.5**	**18.0**	**4784.6**	1569.6	1056.6	2158.4
Wyre Forest	2.2	8.0	**10.2**	0.4	6.2	**6.5**	138.0	39.3	526.2	2.4	**706.0**	234.1	657.7	**891.8**	259.1	195.2	**454.3**	**5.3**	**2074.1**	639.2	906.3	528.7
County Total (rounded)	**133**	**61**	**194**	**17**	**94**	**111**	**1362**	**344**	**6513**	**112**	**8331**	**1760**	**3551**	**5311**	**1611**	**1148**	**2759**	**58**	**16,764**	**4941**	**5197**	**6625**

Figures may not total due to rounding. Source: adapted from DBERR table, http://www.berr.gov.uk/files/file48643.xls

DWELLING TYPE *	NO. OF NEW DWELLINGS 2011-2026†	TOTAL CO_2 EMISSIONS 2011-2026	TARGET 10% CO_2 SAVINGS 2011-2026	EQUIVALENT RENEWABLE ENERGY CAPACITY PER DWELLING (KWH)	
1 bed flat	196	446,488	44,649	1013.8	
2 bed flat	294	1,002,627	100,263	1472.5	
3 bed flat	5	24,135	2,414	2148.3	
2 bed house (average)	392	1,794,576	179,458	2097	
3 bed house (average)	280	1,531,880	153,188	2505	
4 bed house (average)	266	1,947,918	194,792	3377	
Total CO_2 Emissions Savings 2011-2026			**674,764**	**Average Capacity per dwelling**	**2,138 kWh**

†The numbers for each dwelling type have been assumed from the proportions from past trends (2005/06 figures) taken forward to the allocations in the draft RSS revision Option 1.

* EST break down emissions data into 4 house types (mid-terraced; end-terraced; semi-detached; and detached). The average figures have been calculated from each of these to arrive at a general figure for each district house type.

n.b. EST do not provide data for 1-bed houses. For the purposes of this table, the nine 1-bed houses calculated to be built between 2011-2026 have been apportioned to the 2-bed flat category.

Appendix H. Sources of Further Information and Grant Assistance

There are a variety of national and local bodies providing renewable energy advice and services to householders, businesses, and the public sector. The following selection is not exhaustive, but represents some of the relevant contacts for Worcestershire.

The Energy Saving Trust provides a national source of advice for householders on most aspects of day-to-day energy saving.

21 Dartmouth Street, London SW1H 9BP

Tel: 020 7222 0101
Fax: 020 7654 2460
Web: www.energysavingtrust.org.uk

The Carbon Trust is the equivalent organisation for public, not for profit and private sector organisations.

The Carbon Trust, 8th Floor, 3 Clement's Inn, London WC2A 2AZ

Tel: 0800 085 2005
Fax: 020 7170 7020
Email: customercentre@carbontrust.co.uk
Web: www.carbontrust.co.uk

Energy West Midlands is the regional energy agency responsible for producing the Regional Energy Strategy.

Energy West Midlands, Regional Partnership Centre, 3rd Floor, Albert House, Quay Place, 92-93 Edward Street, Birmingham B1 2RA

Tel: 0121 245 0200
Fax: 0121 245 0201
Email: a.smith@wmra.gov.uk
Web: www.energywm.org.uk

The Marches Energy Agency seeks to promote energy efficiency, renewable energy and sustainability throughout Shropshire, Worcestershire and Herefordshire.

Marches Energy Agency, 23 Swan Hill, Shrewsbury SY1 1NN

Tel: 01743 246007
Email: info@mea.org.uk
Web: www.mea.org.uk

Act on Energy provides advice on energy conservation for householders and small businesses in Warwickshire, Worcestershire and Coventry.

Act on Energy, 29 Wellesbourne House, Walton Road, Wellesbourne, Warwickshire CV35 9JB

Tel: 01789 842898
Fax: 01789 842963
Email: advice@actonenergy.org.uk
Web: www.actonenergy.org.uk

Worcestershire County Council's Green Directory

Sustainability Team, Worcestershire County Council, County Hall, Worcester WR5 2NP

Tel: 01905 766855
Email:
sustainability@worcestershire.gov.uk
Web:
http://worcestershire.whub.org.uk/home/wcc-sustainability-directory-welcome.htm

Grant Assistance

It is recognised that the capital costs associated with renewable energy installations can be high for both private householders and larger-scale operators. In certain circumstances, grant assistance and specialist low-cost or interest-free loans can help to overcome this.For householders, the Energy Saving Trust offers an interactive search tool to find potential sources of grant-aid. This can be accessed on its website, at:
http://www.energysavingtrust.org.uk/proxy/view/full/2019/grantsandofferssearch

Other, more specific grants may be available for activities connected to renewables, for example for farmers/ landowners growing energy crops. Whilst some grant aid is delivered on a long-term basis, other grants may be one-offs or time limited, or may be on a 'first come, first serve' basis until funds are exhausted. It is worth investigating what kind(s) of grant may be available, by contacting the organisations listed above, and by looking to central government departments concerned with renewable energy:

http://www.defra.gov.uk **http://www.berr.gov.uk**

European funding from the Rural Development Programme for England (RDPE) is administered through the regional development agency, Advantage West Midlands. The RDPE includes support for 'Environmental Technologies', which can offer financial assistance to qualifying renewable energy projects in rural areas.

Further Reading

The Assessment and Rating of Noise from Wind Farms - Report to DTI (September 1996)

The Community Strategy for Worcester 2007-2012, Worcester Alliance

A Community Strategy for the Wyre Forest District 2004-2014, The Wyre Forest Matters Partnership (February 2004)

A New Look at the Landscapes of Worcestershire - Worcestershire Landscape Character Assessment, Environmental Policy Team, Worcestershire County Council (2004)

Assessment and development of fuelwood uses for products from SSSI and ancient woodland conservation management at Wyre Forest, Worcestershire/Shropshire -English Nature Research Reports, No 711, Heartwoods Ltd in conjunction with Marches Wood Energy Network Ltd & Forestry Commission Research Agency (September 2006)

Bromsgrove Sustainable Community Strategy 2007 - 2010, Bromsgrove Partnership

Changes to Permitted Development Consultation Paper 1: Permitted Development Rights for Householder Microgeneration, DCLG (April 2007)

Draft Climate Change Bill, HM Government (March 2007)

Code for Sustainable Homes - A step-change in sustainable home building practice, DCLG (December 2006)

Cotswolds Area of Outstanding Natural Beauty Management Plan, Cotswold AONB Partnership (2004)

Creating Value from Renewable Materials - A strategy for non-food crops and uses, Two Year Progress Report, Defra (November 2006)

Design Quality Supplementary Planning Guidance, Wyre Forest District Council (July 2004)

Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market (September 2001)

Domestic Installation of Microgeneration Equipment Final Report - Review of the related Permitted Development Regulations, DCLG (April 2007)

Energy Act 2004, The Stationery Office (2004)

Energy Measures Report, DBERR (September 2007)

Energy White Paper - Our Energy Future - Creating a Low Carbon Economy, Department of Trade and Industry (2003)

The Government's Response to the Biomass Task Force Report, DTI/DEFRA (April 2006)

Growing our Future - The West Midlands Regional Forestry Framework, Forestry Commission (October 2004)

Grow with Wyre - Wyre Forest Landscape Partnership Application to Heritage Lottery Fund for a Stage 1 Grant (30th September 2006)

Heat Mapping and Decentralised Energy Feasibility Study Phase 1: Data Gathering and Mapping - Halcrow Group Ltd for Advantage West Midlands (April 2008).

Integrating renewable energy into new developments: Toolkit for planners, developers and consultants, London Renewables/Greater London Authority (September 2004)

The Malvern Hills Area of Outstanding Beauty Management Plan 2004-2009, Malvern Hills AONB Joint Advisory Committee (2004)

Meeting the Energy Challenge - A White Paper on Energy, Department of Trade and Industry (May 2007)

Microgeneration in the Historic Environment, English Heritage (2008)

NHBC Guide to Renewable Energy (May 2007) National House-Building Council

Our Energy Challenge - Power from the people - Microgeneration Strategy, DTI (March 2006)

Partnership Towards Excellence - The Sustainable Community Strategy for Worcestershire, Second Edition 2008 - 2013, The Worcestershire Partnership (2008)

Planning Policy Guidance Note 2: Green Belts, DCLG (January 1995)

Planning Policy Statement: Planning and Climate Change - Supplement to Planning Policy Statement 1, DCLG (December 2007)

Planning Policy Statement 9: Biodiversity and Geological Conservation, DCLG (August 2005)

Planning Policy Statement 22: Renewable Energy, DCLG (August 2004)

Preliminary Position Statement on Miscanthus Planting, Cotswolds Conservation Board (September 2006)

Borough of Redditch Community Strategy, Redditch Partnership (April 2003)

Renewable Energy: Practicalities - Volume I: Report, House of Lords Science and Technology Committee (July 2004)

Renewable Energy and Climate Change in Worcestershire, Marches Energy Agency (2004)

Renewable Energy and Its Impact on Rural Development and Sustainability in the UK, ADAS Consulting Ltd/University of Newcastle (2003)

Renewable Energy Prospects for the West Midlands - Final Report, Halcrow Group Ltd for Government Office for the West Midlands (November 2001)

Report to Cotswolds Conservation Board on Renewable Energy in the Cotswolds AONB, Severn Wye Energy Agency (2006)

Report to English Nature & Heartwoods on the Potential for Wood Energy Associated with the Wyre Forest, Marches Wood Energy Network Limited (6 February 2006)

Rural Regeneration Zone Annual Report 2005-06, Advantage West Midlands (June 2006)

The Stern Report on the Economics of Climate Change, HM Treasury (October 2006)

Shaping the future together - Draft Wychavon Community Strategy 2007 - 2010, Wychavon Community Plan Core Group (May 2007)

Statement on Criteria for Renewable Energy Projects, Cotswolds Conservation Board

A strategy for non-food crops and uses - Creating value from renewable materials, Defra (November 2004)

Sustainable Community Strategy for the Malvern Hills District 2006-2021 - Draft for Consultation, Vision 21

UK Biomass Strategy, Defra (May 2007)

UK Energy Sector Indicators 2007 - A supplement to the Fourth Annual Report on progress towards the 2003 Energy White Paper goals, DTI (June 2007)

Using the 'Merton Rule' Report of a TCPA survey of local authority planning departments in England, Town and Country Planning Association (July 2006)

Wind Power in the UK - A guide to the key issues surrounding onshore wind power development in the UK, Sustainable Development Commission (May 2005)

West Midlands Non-Food Crops Opportunities/Mapping Study Draft final report, Commissioned by Advantage West Midlands (July 2007)

West Midlands Regional Energy Strategy, West Midlands Partnership Steering Group and Working Groups (November 2004)

West Midlands Regional Energy Strategy Monitoring Report, West Midlands Regional Observatory (April 2006)

West Midlands Regional Spatial Strategy, Government Office for the West Midlands (June 2004)

The West Midlands Regional Urban Wind Capacity Study (June 2004) TNEI/GOWM/AWM

West Midlands Wood Energy Strategy Review 2006, WM Woodland & Forestry Forum Wood Energy Task Group

Wind Energy and the Historic Environment, English Heritage (October 2005)

Wood for Energy - Energising the West Midlands for the 21st Century, Forestry Commission

Worcestershire Climate Change Strategy, Worcestershire Climate Change Group (October 2004)

Worcestershire County Structure Plan 1996-2011, Worcestershire County Council (June 2001)

The Worcestershire Local Area Agreement 2006-2009, The Worcestershire Partnership (April 2006)

Worcestershire Local Transport Plan 2, 2006-11 (March 2006), Worcestershire County Council

List of Consultees

The following bodies have been consulted as part of the development of this research paper.

Advantage West Midlands

AF Hill & Son

Bioenergy WM

Biomass Energy Centre

British Hydropower Association

British Wind Energy Association

Bromsgrove LPA

Chris Day Associates

Cotswolds AONB

Countrywide Farmers

EON UK

Energy West Midlands

Evesham College

H&W Chamber of Commerce

Heartwoods

Home Builders Federation

Malvern Hills AONB

Malvern Hills LPA

Malvern Hills Vision 21

Marches Energy Agency

National Energy Foundation

NFU West Midlands

National Trust

NISP

Redditch LPA

Rural Hub

Wood Energy Task Group

WCC Property Services

Worcester Bosch

Worcester LPA

Worcestershire Biodiversity Partnership

Wychavon LPA

Wyre Forest LPA

Worcestershire Young Farmers

In addition, this draft has been circulated among the **Worcestershire Partnership Environment Group**, membership of which aims to represent key stakeholders with an environmental interest in Worcestershire, including English Heritage, District LSPs, Government Office for the West Midlands, the Environment Agency and Natural England.

This document can be made available in other languages (including British Sign Language) and alternative formats (large print, audio tape, computer disk and Braille) on request from Strategic Planning on telephone number 01905 766097.

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