Critique of

Herefordshire Council
Local Development Framework
Herefordshire Renewable Energy Study

Two 2 MW wind turbines at Dundee Tyre plant

Peter Linnell
February 2011

Acknowledgements.
I am indebted to Ainsleigh Rice for technical comments on the draft and to Ruth Stanier for final proof reading

This is an independent report produced entirely by Peter Linnell. The contents are entirely his work unless otherwise cited and full responsibility for any errors or omissions rests with the writer. This critique is intended as an honest contribution to the local planning discourse in Herefordshire; but the criticism of the SQW Methodology may also be applicable elsewhere.

The authors of the report were invited to comment on this critique in advance of publication, but are barred from so doing by the terms of their contract with HCC.

No funding was received from any source to enable this work. If you or your organisation find it of value please consider making a suitable donation.

Payments can be made by Paypal to
pete@lifespacedesign.co.uk

For contact please use this email address in the first instance.

Contents

Summary

This report was commissioned from Wardell Armstrong by HCC Forward Planning to contribute to the evidence base for the long term planning process. The report relies on a methodology (SQW) considered by national and local government as appropriate for the task.

This critique challenges the report and methodology on the grounds of assumptions which are debatable, and of serious omissions. Additionally some energy technologies which are now recognised as flawed should be excluded from a plan for sustainability.

The application of the method, and the findings from it, to policies for HCC is flawed because it relies on the inadequate evidence, and takes no account of different policy requirements for genuinely sustainable development.

Specific issues with the report;

- The SQW methodology excludes consideration of passive solar design. This is a building design approach which allows structures to capture heat from sunlight, as in a greenhouse, coupled to very high standards of insulation. By excluding this option, an opportunity to save energy and prevent fuel poverty in future is lost.

- Energy use projections for new developments are based on proposed improvements to building regulations which have now been withdrawn by the government.

- The report fails to count road access and grid capacity as constraints on large or medium wind turbines. At least one previous survey found no sites in Herefordshire which pass these tests, so the capacity claimed in this report must be over-estimated. In policy terms this places critical importance on areas which could accommodate this technology.

- Policy suggestions in the report for renewable heat energies in new developments fail to consider the need to apply these resources to existing uses.

- The report fails to consider potential for larger arrays of solar energy systems, limiting itself to roofs at single building scales. In addition it fails to insist on universal deployment of these technologies to all proposed new housing.

- Policy proposals for new non residential buildings to be required to off set as little as 10% of their greenhouse gas emissions allows for very poor design and use in a sector which already uses two thirds of all electricity in the county.

- A proposed Biomass Plan is most welcome, and should begin at once, with a priority for biogas production from waste streams (AD). The next priority must be to ensure that energy resource in burnable fuels should be utilised in combined heat and power plant located to serve socially critical needs.

- The proposed priority of community ownership of local energy resources is most welcome, but there is a lack of capacity to ensure this happens. This capacity needs to be addressed urgently as a contribution to ownership and participation by all members of the community.

1.0 Introduction

The production of a study into the potential for renewable energy deployment in the administrative area of Herefordshire Council (Unitary Authority) is a long overdue contribution to an evidence base for long term development thinking. However, the value of this specific report as evidence may be compromised by flaws in its underlying methodology as well as by too narrow a focus in its conceptual framework. This critique is intended to reveal these flaws by a critical analysis of the body of the report and its underlying methodology. In recognition of the effort and expertise brought to their brief by Wardell Armstrong I must emphasise that this is in no way a criticism of their competence or integrity. They have done an excellent job with a constrained brief and resources and have done good work in policy suggestions to expand the vision for a sustainable and resilient Herefordshire.(Wardell Armstrong 2010)

1.1 Factual Summary

1.1.1
The study was commissioned from Wardell Armstrong by Herefordshire Council Forward Planning Department as a contribution to the evidence base for the Strategic Plan process. At the time this was part of a Regional Spatial Strategy for the West Midlands Region, which has been abandoned by the current government in favour of reliance on district level Local Development Frameworks. The brief quoted recognises possible changes in policy but goes on to consider linkage to long term climate change mediation and energy policies as validation of the need for the report.

1.1.2
The report relies on the nationally recognised SQW **Renewable and Low-Carbon Energy Capacity methodology for the English regions.** (SQW 2009) In recognition of the special opportunities and obstacles relevant to the county a number of tweaks were applied, in biomass and mid scale wind. (Personal communication, WA staff member, Sept 2010) Data are presented in the body in tables and in appendices in the form of a series of maps indicating modelled existing loads and proposed areas (*not* specific sites) of renewable resource.

1.1.3
The data gathered on existing energy loads relies on a range of assumptions clearly flagged as such with supporting arguments. The brief makes specific reference to a requirement for a "Merton Rules" approach to new housing developments (Merton 2003), which would have a radical impact on selection of appropriate deployments of available renewable resources. Arguments for a series of policy proposals are based on the assumptions of inherent validity in the data and the underlying methodology. In addition policy proposals are offered in two scenarios: pioneering and pragmatic. No account is taken of other sustainable development paradigms.

1.1.4
The attempted emphasis on opportunities for community ownership of energy resources is most warmly welcomed.

1.2 Contextualisation

1.2.1
As the study is derived from the SQW methodology it is as well to be clear about the purpose of that process;

The key objectives of the methodology are:

- *to help regions assess the potential for renewable energy in their area in a consistent way;*
- *for each regional assessment to underpin the evidence base for setting ambitious targets for renewable energy and a clear strategy to support their delivery in the Regional Strategy;*
- *to help regions plan for substantial new development in locations and ways which provide for energy, in particular heat, to be gained where there are clear opportunities for new or extended decentralised energy systems;*
- *to support Government policy and targets.*

(SQW 2009 p.1*)*

1.2.2
As the RSS framework is now abolished the underlying context of this methodology is removed. It may still have value in providing insight into possibilities on a regional basis, but there is no longer a *regional* strategic planning context for the assumptions of the methodology. How important this is is discussed where relevant below.

1.2.3
Any evidence base to drive ambitious targets for renewable energy; with a consequent increase in local resilience, is to be applauded provided the targets set are in fact ambitious in the urgent context of energy prices and availability as well as climate change impacts. In addition repatriation of investment capital and local primary energy production will both create local economic benefits.

1.2.4
Any linking of substantial new developments with renewable energy capacity assumes that the capacity is not required to meet the needs of existing users: domestic, commercial or industrial. A strategic resource study ideally should begin with an assessment of potential to meet existing needs from the potential resource before planning to add additional loads. Similarly, steps should be taken at strategic planning level to require substantial *new* developments to meet their own energy needs on site and *without diminishing the resource available to others*, locally or globally.

1.2.5
Planning for more efficient use of heat energy is to be applauded, especially where this can be deployed so as to reduce external primary

energy demand of existing heritage buildings, such as in conservation areas, where energy loss mitigation is inappropriate or damaging in historic fabrics. For non sensitive fabrics the priority must be demand reduction through high quality retro-fitting.

1.3 Targets and sustainability.

> *The UK Renewable Energy Strategy (RES) (2009) sets a target for 15% of the UK's energy to come from renewable resources by 2020,which represents a seven fold increase from 2008. To achieve this target it is proposed that 30% of electricity, 12% of heat, and 10% of transport, will be powered by renewable resources.*

(Wardell Armstrong 2010 p2*)*

1.3.1
This is not ambitious, nor nearly sufficient to achieve sustainability and resilience within a generation. A better approach would be to ask what we anticipate our locality to look like in energy supply and usage with no oil or gas available, then plan towards that with a parallel objective of maintaining food production. In the Transition paradigm this would closely align with an **Energy Descent Action Plan** (Fenderson 2006). It is acknowledged that such a strategy would front load capital investment, but over time as non renewable resources deplete and rise in price, such policies will result in reliable, adequate and relatively affordable energy. There is no question that demand reduction is a major requirement, best met by designing loads out of buildings and other infrastructure and by behaviour changes (EST 2008).The continuation of **Feed in Tariffs** and the proposed **Green Deal** are all HMG policies which will support these objectives. (DECC 2011)

1.3.2
Just to confuse matters, it is worth noting that during the writing of this critique television advertising of the first mass market electric cars has appeared. These offer an end user bonus right now of massively cheaper fuelling, but potentially multiply demand for electricity (with no regard for its source). Electric cars also have a potential contribution to make as a grid connected reserve, evening out intermittent supply from wind farms, so long as the grid is smart enough to prioritise loads (Hodge et al 2010)

1.3.3
This report aims to show available resources which could be deployed towards centrally determined (UK and EU) targets for renewable energy and for CO_2 emissions reduction. Not only are these not tested against long term sustainability metrics, they are also not always synonymous. The report identifies use of heat pumps in areas where mains gas is available as a well known example. Similar considerations are required for biomass, especially in re-directing standing timber resource from durable (e.g. building products) to destructive use as fuel. (Potter 2008) Included is a strategic planning vision based on pre-existing elements of the RSS, which though now redundant are still considered relevant to near future planning of housing renewal and growth (P.Yates 10/10)

2.0 The report itself.

2.1.1
The report is structured in an easily accessible way, allowing readers to follow progressive elaboration of data and arguments according to the level of interest and/or expertise they bring. The Executive Summary provides all readers with a concise statement of the principal findings and also recommendations based on them. The body offers forward projections of energy demand; as heat and electricity for new developments, and includes estimates of changes in CO_2 emissions for the county. The main outputs are shown in tabular format.

2.1.2
The report proceeds to roll out explanations for application of the underlying methodology, provides data in clear boxes within the text and provides pointers to full detailed maps of resource contained in appendices. Sadly there are no active hyperlinks within the pdf version available from the HCC website to assist internal navigation between text body and related maps.

2.1.3
The data/maps themselves are based on the OS and successive application of overlays for factors on interest: heat and electricity demand and CO_2 emissions, sites of potential deployment of Wind Energy Conversion Systems (WECS), land considered suitable for biomass production, and hydro power sites. The selection of graduated, similar colour, tones to show factor densities demands very close attention to differentiate, especially in urban zones where islands occur of higher or lower density. The use of data at postcode/area level (a method chosen to allow import of data sets from existing databases) does give rise to some anomalies. This can be easily seen when close examination of heat load maps reveals areas known to be of same age and type of housing (estates) are shown as having varying levels of heat demand.

2.1.4.
The final section is devoted to fitting the output data into existing policies and suggesting a series of new policies and targets to be adopted for utilising the resources identified. These policies are largely derived from existing practice already in use elsewhere.

2.2 The data - adequacy and relevance

2.2.1
This section largely consists of a critique of the SQW methodology in its own right. Not all types of energy source covered are present in Herefordshire, or covered in the WA report, but they are worth commenting on as treated in the SQW methodology. From the outset it is clearly framed in terms of a supply side paradigm, rather than opening with a consideration of the potential impacts of demand reduction strategies:

[T]he Government committed to developing a robust methodological approach and criteria for identifying the opportunities and constraints for renewable energy deployment in any given area at a strategic level. This document aims to fulfil that commitment, and has been prepared with the involvement of key stakeholders with an interest in planning and renewable energy.

If the intention includes the aim to support HMG policy, especially targets, one would expect the methodology to at least acknowledge radical options, if for no other reason than to illustrate gaps in capital be it financial, political or social, needed to implement schemes regarded as commonplace elsewhere in Europe.

In the scope and definitions (*section 2.5*) the lines

"Several further categories that appear in the literature have been excluded from the list as their potential in the UK..... cannot be quantified in terms of installed capacity (such as solar passive design)."

In other words the single most crucial factor impacting on design for demand reduction in any new build or retro fit is excluded from the methodology because it cannot be measured. This implies acceptance of a design philosophy where new houses for example are designed to use heat energy sourced from a scarce renewable resource rather than designed and built to Code for Sustainable Homes (CfSH) level 5 or 6 standard from the outset. This policy condemns occupants to dependence on external energy supplies for the life of the building, as retrofit cannot overcome poor plot siting by orientation or building on poorly insolated locations. A case could be made that scarce renewable resources should be prioritised to a common good such as hospitals or buildings in heritage settings.

2.2.2

Table 2.1 showing the categories of RE technologies covered omits the possibilities of WECS at medium scale, and treats all solar technologies as micro generation. In deference to WA, their report has included medium wind. Nevertheless it still devotes space to the now discredited urban micro wind technology (Rhodes 2008), and ignores solar farms and whole street scale solar thermal schemes.

Figure 2-1 shows how the methodology backs away from economic realities, rendering its outcomes perhaps rather fanciful. For example in the case of large scale WECS there are many areas of good wind resource with no viable road access at an economically feasible level - the methodology will not show this as a constraint so will over estimate this potential. This will be found to be much more serious than the types of constraints examined within stage 3 (*Table 2-2)* of the methodology. Anecdotally we know that early wind farm developers found no available sites in Herefordshire worth considering under the economic conditions prevailing in 2005 (A. Heal; pers. comm.2010)

2.3 *Chapter 3. Detailed assessment by technology.*

This chapter again emphasises the regional level at which this methodology is applicable.

2.3.1 *Wind*

From *Annex A* and *Table A-1* we are told that WECS viability is a dynamic parameter

> *"likely to change over time as technology evolves".*

The assumption here is that somehow turbines will be improved in order to take advantage of resource at lower average speeds. This ignores the inevitability of the Betts Limit: the theoretical maximum performance of a WECS in converting available energy in the wind (59%) and known wide variation of capacity factor for identical turbines on different sites with similar predicted wind speeds (ecotricity.co.uk 2010, goodenergygeneration.co.uk 2010). Variations between sites are going to be greater than marginal efficiency improvements likely for the foreseeable future. It is therefore wrong to assume any meaningful improvements in efficiency.

More alarming is the proposition that an exclusion zone of 400 to 600 meters around built up areas should rule out WECS in semi urban and sub urban zones such as industrial parks. Case examples - Green Park at Reading with a 2MW turbine, and the Dundee tyre plant with two 2 MW machines (ecotricity 2010). This appears to rule out deployment of a huge potential for private wire or on-site power use schemes; reducing losses on the grid and making a WECS economic at a lower capacity factor. *See below and title page.*

Green Park Reading *2MW turbine (photo A Smith/ Google Image/ Creative Commons)*

Interestingly, for Herefordshire, landscape character/ sensitivity assessment was not included as a constraint, except in terms of nationally protected landscape zones in AONBs, nor were cumulative impact and capping of total wind farm capacity. These factors are used as tools in opposition groups to campaign against and hence prevent or delay developments (even where this contradicts national policy). The effect of this on predicted resource is to suggest that much greater wind energy capacity is likely to be developed in the time available than is actually the case.

Related to density of deployment is the issue of grid capacity, again ignored in the methodology. The problem with this in remote areas (such as Herefordshire) is capital cost of making sufficient grid capacity available to enable full use of the theoretical resource. Whilst the concentration of multi-MW wind farms in central Wales justifies medium range grid developments, improvements needed for a handful of distributed turbines may be beyond economic viability. The assumption that national policy is a driver for actual implementation of local levels of sufficient grid capacity is challenged by wide experience of delay or failure.

The Herefordshire report includes the potential application of medium scale wind turbines, which are especially vulnerable to capital costs of re-engineering roads and grid capacity compared to larger multi MW projects.

2.3.2 *Biomass*

The production of fuel wood from plantation forestry or native woodland has been thoroughly explored by Forest Research. None of this work takes account of the behaviour of forest and woodland owners. The latter would certainly hesitate to alter generations of under-management of what amounts to their playground without strong incentives. The prospect of using output from plantations directly as fuel is manageable and apparently sensible, but commercial forestry in the last hundred years is an outstanding example of failure to follow consistent policy and purpose across the generations needed in forestry management (Rackham 1995). One consequence of this today is what the industry is calling *"The Wall of Wood";* dominance of same age stands across the national resource arising from generous taxation policies generations ago. Another is the prediction of "Peak wood" as energy use of this crop raises its value and brings unsustainable harvesting practices. (Potter 2008) . This would also have an incidental consequence of creating a spike in CO_2 release as this stored carbon is burned in a shorter time than it took to grow.

Biomass as a primary energy source is too precious for it to be used as an off the shelf panacea for all zero carbon demands, such as new housing. It should be carefully husbanded to ensure sustainable base load heat and power for essential public services such as hospitals and schools. A small scale rural industry bringing traditional woodlands back into sustainable management cycles will continue to provide wood fuel for a fortunate few, mostly rural, with direct access to this resource, but at ever rising prices.

For landowners to commit marginal low grade land to long term energy crops would demand an assured market at a price which justifies initial investment and forgoing of alternative uses of the land. This economic judgement is ruled out of the methodology, perhaps unwisely as without reasonable certainty of a lifetime return, no action will be taken to create this resource. There is room here for communities to act together to create shared heat or CHP schemes coupled to ownership of feedstock. An examination of the micro economics of such schemes would indicate likelihood of take up in the market place.

Similarly it is unwise to exclude economic considerations from study of potential from agricultural arisings, or from maize used as feedstock for biogas digestion. Since the methodology was written global prices of basic agricultural commodities have swung wildly; whilst diesel fuel has risen, either steadily or sharply, in price. The methodology makes no attempt to address long term sustainability of the proposed land use for energy crops. Nowhere is this more important than in energy and materials inputs to intensive maize, beet and oilseeds production. The demand for land for energy crops is already having global impacts in terms of habitats and human welfare; selection of appropriate uses of land for energy crops in the UK requires a fine balance of economic and ethical judgements beyond the remit of this methodology but crucial to sustainable development policies.

2.3.3 *Anaerobic Digestion (AD)*

That many farms are now in the process of installing Anaerobic Digester plant to produce either gas or electricity (and compost) demonstrates the off the shelf character of this century old technology. The present drivers for this are the FiT scheme, closely followed by waste management issues. However it would appear that many non farm schemes now compete for the available resource (such as municipal food waste stream or by products), so there is a suggestion that there is already over capacity in the pipeline. No new project should be developed without proven; ideally contracted; feed-stocks. Similarly there is no longer any excuse for methane producing AD processes to be allowed to occur “in the wild”, nor for AD feedstock to ever go to landfill. Recognition of the climate impact of methane, over twenty times greater than CO_2, should be a driver to prioritise early deployment of this technology.

2.3.4 *Municipal Solid Waste (MSW)*

Municipal solid waste as an energy source is fraught with issues. Whilst the original driver for this method of waste management was landfill constraint, it is now being promoted as a sensible use of waste products. From a sustainability viewpoint there are flaws:-

1. It depends on the waste itself being combustible. In order to make this so it must already be sorted for glass, metals etc. The remaining materials almost by definition are organic, either as natural substances such as food wastes or fibres, or as plastics. Fibres and food wastes are already counted as a resource for utilisation elsewhere (biomass burners/ recycling or in AD plant). This leaves plastics. How long are we going to continue using these materials in such wasteful ways? long enough to justify the investment in a clean EFW plant? (the methodology takes cognisance of these matters in Table A-7 regarding landfill gas).

2. To make a clean burning plant, it has to be big. This demands a regional level plant, hence a demand for many tonne.kms of cartage for waste to travel from origin to the end use plant. This imposes a lock in to ever rising haulage costs which cannot be sustainable. Smaller plant cannot cheaply be made as clean, raising toxicity issues; and no plant is free from the issue of CO_2 release. In short this is not a sustainable energy solution, it is a short term waste disposal policy. Extrapolating from existing technologies and resource constraints to 2020 suggests there will be a much lower level of energy rich materials available to divert from land fill; they will have been taken from the stream higher up, beginning at the doorstep, or even at production level in the case of packaging.

2.3.5 ***Micro-generation.***

Solar. The methodology assumes solar technologies will only be deployed on roofs. This is already out of date, as projects for solar PV in ground arrays are already commissioned. (This is recognised by the WA report, but not counted in) In addition it ignores potential contribution of solar thermal arrays feeding into district heating schemes, even on a street by street basis. The actual assessment methods used are derived from these assumptions, and therefore result in an under-estimate of potential.

The inclusion of micro wind here is a distraction. Both anecdotal and controlled trials experience has shown this is not a viable technology. (Rhodes 2008) Very few property owners are likely to buy into this because of the high capital cost per kW installed. The unreliability of wind flow (i.e. turbulence) results in a very low or even negative capacity factor depending on the technology selected. Even in the best sites numbers required and capital cost both point to deployment of larger WECS. Where a site is identified as a genuinely good site (i.e. turbulence is known to be low) for a 15kW turbine, what reason is there to not deploy a 500kW one?

3.0 Application of SQW to Herefordshire

3.1.1
The above criticisms largely also apply to application of the methodology to county level, with the acknowledgement that WA have extended it to include medium scale wind and more detailed treatments of biomass to take account of local conditions. Any inadequacies in the reported data are therefore down to the methodology, not to any omission or error on the part of WA. As an assessment of the county wide potential the report at least gives orders of magnitude indication of which technologies are worth further study at a site specific level, and which require a county wide policy.

3.1.2
The heat mapping for existing loads uses a technique permitting use of pre-existing databases of house types and accepted averages in energy use by homes, industrial and commercial premises. This may be too simplistic a method for the stated aim of identifying suitable sites for CHP or District Heating (DH) schemes. It must be noted that where sufficient heat load density may occur, it will almost certainly be in an area served by the gas main. For the purpose of CO_2 emissions reduction it only makes sense to install biomass fuelled systems to replace higher emitting fuel sources such as oil, coal or grid electricity. For local resilience and spin off economic benefits on the other hand biomass fuel has obvious advantages.

3.1.3
In the case of housing areas, the heat maps already show variations in heat use density across housing estates known to be of blocks of identical buildings - an anomaly derived from the heat use density assessed over area which includes open space. For potential DH viability it may be more accurate to use an assessment based on counting dwelling types or occupation densities within building footprints. This would show up locations of high housing density such as blocks of flats where heat load could be most economically met by, for example, a biomass fired DH and a shared passive solar array feeding accumulators. The numbers of sites of interest is small enough to quickly and easily derive the required counts from, for example, Registered Social Landlord bodies.

3.1.4
In the case of industrial and commercial premises the heat load estimates are based on industry standard national averages. This approach fails in two ways. Firstly it does not consider the actual mix of types of uses within the relatively small economy of the single county, which will impact on the proportions of energy required for space heating or for process heat. Secondly, it fails to consider what proportion of electricity in commercial and industry buildings is used for heating (or cooling - as air conditioning units).This is a case where application of a regional methodology may be inappropriate to a small county. Rather than use a national average, loads should be more rigorously surveyed to

identify major heat users as process heat, e.g. Bulmers, Cargill. In other words local knowledge may give better answers than applying a general tool.

3.1.5

From the summary, in the totals of energy demand

Electrical: 731 GWh/yr

This figure is not recognised, as the DECC figure for grid supplied electricity to the county in 2008 is 1005.3 GWh (DECC URN 10D/487A). This makes any assessment of demand based on the reported figure short by about a quarter, and hence required capacity estimated short by about a third. In addition, it takes no account of off-grid or private wire supplies, which are certainly demand, which are not counted and may be supplied by a resource which is already installed and yet included in the projected capacity estimates. The actual sums of energy involved are relatively trivial at this time, but will become less so as more projects are deployed.

3.1.6

It is interesting that the map of existing renewable energy projects fails to show Wind&Sun Ltd. at Humber, not only a 2kW WECS and a significant array of several kW of PV, but also a nationally recognised centre of expertise in renewable energy installations for over twenty years. There are an additional number of single property PV and small wind installations known to this writer, rising rapidly as FiTs are exploited. Another omission from the existing infrastructure map is the LNG pipeline which runs through the county carrying imported gas from Milford Haven to a grid distributor at Tirley in Gloucestershire. This may become relevant in the future if a high output AD plant is developed to feed in to the gas grid, rather than supply local uses; it certainly should not be omitted from a strategic planning capacity assessment.

3.1.7

A more serious omission is the failure to take account of the "beer money" firewood industry, which utilises a renewable resource included in the theoretical estimate of available biomass. Whilst the potential is recognised as massively under-used, relying as it does on casual arisings rather than purposeful wood lot management it is wrong to ignore that it does play an important role in energy supply and employment in rural areas. Scarcity of supply is already impacting on price which may bring more resource into management sooner.

4.0 Policy proposals

4.1.1
Advocacy of community participation and ownership within the policy recommendations is most welcome. As is often the case (e.g. EST, Power in Numbers) this fails to consider the paucity of experience in community solutions, and the uneven distribution of the required social capital. Whilst these are not matters central to the report no such policy can be implemented without overcoming these obstacles.

4.1.2
Whilst the report is primarily intended to present an objective resource assessment, it also makes a number of policy suggestions for planning policies and for utilisation of the estimated resource. The policy recommendations for RE deployment are scaled as either pioneering or pragmatic. From the sustainable development/ local resilience paradigm the pragmatic policies are inadequate and the pioneering policies could be regarded as an absolute minimum. The other policies suggested are firmly rooted in the assumptions of a growth model, derived from a growth led RSS but defended now as supposedly meeting local needs. The single most critical element of this is the projected growth in housing, with associated energy needs. Recommendations made in the report are based on a further series of assumptions about design and use of this new housing, particularly that it will be built to increasingly tight standards of energy economy, ultimately *zero carbon.*

4.1.3
Since the report was written housing Minister Grant Shapps has disbanded the Zero Carbon Hub, so the body responsible for defining this standard in a form applicable to the housing industry no longer exists. Secondly the minister has abandoned the target of Zero Carbon housing by 2016. This means that the driver for ever higher energy use standards has gone. Where low carbon building rules are applied at local level, primarily the Merton Rules, developers respond by attempting to deploy the easiest technology available to meet energy needs at the time of construction, rather than consider energy needs over the life of the buildings. This has resulted in a rash of new developments designed around biomass boilers at the end of international supply chains for pelleted fuel, which struggle to meet clean air standards (Coleman 2008).

4.1.4
Biomass as a primary energy source is too precious for it to be used as an off the shelf panacea for all zero carbon demands, such as new housing. It should be carefully husbanded to ensure sustainable base load heat and power for essential public services such as hospitals and schools, followed by provision of an agreed hierarchy of energy needs.

4.2 Impact of improved building standards

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

(p 51. S 5.2.3)

This is in no way ambitious, nor a policy fit for purpose given the excellent framework set out in its preceding paragraph -

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

(p 51 S 5.2.2) emphasis mine.

4.2.1
There is no need for new housing to be anything other than CfSH level 5 or 6 standard, eliminating most if not all demand for domestic heating. As stated elsewhere scarce renewable heat capacity should perhaps be prioritised to essential services; these decisions following from the proposed Biomass Action Plan. It remains for policy makers to determine levels and methods of offset required to justify such wasteful energy use. Inclusion of fuel based DH systems into new build locks users into a dependence on the supply, and hence an open ended commitment to pay whatever the price. *

This type of built-in potential for fuel poverty should be avoided at all costs as it will be almost impossible to retro-fit passive measures to modern houses, and certainly impossible to re site dwellings to maximise insolation.

4.2.2
The policies refer to the existing Feed in Tariffs (FiT) regime. Whilst new, the ultimate duration of this regime for new projects is not known as the current framework ends in 2013. Given the history of well resourced opposition to new developments, especially to WECS, it is extremely unlikely that a major deployment of renewable technologies will occur within this time frame. This makes actual utilisation of much of the estimated capacity dependant of the continuation of the FiT at a time of

*I am indebted to Ainsleigh Rice of Hereford Hydro for this calculation.
Say 100000 homes. Land area in county under managed woodlands say 10% of county area or 200 km^2, yield class of deciduous trees (oak/ash) 5 m^3/ha/y, density 600kg/m^3. 4 kWh/kg, gives just 1 kW per home for about 25% of the year. No provision to use wood for other public, industrial premises, farms, heritage homes, transport.

fiscal constraints which may become politically unacceptable. The viability of single property PV and of medium scale wind projects are critically dependent on the existing FiT; in its absence these technologies are unlikely to be deployed, ultimately impacting on achievement of targets, until the wholesale electricity price passes certain thresholds.

4.2.3
The policy proposal for new developments (p.51; S 5.2.4 and S 5.2.5) to off set a mere 10% of predicted GHG emissions is poor by any measure. Such a policy would permit new developments to be constructed and operated to very poor standards of energy economy and yet only demand a trivial level of mitigation. Developers would be encouraged to game this policy by cornering a market in the available resource(s), thus denying it to other potential users and/or driving up prices.

4.2.4
A policy addressing this could begin with a demand that *at least* 100% of CO_2 due to the development must be captured within a locally visible radius (such as the county) and necessarily without impacting on the resource available to others. This would drive much higher standards of design and especially ongoing management of energy use in new buildings as well as on site utilisation of renewable energy technologies. Perhaps it would also create more powerful and resourceful lobbyists for utilisation of contended potential sites and technologies. Any claim that an off set scheme is adequate recompense for the implementation of a GHG releasing project must be subject to rigorous audit and enforcement action, and adequate resources made available to enforce this. For major developments, offsets for embodied CO_2 should be required by policy.

4.3 Overview of technologies

4.3.1 Wind

The recommendations made in this section are subject to the flawed assumptions in the underlying methodology. For example, the suggestion that the county can site 174 large scale WECS is based on the absence of road access and grid capacity constraints. As previously noted, these factors had already ruled out *any* large scale WECS for commercial developers in 2005. The critical dependence of medium WECS and any widespread use of PV on existing levels of FiT are also relevant considerations in estimating speed of future roll out.

4.3.2 Biomass/AD

The proposal for an Integrated Biomass Plan is welcomed and this should begin at once.

The limitations of potential resource use discussed above, along with the failure of the methodology to consider resource inputs renders the capacity estimates invalid. Ultimately decisions will be made by farmers and landowners on short to medium term economic factors so a policy framework needs to be in place to guarantee an ethical consideration in such decisions to ensure continuation of affordable food supply. Land use choices in terms of crop selection are not subject to planning law, so this process is not an influence on such selections except in managing demand. Policies to ensure all suitable AD feedstock is diverted from waste streams should be implemented at the earliest possible time. I endorse the suggestion for future zoning to provide process heat as a usable resource, but pending this the optimum use of gas from AD is to supply it to users through the grid, rather than on-site burning for electricity and dumping the heat.

4.3.3 Solar

The policies for solar deployment need to be separated between PV and thermal technologies. The assumptions of the methodology limit the suggested applications of these technologies quite unrealistically as they are limited to roof installations only. One area where this can be seen to fall short is in the potential for larger solar thermal arrays feeding into accumulators in urban areas where building orientation prevents roof mounting. Evacuated tube collectors are able to utilise incident insolation from wider angles than older flat plate systems, making a much wider range of potential sites viable.

The FiT regime has already led to wide interest, notably from investors, in large arrays of PV in rural areas (solar farms) as are widely seen in Germany. This is not counted in the report, but is mentioned in passing as a potential bonus. The policy suggestion that public bodies should "rent" roof space to community owned solar PV arrays is welcomed and already in progress elsewhere (Stratford hospital). Fees for such sites should be based on costs recovery only for community groups, not on an attempt to exploit the utilisation of the resource.

4.3.4 CHP and DH

The policies for CHP and DH are excellent, especially proposed integration with biomass DH and deployment to socially vital sites at schools and hospitals. Integration of additional solar thermal arrays and use of accumulators must be included.

4.3.5 Heat Pumps

Policies for deployment of Heat Pumps have to be considered in the light of experience from early adopters, and ultimately grid dependence. Anecdotal reports in on line forums suggest that some equipment and some installers fail to meet quoted performance standards - having serious impacts on the validity of this technology for energy economy (Green Building Forum 2010). At worst, and in most demanding conditions, the apparatus acts as a simple resistance heater. It is perhaps most important to recognise that such tools demand a reliable electricity supply, meaning the grid, and their deployment in urban areas (to displace gas heating/ micro CHP) may well result in no saving of GHG emissions at all. Only de-carbonisation of the grid can ensure that heat pumps have a role to play anywhere other than non gas main areas. For a trivial number of sites beyond the reach of even the electricity grid, heat pumps are a valuable means of reducing reliance on diminishing wood-fuels so long as sufficient generating capacity is to hand. It remains obvious that no heating solution can ever be better than building to prevent heat losses.

4.4 Comments on *Table 6.1 (Potential Resource and Deployment Strategy.)*

- This table shows estimated levels of possible resource and suggests level of deployment for each. As the capacity levels are derived from the underlying methodology they are subject to its internal flaws and assumptions.
- Nowhere is this more clear than in the case of large wind - suggested deployment at 30% of the estimated 174 machines would struggle to find suitable sites with road access (even allowing for re-engineering) and grid capacity.
- The proposed uptake of forest residues fails to consider the impact of woodland management for small-wood production, a traditional practice yielding much higher returns than residues from longer term timber management (Rackham 1995). This must be included in the Integrated Biomass Plan.
- Policy suggestions have been made above concerning the prioritisation of effort to ensure full utilisation of the AD resource, and the focus on a properly thought through integrated and above all sustainable set of policies for utilisation of the remaining biomass resource.
- The equivalent CO_2 saving from the deployment of 20% of landfill gas potential appears not to take account of the consequences of releasing methane into the atmosphere instead of burning it. All possible effort must be made to capture this gas and burn it as a high priority!
- The estimated available solar resource for existing buildings is already constrained; there should be no reluctance to deploy the remaining capacity at the earliest possible opportunity, so the suggested target of 20% is inadequate.
- The suggestion that new build utilisation of solar potential should be anything less than 100% defies comprehension and must be brought into line with existing zero carbon design criteria.

5.0 Conclusions

5.1.1
Overall this report is to be welcomed. Whilst it is considered to have flaws, these must not be allowed to disguise the obvious fact that for the first time a consolidated assessment of the renewable energy potential for the county is now available in a single document in the public domain. The advocacy of community participation and ownership of renewable energy projects is most warmly welcomed as this will counter the existing FiT serving the investment objectives of the already well off at the expense of all electricity customers. The offering of two levels of policy recommendations, the "pioneering" and the "pragmatic" draws attention away from how unambitious the pragmatic version actually is. Introduction of a truly ground breaking "sustainable and resilient within a generation" level of deployment would be worth examining.

5.1.2
The implications of using this report's outputs as a guide to policy formulation for housing growth have been considered in detail above, but amount to an apparent reliance on biomass fuel being available to permit so-called zero-carbon housing developments, coupled with an over-estimate of the realisable potential for wind generated grid electricity. An alternative sustainable and equitable policy could be grounded in an initial discussion of the priorities for deployment of the actual biomass resource, coupled to a recognition of genuine low carbon house building standards such as CfSH level 5 or 6.

5.1.3
The wind turbine siting discourse is known to be heavily influenced by small numbers of socially advantaged and able campaigners (Linnell 2010, Van der Horst 2007). This minority group must not be allowed to prevent or even delay deployment of large WECS at sites which enjoy both suitable energy resource and viable road access. The failure of this report to include road access as a constraint suggests a much higher level of potential resource than may actually be the case, leading to a failure to see through developments in these critical locations. This would leave the field open for well resourced outside developers to target the highest yield sites at the economic margins.

5.1.4
The inclusion of micro wind at all is a distraction; this is a discredited and irrelevant technology except for remote off-grid sites. Existing facilities show that even with generous FiTs they struggle to achieve economic viability. The medium scale WECS are really only relevant in the context of a generous FiT at that scale. If the tariff is reduced in any renewal of the scheme (not guaranteed at all!) after 2013 then this scale of development may become non-viable until wholesale electricity prices reach high enough thresholds.

5.1.5
The complex interactions of technical, social and economic factors in the resolution of the problems of climate change mitigation and long term energy security may be argued to be beyond the remit of a Unitary Authority Planning Department. This may lead to an approach based on business as usual (BAU) coupled to statutory targets for energy use and CO_2 emissions reduction. This approach may be unpredictably vulnerable to short term political changes such as the removal of building regulations targets, or responses to specific economic cycles leading to a house building boom at outdated standards. For these reasons it is important for HCC plans to embrace to the highest level permitted by law the potential for all new housing to be built to CfSH level 5 or 6. Similar requirements should be expected of non residential developments. Robust policies need to be in place to support the retro-fitting of high quality insulation to all existing dwellings, especially those beyond the reach of the gas main. Robust measures to provide life time education and training for all engaged in the construction industry are needed to support these policies.

5.2 Further work required

- An early start on the Biomass Action Plan. This needs to address the true level of sustainability, especially in growing energy crops on arable land and long term sustainability of woodland resource.

- As well as technical sustainability this Plan also needs to address social priorities and energy equity in where this resource is deployed.

- The potential resource maps for large and medium wind need to be re-examined in the context of re-engineering the access roads to permit passage of relevant sized turbine elements. This will identify those sites with both available energy and true economic viability to be developed as a priority.

- Urgent identification of sites in public ownership for deployment of large and medium WECS, and simple legal processes to make such available to community groups for such developments. For example the new cattle market north of the city could site turbines like those illustrated in this paper.

- All buildings in public ownership should be made available to co-operative or community interest companies to deploy solar PV where viable.

- A re-examination of the constraints to solar thermal to take account of possible shared schemes, and the enhanced capture possible with newest technologies.

- An assessment study of the range of house types in the county needs to be undertaken as a priority, leading to standard designs for high quality retro-fit insulation. This study would also feed in to longer term plans for CHP or DH schemes using biomass. HCC should take the lead in supporting supply chains for the required expertise and training in time for the advent of the "Green Deal" in 2012.

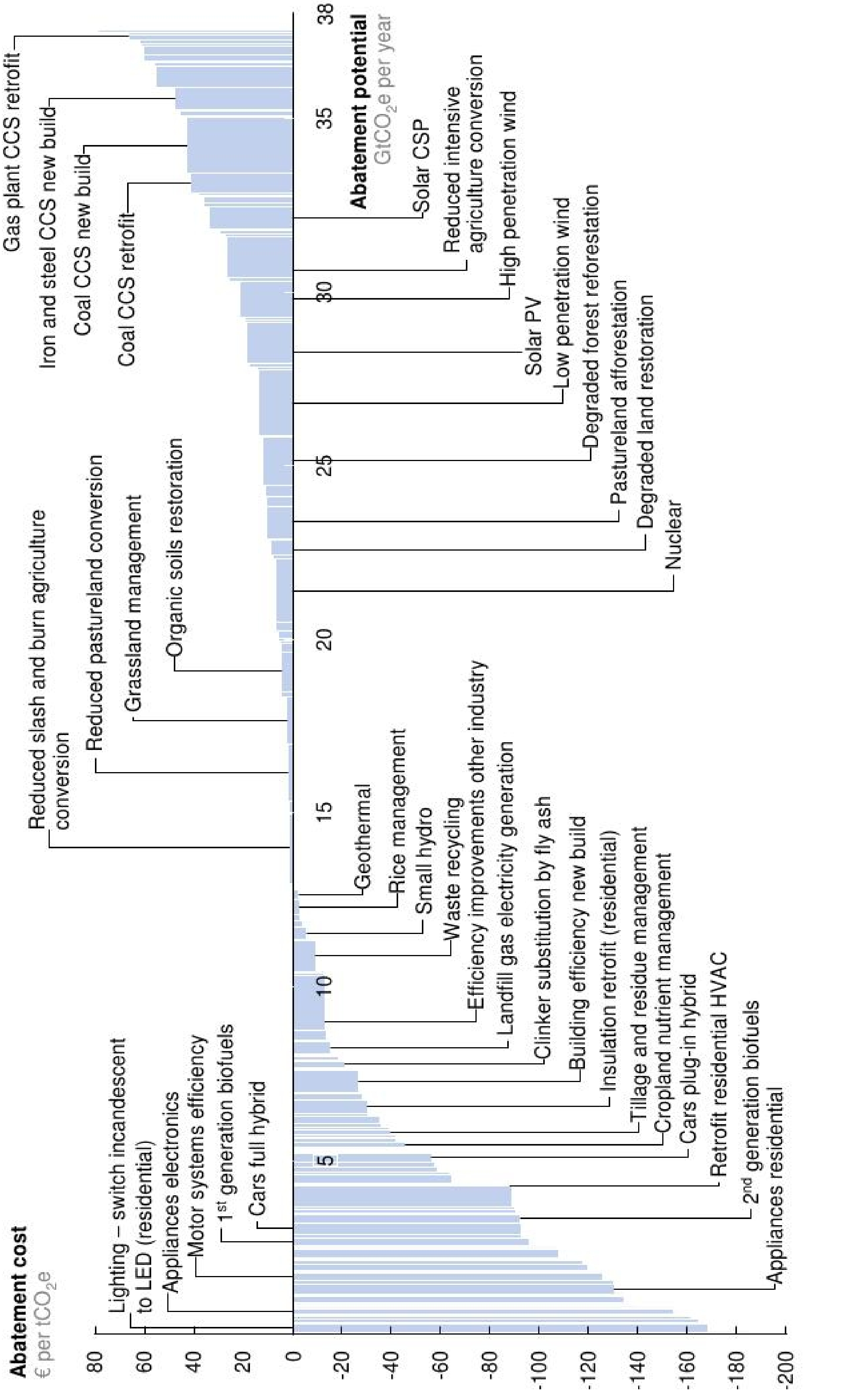
- Policies for new housing should not permit anything less than Code for Sustainable Homes level 5 or 6 energy economy. This is most critical for any new social or "affordable" housing built as a developer contribution in exchange for planning permissions for speculative developments.

- New non residential developments should also achieve the highest possible standards of energy use throughout their life. Any compensatory offsets must be audit-able as genuine contributions to zero carbon primary energy at 100% if within the county, or even higher if this contribution is in the form of long range grid feeds.

5.2.1
For long term Strategic Planning HCC needs to begin taking account of prevailing global trends in energy economics and formulating a policy framework which goes beyond simplistic attempts to meet imposed targets for GHG reductions and RE deployment. As suggested in the WA report- Herefordshire has an opportunity to engage in a radically far sighted development plan to bring about a genuinely sustainable local economy based on de carbonisation, growth in local energy investments, highest design standards for new buildings in all sectors, and employment growth in retro-fit of the existing building stock and biomass supply chains.

The authors of the report were invited to comment on this critique in advance of publication, but are barred from so doing by the terms of their contract with HCC.

Appendix 1 Global GHG abatement cost curve beyond BAU - 2030 (McKinsey&co. 2010)



Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €80 per tCO_2e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.
Source: Global GHG Abatement Cost Curve v2.1

To interpret this graph, the vertical axis shows the estimated or predicted cost of GHG abatement; expressed in tonnes of Carbon Dioxide equivalent (tCO_2e) saved by given amounts of expenditure. The positive side of the graph indicates techniques which have a net financial cost, the negative side those which have a net gain, i.e. a financial return on investment.

The horizontal axis shows the estimated or predicted global amount of GHG savings per year from application of the given techniques. So for example we can see that switching to low energy light-bulbs has the highest financial return, by saving users electricity, but has a relatively minor impact on the global scale.

The cost projections given are based on the assumption of an "aggressive" implementation of the various techniques, assuming economies of scale for technologies which will be subject to resource constraints, or levels of behaviour change in the case of land use changes which may be politically impossible to enforce.

As this graph has not been subjected to either data or methodological audit by this writer, it must be viewed sceptically. Notably the economics are dependent on a price basing model that does not appear to take account of possible diminution of supply. In just one version revision of the model, the predicted price of crude oil in constant 2008 dollars has more than doubled by 2030. In contrast it cannot at present accommodate resource bottlenecks in strategic materials which may impact on technology deployments (e.g. rare earths, or specialised engineering capacities) Any reduction in conversion of primary climax vegetation to crop-land depends on major assumptions about population, diet and distributive justice.

It must also be said that this graph takes no consideration of issues of energy supply security or of local scale behaviour change. There may therefore be technologies which do not appear from the graph as economic, but which are adopted anyway with financial support from governments to achieve higher levels of security such as the UK FiT and domestic scale PV. In terms of behaviour change, the use of private motorised transport could be examined. The BAU model assumes that people can, should and will want to continue to use individual private transport at present day levels. By better strategic planning of urban areas, and of wider public transport services, this behaviour may be radically altered in favour of public transport, cycling or walking.

On a local level however the graph does begin to permit at least ball park evaluation of the likely impacts of differing policy decisions.

References

COLEMAN, P.; *The Air Quality Impact of Wood Fuelled Biomass Combustion.* Environment Protection UK (Wales) Managing the impacts of micro-generation in Wales. Gorseinon July 24th 2008.

DECC: Energy Security and Green Economy Bill; Green Deal. DECC Jan 2011. http://www.decc.gov.uk

ECOTRICITY (2010); http://www.ecotricity.co.uk/wind-parks accessed 28.5.2010

EST ; *Power in Numbers*, London, Energy Saving Trust. 2008

FENDERSON, A.; *Energy Descent Action Plans - A Primer*, Post Carbon Institute 2006. http://www.energybulletin.net/node/16859

Green Building Forum. http://www.greenbuildingforum.co.uk/forum. accessed Feb. .2010.

HODGE, B-M., S., HUNGUA, S., SHUKLAA, A., PEKNYA, J., F. & REKLAITISA, G., V. The Effects of Vehicle-to-Grid Systems on Wind Power Integration in California. *Computer Aided Chemical Engineering* .Vol. **28**. 2010. pp 1039-1044.

Van der HORST, D. Nimby or not ? Exploring the relevance of location and the politics of voiced opinion in renewable energy siting controversies. *Energy Policy* **35** pp 2705-2714

LINNELL,P. Are smaller turbines the way forward for wind energy in Herefordshire? Unpublished M.Sc. thesis. University of East London/CAT Graduate School of the Environment. 2010. Available from http://www.lifespacedesign.co.uk/PLAc.html

McKINSEY & Co. (Enkvist,P.E.,Dinkel,J.,& Lin,C.):*Impact of the financial crisis on carbon economics.* McKinsey and Company 2010

MERTON; London Borough of Merton Unified Development Plan, 2003

POTTER, P.,C. Peak Wood- The Consequences. *Forestry Journal*, **Nov** 2007

RACKHAM, O. *Trees and Woodland in the British Landscape*. London, Wiedenfeld and Nicolson. 1995 ed.

RHODES, M. 2008. *The Warwick Wind Trials: Insights into a tragedy of inflated expectations and cultural ignorance.* Environment Protection UK (Wales) Managing the impacts of micro-generation in Wales. Gorseinon July 24th 2008. matthew.rhodes@encraft.co.uk

SQW 2009; *Renewable and Low-Carbon Energy Capacity methodology* *for the English regions.* SQW energy/ Land Use Consultants 2009. downloaded from http://www.sqw.co.uk/file_download/246 on 7.1.2011

WARDELL ARMSTRONG; (STONEY,S. & SCHOLES,H.) *Herefordshire Council Local Development Framework Herefordshire Renewable Energy Study*. Wardell Armstrong/Herefordshire Council 2010. Downloaded from; http://www.herefordshire.gov.uk/housing/planning/50041.asp on 7.1.2011.