Renewable Energy Strategy for West Berkshire

LOCAL STRATEGIC PARTNERSHIP



October 2012

West Berkshire COUNCIL

TV Energy

This report has been prepared by TV Energy on behalf of the LSP and West Berkshire Council. Report reference TVR285.

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ABBREVIATIONS

AONB	Area of Outstanding Natural Beauty
NWD	North Wessex Downs
RE	Renewable Energy
PV	Photovoltaic
CLG	Communities and Local Government
AGL	Above Ground Level
LSA	Life Cycle Assessment
BHA	British Hydro Association
MSW	Municipal Solid Waste
AD	Anaerobic Digestion
EfW	Energy from waste
Defra	Department of Food and Rural Affairs
DECC	Department of Energy and Climate Change
Cumec	Cubic meters per second
NRFA	National River Flow Archive
TVE	Thames Valley Energy
DECC	Department of Energy and Climate Change
FIT	Feed in tariff
RHI	Renewable heat incentive
WB	West Berkshire

FOREWORD

This report is set out in three sections: (1) a concise renewable energy strategy document discussing current levels of energy consumption and proposing a range of renewable energy resources that might be deployed to satisfy local energy needs. The report goes on to suggest a range of projects utilising the various technologies along with energy targets that might be applicable for 2020.

The strategy draws on (2) a short document observing relevant references to renewable energy in the West Berkshire Core Strategy issued in 2012 with linked references to the North Wessex Downs AONB and AWE Aldermaston and finally (3) a detailed technical exploration of the renewable energy resource in West Berkshire.

EXECUTIVE SUMMARY

West Berkshire (WB) is a landlocked, mainly rural constituency and has considerable potential for renewable energy production and use based on deployment of technologies generating power from the wind, sun, waste and plants (primarily trees). The accessible potential available from these renewable resources is of a similar order to the total primary energy needs of the area in terms of heating and power as well as transport and could theoretically make WB self sufficient in energy. Indeed, given the substantial reductions in energy needs (as reported by DECC) year on year, WB could before long have a potential surplus of energy and might consider becoming an energy exporter.

Such a whole hearted transition to a 'low carbon economy' would create considerable socio-economic benefits for the community in terms of job and business creation, wealth creation and retention plus a range of social gains resulting from the availability of cheaper energy (e.g. the ability to address fuel poverty and energy affordability). However, in order to harness large amounts of these renewable resources there would by necessity be major implications for landscape, biodiversity, infrastructure and development. Such impacts are seen to be highly contentious in many instances and as such will severely constrain deployment in at least the short to medium term (up to 2020). Longer term with uncertainties in conventional fuel availability for heating (coal, oil, gas) and for power supply (coal, gas, nuclear) at acceptable prices, what is deemed unacceptable currently is likely to change and greater deployment might be expected as a result. Added to this long term, is the impact that climate change is likely to have causing unpredictable changes to our local environment, for example through an increase in wind speed and duration, solar gain and rainfall frequency and amounts of precipitation (affecting rivers and plant growth).

The rate and degree of these economic and environmental changes is hard to predict but will surely influence local people and social attitudes to beneficial change to ameliorate these impacts as much as possible. The interaction with the planning and development policies of West Berkshire Council (WBC) and the leadership shown by local councillors will become increasingly important in plotting the way ahead.

Ultimately, this report sets out to illustrate what immediate potential exists to harness local renewable energy resources in WB and so to continue the move towards a more sustainable way of living and working for local people providing greater security of supply, affordability and lower emissions. The report shows how the technical potential is essentially illusory but through applying various constraints (physical environment, regulation and designations) a core of activity and 'accessible potential' exists that could catalyse real change in WB and potentially contribute up to 11% of primary energy by 2020 to be met from local renewable energy sources.

TV Energy (TVE) was commissioned on behalf of the Local Strategic Partnership (LSP) to carry out this strategic review of the potential for renewable energy (RE) deployment across WB. The report should be considered alongside other reviews being carried out on waste, carbon, food and travel as part of an overall climate change strategy. This document should aid WB council in setting up practical and achievable RE targets for a sustainable West Berkshire.

1. A RENEWABLE ENERGY STRATEGY FOR WEST BERKSHIRE

ENERGY CONTEXT (2012)

1. West Berkshire (WB) is a landlocked, mainly rural constituency and has considerable potential for renewable energy production and use based on deployment of technologies generating power from the wind, sun and biomass (primarily trees). *NB. Energy from waste is not considered in detail in this report.* The 'accessible' potential available from these renewable resources is estimated to be of a similar order to the total energy needs of the area in terms of transport, heating and power requirements and could theoretically make WB almost self sufficient in energy. See Table 1 and Figure 1 below and also Annex 1: renewable energy potential.

<table>
<tr><th>Technology/resource</th><th>Accessible energy including arable land and AONB (GWh)</th><th>Accessible energy excluding arable land and ANOB (GWh)</th><th>Existing Use (TV STATS) GWh</th></tr>
<tr><td>Large wind</td><td>1273</td><td>146</td><td>0</td></tr>
<tr><td>Small wind</td><td colspan="2">94</td><td>0.041</td></tr>
<tr><td>Solar PV</td><td colspan="2" rowspan="2">31.45</td><td>1.378</td></tr>
<tr><td>Solar thermal</td><td>0.113</td></tr>
<tr><td>Solar ground arrays</td><td>2959</td><td>949</td><td>0</td></tr>
<tr><td>Hydro</td><td></td><td></td><td>0</td></tr>
<tr><td>Biomass</td><td colspan="2">98.15</td><td>2.656</td></tr>
<tr><td>Heat Pumps</td><td colspan="2">146</td><td>0.897</td></tr>
<tr><td>Total</td><td>4601.6</td><td>1464.6</td><td>5.085</td></tr>
</table>

Table 1, Renewable energy potential

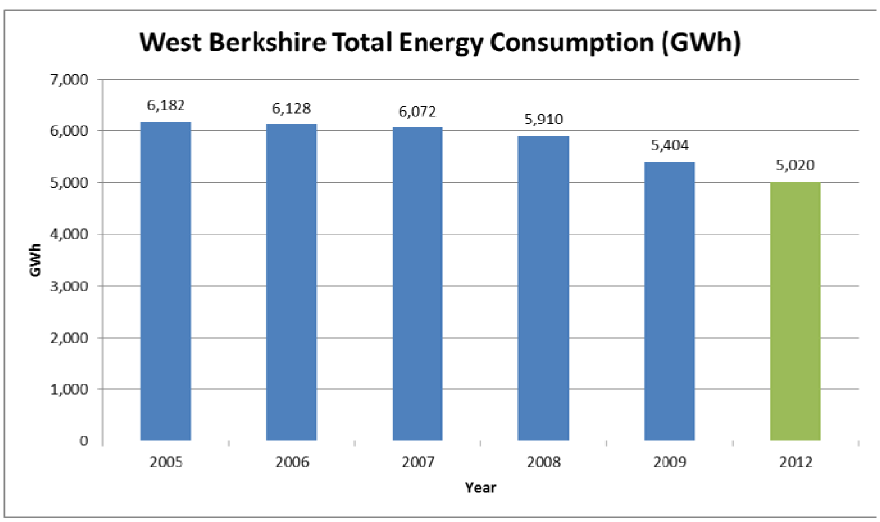

Figure 1, West Berkshire Total Energy Consumption[1] (with predicted 2012 figures)

[1] Figures from http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/regional/total_final/total_final.aspx

2. However, major constraints to deploying technology in WB rapidly reduce this potential. For example, accepting that large wind energy devices and extensive solar farms are unlikely to be deemed acceptable in the North Wessex Downs AONB on the grounds of visual intrusion reduces this potential considerably.

3. Nevertheless, even excluding these areas, there is still a significant potential capable of supplying more than half of WB's heating and power needs. See Figures 1 and 2 illustrating energy consumption for the period 2005 – 2012, the prediction for energy needs in 2012 is of the order of 2,520GWh for domestic, industrial and commercial use (excluding transport).[2]

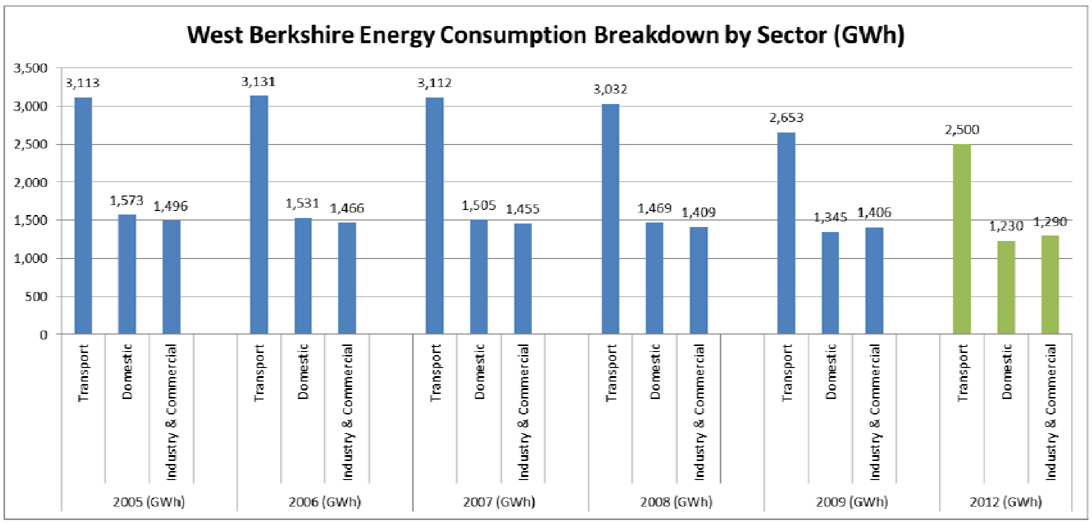

Figure 2, West Berkshire Energy Consumption Breakdown by Sector (with predicted 2012 figures)

4. In the short to medium term (say to 2020), any strategy that seeks to move renewables forward in WB is going to be largely dictated by the need to minimise visual impact, given the great sensitivities to conserving landscape locally. However, if this constraint is allowed to dominate longer term then ***there must be an acceptance that only limited progress can be made to harness the local potential*** since the degree of visual impact is roughly proportional to the scale and energy intensity of renewable energy projects. Figure 3 below seeks to illustrate this point and is supplemented by a table explaining the 'capacity factors' for various technologies and scales. The higher the factor the more effective is the technology in simple terms.

5. This point is well made considering how little progress has been made in WB to date. Table 1 far right column shows the very modest use of renewables reported by TV Energy in the 'TV STATS' evidence base review completed in September 2012[3]. Forward movement is also limited, see Figure 4. The exception to this lies with PV (photovoltaics installations) where progress is being made as a result of new fiscal incentives introduced by central government. Note also the poor position with respect to other Local Authority areas across the Thames Valley as shown in Figure 5 below.

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[2] http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/regional/total_final/total_final.aspx

[3] West Berkshire statistics report 2012

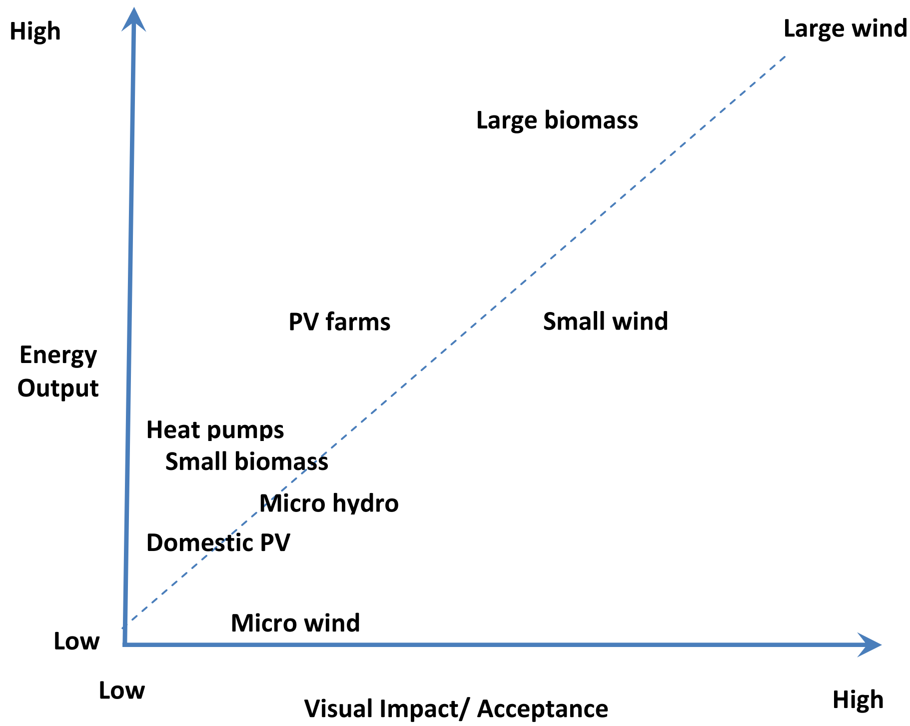

Figure 3, Visual impact versus Energy output

Technology	Capacity factors
Onshore wind (large >100kW)	26%
Onshore wind (small 5-50kW)	15%
Onshore wind (micro <5kW)	4%
Solar PV	10%
Solar thermal	13%
Biomass heat - domestic (<50kW$_{th}$)	10%
Biomass heat - community/commercial (>50kw$_{th}$)	20%
Low head hydro	40%
Ground Source Heat Pump	30%

Table 2, Technology capacity factors

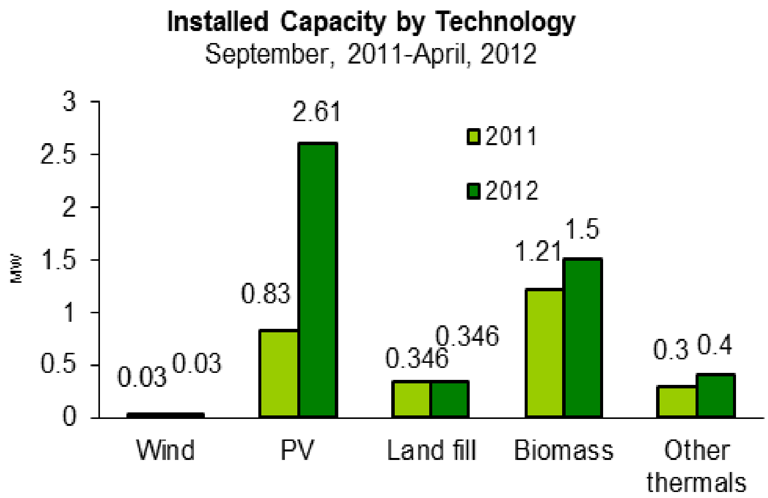

Figure 4, Renewable energy installed capacity (MW) in WB

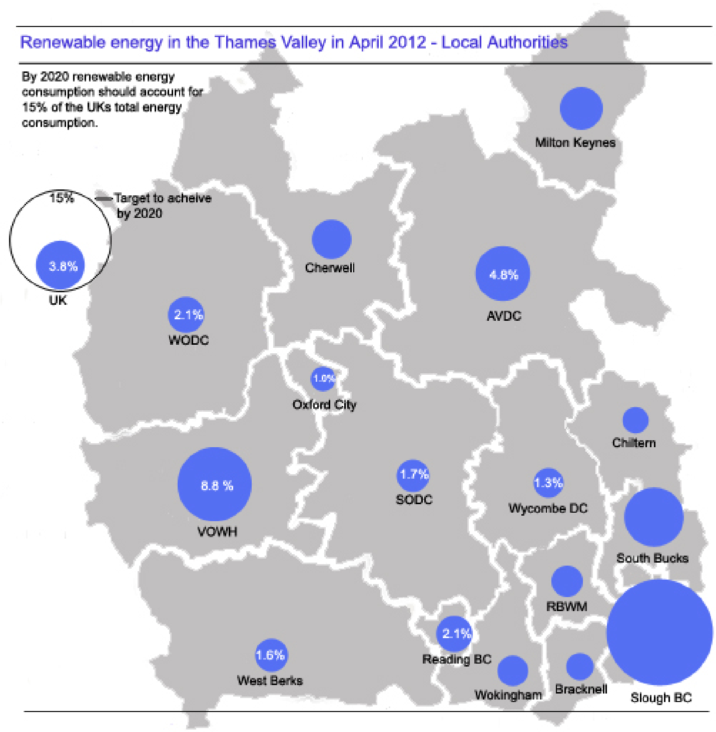

Figure 5, TV Local Authority percentage RE use map

6. The draft WB climate change strategy[4] makes no reference to a target for renewable energy use by 2020 but to come into line with national expectations should be seeking 15% of primary energy being met by renewables. Taking transport use into account as well as heating and power, WB currently stands at a very modest 1.6%.

[4] Draft version available through West Berkshire Council, due for release later in 2012

LOOKING AHEAD (2012 – 2020)

7. Given the very many constraints on development, what then might realistically be achieved over the next 8 years in WB? Taking a pragmatic view there are seen to be three general areas where WB might seek to bring forward and influence renewable energy projects:

- Projects based on existing developments and housing (so 'retrofit' technology')
- Projects based on planned housing and commercial developments/ infrastructure (so 'new' but integrated developments)
- Projects based on 'greenfield' sites (so completely 'new' developments)

8. The first two areas are less likely to have a significant additional visual impact over and above that anticipated by the existing or planned developments and as such should be less controversial. ***However, it is the third area where most untapped potential lies***. To note also that installing retrofit technology at scale can also be disruptive unless well planned and executed.

9. Looking ahead, there appears to be a desire to see more renewables being both generated and used as a part of a wider strategy to move towards a lower carbon economy and a more sustainable future for local citizens. The recently approved Core Strategy[5] adopted by West Berkshire Council (WBC) on Monday 16 July 2012 is central to considerations here. This follows the publication of the Inspector's Report into the examination of the document on 6 July 2012. The strategy is the lead document of the Council's new Local Plan and sets out the vision for the District, together with key policies to guide development over the period up to 2026. ***As such, it will have a major role in determining what can and what cannot move forward relating to new energy infrastructure.*** Also, of key significance is that the plan has been informed by extensive consultation and has been subject to sustainability appraisal to assess the social, environmental and economic impacts of policies. Hence, it can be used to 'take the temperature' of the District and to see what appetite there is for change enabling renewables to be adopted on a wider scale. The tie in with the Core Strategy and policy is explored in detail in the next section of the report.

WHAT MIGHT BE ACHIEVED BY 2020?

10. The 8 years to 2020 will pass quickly and hence if significant impact is to be achieved to increase the amount of renewable energy used then urgent action is needed. The LSP including the council can only expect to have limited influence so where best to focus efforts bearing in mind the rapidly evolving national energy policy and fiscal incentives directed at supporting greater use of renewables.

11. The following table sets out what might realistically be brought forward in WB by 2020. The following sections then go on to explore the numbers included in the table. Two scenarios are considered (1) a **Business as Usual** or BAU based on zero local intervention and allowing the market place to dictate progress – extrapolating largely from TV STATS figures and (2) a more progressive scenario based on LSP (including

[5] **http://www.westberks.gov.uk/CHttpHandler.ashx?id=31637&p=0**

WB council) prioritisation called **Business+** delivering a x3 benefit in terms of GWh produced.

BUSINESS AS USUAL (BAU)

BAU -What might be achieved in 2020 (number)

		PV/Solar thermal (kW_e)	Heat pumps (kW_{th})	Biomass (kW_{th})	Wind (kW_e)	Hydro (kW_e)	AD (kW_e)
Existing (Retrofit)	Domestic housing (each @)	1,619[6]	1,619	100	3[7]	0	0
		2	5	15	6	0	0
	Other (each @)	104[8]	20[9]	8[10]	5	1	3
		30	100	500	9	50	200
New (Integrated)	Domestic housing (each @)	950[11]	950	1[12]	0	0	0
		2	5	1000	0	0	0
	Other (each @)	0	0	0	0	0	0
		0	0	0	0	0	0
Greenfield (each @)		2[13]	0	0	1	1	0
		2,000	0	0	1,300	50	0

Table 3, 2020 Renewable Energy Projections (BAU)

BAU -What might be achieved in 2020 (output GWh)

		PV/Solar thermal	Heat pumps	Biomass	Wind	Hydro	AD	Total
Existing (Retrofit)	Domestic housing	2.84	21.27	1.31	0.02	0.00	0.00	**25.45**
	Other	2.73	5.26	7.01	0.06	0.18	2.10	**17.33**
New (Integrated)	Domestic housing	1.66	12.48	1.75	0.00	0.00	0	**15.90**
	Other	0.00	0.00	0.00	0.00	0.00	0	**0.00**
Greenfield		3.50	0.00	0.00	2.96	0.18	0.00	**6.64**
		10.74	**39.01**	**10.07**	**3.04**	**0.35**	**2.10**	**65.32**

Table 4, 2020 Renewable Energy Projection (BAU, GWh)

[6] 10% of all suitable houses within West Berkshire
[7] Continued on a trend from TV Stats
[8] 10% of all suitable commercial/educational/industrial buildings within West Berkshire
[9] 2% of all suitable commercial/educational/industrial buildings within West Berkshire
[10] 1 secondary school per year to have a biomass boiler installed
[11] 20% of all new houses planned within West Berkshire
[12] 1 District heating scheme within the new housing developments within West Berkshire
[13] 2 Ground mounted PV systems; Thatcham and ....

12. Irrespective of targets, the potential for positive change affecting most lives in WB in the short term and increasing quality of life lies here. Looking holistically at current housing stock and retail/ commercial/ industrial buildings and improving energy efficiency as well as introducing micro-renewable energy technology must have a high priority. Some technologies are ideally suited for retrofit and include solar thermal and PV. Some technologies require more consideration but can be equally effective and include biomass/ wood and heat pumps. Heat pumps in particular might provide a significant potential. The 'Renewable Heat Incentive' (RHI) is seen to be an important consideration in the short term at least to mobilise heat based renewables.

13. Existing planning rules can help to encourage change and the strict enforcement of Building Regulations where changes are proposed (e.g. extensions to existing stock) is essential to improve stock over a period of time. Much micro-technology is within the bounds of 'permitted development' apart from sensitive locations, listed buildings and designated areas. Here too, a positive attitude is also needed.

14. Of great importance is to ensure that WB works effectively with the 'Green Deal' and providers as this is rolled out over the coming months. The incentives within this new government initiative should revolutionise the incorporation of micro-renewables allowing the momentum established for PV to carry over to other technologies as outlined in paragraph 12 above.

15. The table above footnotes expectations for this scenario, using a figure of 10% intervention for domestic and commercial retrofit, 20% for all new build and a modest introduction of biomass in schools (8) with very limited introduction of large scale wind (1 turbine) and solar farms (2). A single low head hydro scheme is also envisaged.

16. One District Energy scheme is considered possible at scale for a new development. This might be a hybrid scheme also using gas to cope with peak loads and perhaps as a Combined Heat and Power (CHP) project. Such a facility serving around 400 dwellings would require a land footprint of around 200sq.m, with boiler flues likely to be over 8m above ground level.

17. New commercial/ industrial developments are unknown but could contribute.

18. Energy from waste projects may also contribute to the total but are not considered here. Currently there is a small contribution from landfill gas, but this will diminish over time and become insignificant by 2020. MSW digestion or advanced processing (e.g. through pyrolysis or gasification) is also possible, the latter already proving highly contentious (proposed facility at Chieveley). Hence, there is the possibility of a modest contribution by 2020 and this needs to be considered in relevant waste strategies.

PROGRESSIVE (BUSINESS+)

Progressive Business -What might be achieved in 2020 (number)

		PV/Solar thermal (kW$_e$)	Heat pumps (kW$_{th}$)	Biomass (kW$_{th}$)	Wind (kW$_e$)	Hydro (kW$_e$)	AD (kW$_e$)
Existing (Retrofit)	**Domestic housing (each @)**	3,239[14]	3,239	250	10	0	0
		2	5	15	6	0	0
	Other (each @)	209[15]	104[16]	25[17]	25	2	8
		30	100	500	9	50	200
New (Integrated)	**Domestic housing (each @)**	1,900[18]	1,900	3[19]	0	0	0
		2	5	1000	0	0	0
	Other (each @)	5	10	5	5	0	0
		25	100	500	15	0	0
Greenfield (each @)		15[20]	0	1[21]	10	3	3
		2,000	0	2,000	1,300	50	200

Table 5, 2020 Renewable Energy Projections (Progressive Business)

Progressive Business -What might be achieved in 2020 (output GWh)

		PV/Solar thermal	Heat pumps	Biomass	Wind	Hydro	AD	Total
Existing (Retrofit)	**Domestic housing**	5.67	42.56	3.29	0.08	0.00	0.00	**51.60**
	Other	5.49	27.33	21.90	0.30	0.35	5.61	**60.98**
New (Integrated)	**Domestic housing**	3.33	24.97	5.26	0.00	0.00	0	**33.55**
	Other	0.11	2.63	4.38	0.10	0.00	0	**7.22**
Greenfield		26.28	0.00	3.50	29.61	0.53	2.10	**62.02**
		40.89	**97.49**	**38.33**	**30.08**	**0.88**	**7.71**	**215.36**

Table 6, 2020 Renewable Energy Projection (Progressive Business, GWh)

[14] 20% of all suitable houses within West Berkshire
[15] 20% of all suitable commercial/educational/industrial buildings within West Berkshire
[16] 10% of all suitable commercial/educational/industrial buildings within West Berkshire
[17] 3 biomass installations in commercial/educational/industrial per year
[18] 40% of all new houses planned within West Berkshire
[19] 3 District heating scheme within the new housing developments within West Berkshire
[20] 10 Ground mounted PV systems.
[21] 1 independent Biomass system, electricity only!

19. Under this enhanced scenario, the rate of introduction of technology to existing housing and other existing buildings is doubled to 20% by 2020. For new housing up to a 40% intervention rate.

20. The real impact of this scenario is in the deployment of large volumes of micro-technologies (solar and heat pumps) boosted by a modest number of larger scale solar (15), wind (10 turbines) and biomass projects (25) including District Energy schemes (5). Included is one 'stand alone' high efficiency wood fired power station and 3 low head hydro schemes.

21. **New developments** offer the opportunity for integrated use of renewable energy technology often at scale with the concomitant benefits of lower costs of installation and lower profile of introduction. It is essential that all major new developments incorporate a significant level of renewables as such opportunities occur rarely and are generally 'once in a lifetime' events. Planning policy needs to fully embrace this requirement.

22. Of particular interest with larger developments is the use of District Energy (DE) schemes where biomass might be used as the predominant fuel alongside natural gas.

23. In WB, there are a few notable developments coming forward such as Newbury Racecourse (1,500 homes) and Sandleford (2,000 homes) plus regenerating the centre of Thatcham to provide higher quality shopping and facilities for residents and visitors. In Thatcham there will also be an additional 900 homes, Theale 350 homes and within the eastern part of the District, a broad location for development is identified on the, taking in the Eastern Urban Area of Tilehurst, Calcot and Purley on Thames, as well as the rural service centre of Theale.

24. The racecourse contains a commitment to 'generate on-site renewable energy'. Such commitments need to be followed up and a minimum target percentage should be included on a pro rata basis bearing in mind 15% of usage should come from renewables by 2020.

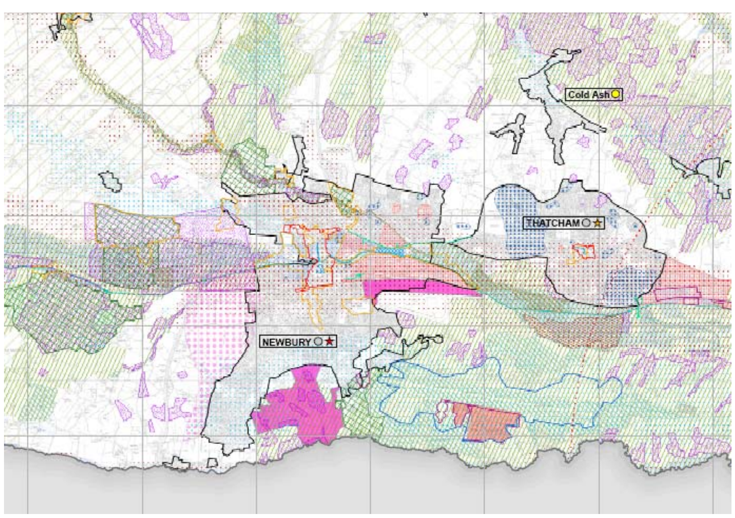

Figure 6, Map showing the position of two major developments in WB (lilac)

25. The most controversial and difficult to establish will be the **large, independent schemes** featuring wind, solar and biomass. Clusters of up to 3 x 1.3MWe wind schemes might sensibly fit within the local landscape as has been extensively discussed in several SE England renewable energy strategy documents in the recent past.

26. Large solar arrays may be less difficult to bring forward given their lower profile and ease of fit within the landscape. A biomass power station would need to have good transport links to meet fuel supply needs and would entail considerable impact (scale, stack/ emissions, traffic movements).

27. In order to support an expansion in biomass/ wood fuel use in West Berkshire (with or without the stand alone facility) there will be the need to develop wood fuel supply infrastructure. In particular, a 'Tree Hub' that is capable of supplying high quality fuel on a consistent basis. This would then draw on a myriad of local suppliers and help boost the local rural economy.

POTENTIAL RENEWABLE ENERGY TARGETS

28. Based on the scenarios examined, WB might expect to be able to achieve a renewable energy target of between **6 and 11%** (based on primary energy needs so heat, power and transport) depending upon the level of positive support of new technology introduction.

29. The ranges are illustrated below showing the interplay of the BAU and Business+ strategies for heat and power plus heat, power and transport when set against three possible future energy consumption estimates (based on projecting forward from 2012 at the same level, straight line based on 2005 – 2009 and a middle case reduction).

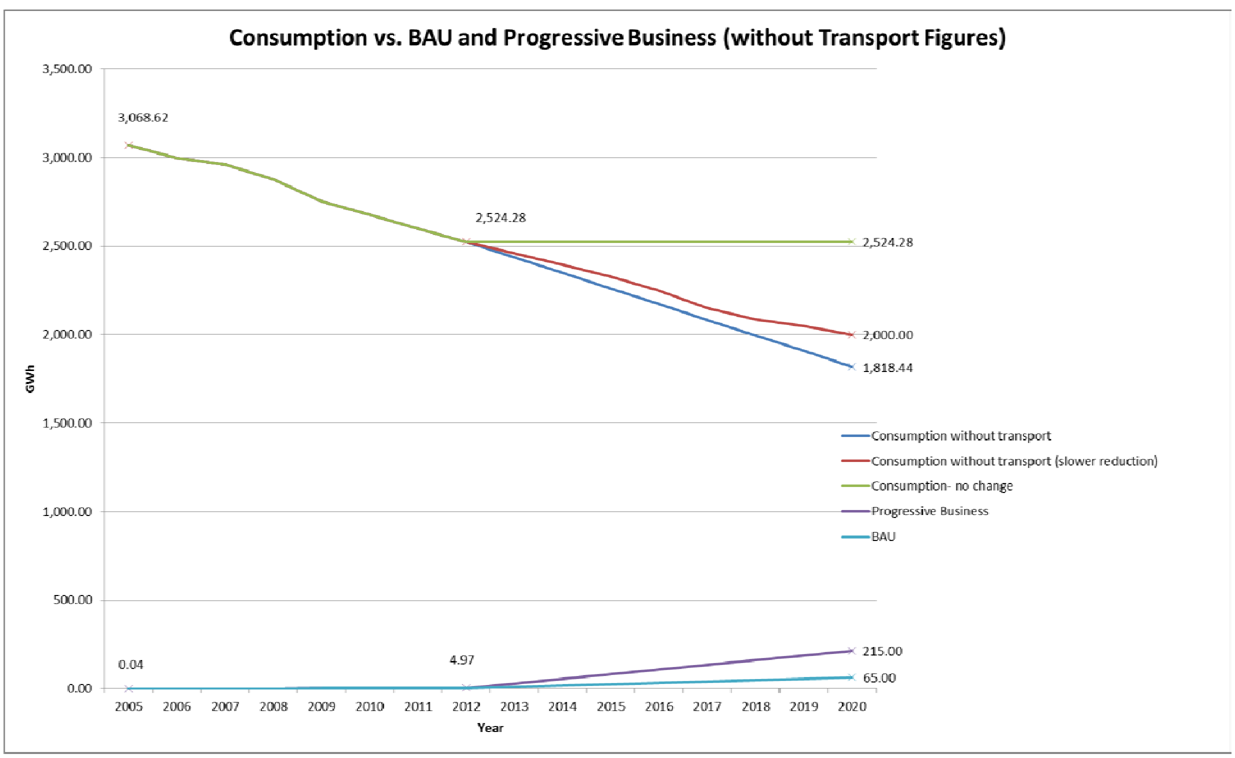

Figure 7, Consumption vs. BAU and Progressive Business (without Transport Figures)

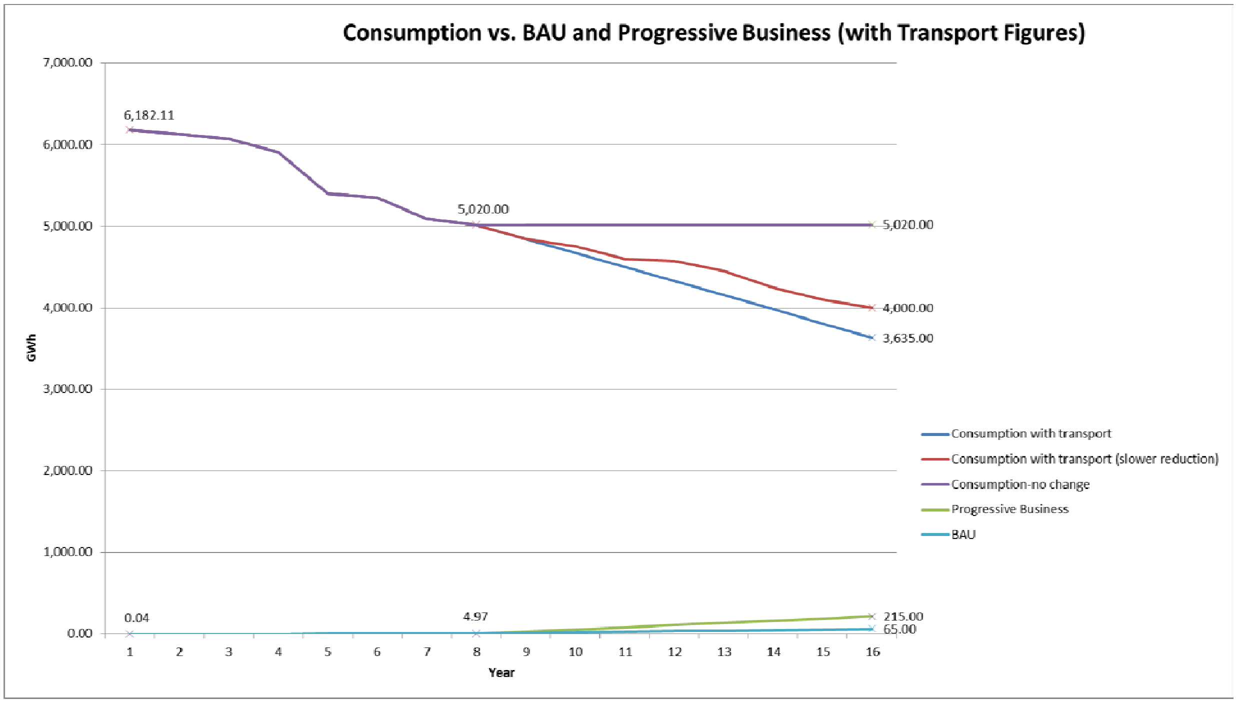

Figure 8, Consumption vs. BAU and Progressive Business (with Transport Figures)

30. The Table below explores the estimated levels of renewable energy contribution that might result from bringing forward the packages of projects outlined earlier. Note the significant impact that the national programme extending renewable energy use with transport fuels (based on the Biofuels Directive seeking 10% of fuels to be renewable by 2020) has on the totals. However, a note of caution when interpreting these figures since there is some debate as to whether this Directive will be fully enforced.

	Heat and Power without Transport	Heat and Power with Transport
Lowest consumption vs. progressive Business	11.00%	10.89%
Slower reduction of consumption vs. progressive business	10.00%	10.37%
No change in consumption vs. progressive Business	8.50%	9.26%
Lowest consumption vs. BAU	3.60%	6.76%
Slower reduction of consumption vs. BAU	3.25%	6.62%
No change in consumption vs. BAU	2.50%	6.27%

Table 7, Percentage of heat, power and transport consumption vs. BAU and Progressive business figures

QUESTIONS RAISED BY THE STRATEGY DOCUMENT

1. TARGETS: To what extent does WB wish to harness local renewable energy resources? What is the political appetite for change? Is reaching 15% by 2020 a serious consideration – this would be in line with national endeavours? Is a lower target seen to be acceptable as WB is land locked and does not have access to marine based renewables? 11% would seem to be achievable but only with a commitment to introduce modest levels of large scale technology. 8% would be a more realistic figure if micro-

renewables were deployed at volume. What resources has WB available to step up activity to achieve higher targets?

2. Working with the AONB needs exploring to see to what extent technology might be introduced within its boundaries. Note recent appeal decision (see Annex 2) reinforcing concerns about visual impact. Nevertheless, there are some good examples of renewables in other environmentally sensitive locations (see Annex 3). Hence, perhaps compromises can be reached?
3. GREEN DEAL: How will WB ensure that the maximum advantage is taken of the Green Deal? This will be essential to create the volume micro-renewables deployment envisaged.
4. ESCo: should WB create an Energy Service Company to help mobilise resources, show leadership and innovate? This might be wholly owned or a partnership model. Local ownership might be one way to counter local opposition to developments transferring some of the benefits to those most impacted.
5. COUNCIL INVESTMENT: should the council be investing in exemplar projects (e.g. a solar farm or biomass boiler/ tree hub) to help kick start local activity? Should the council be investing in its own property portfolio and demonstrating best practice?
6. SOCIAL HOUSING: How will WB ensure that the best deal is obtained for people most at risk of fuel poverty? Should there be closer liaison on energy with HAs and private landlords.
7. PROMOTION/ MARKETING: How will WB raise the profile of renewables and continue to track progress? Should there be a separate energy campaign? If an ESCO is created this might be used as the vehicle.
8. PRIVATE SECTOR: How best to promote to this sector and engage? Use local exemplars such as Waitrose to show benefits. Work with AWE.
9. DISTRICT ENERGY: should a review be carried out to explore local potential in detail a document to examine decentralized RE is alluded to in the core strategy)?
10. PLANNING: are the Core Strategy and policies sufficiently robust to deliver the necessary change (see next section)?

2. LINKAGE WITH WB CORE STRATEGY (2012)

The recently approved Core Strategy[22] adopted by West Berkshire Council (WBC) on Monday 16 July 2012 is central to how renewables might proceed in the short to medium term. This adoption follows the publication of the Inspector's Report into the examination of the document on 6 July 2012. The strategy is the lead document of the Council's new Local Plan and sets out the vision for the District, together with key policies to guide development over the period up to 2026. **As such, it will have a major role in determining what can, and what cannot move forward relating to new energy infrastructure.** Also, of key significance is that the plan has been informed by extensive consultation and has been subject to sustainability appraisal to assess the social, environmental and economic impacts of policies. Hence, it can be used to 'take the temperature' of the District and to see what appetite there is for change enabling renewables to be adopted on a wider scale.

The major reference in the strategy revolves around Policy CS15 as seen below. This concentrates on the potential to make new developments more energy efficient and where possible, to utilise renewable energy technologies. The idea of 'decentralised renewable energy' is to be investigated through a future Local Plan Document it is stated. This will also highlight the potential for any commercial scale RE opportunities.

Policy CS15 – Sustainable Construction and Energy Efficiency			
Linked Objectives - 1: Tackling Climate Change, 2: Housing Growth			
Core Strategy Outcome	Delivery Indicators	Target	Data Source
New development should support the aim of reducing CO_2 emissions	The level of renewable, low or zero carbon energy will be calculated via the design SAP [96] or SBEM [97] test, whichever is the most appropriate, at the planning application stage	Positive trend	Thames Valley Energy statistics and in house monitoring.
	Number and percentage of developments meeting required BREEAM and Code for Sustainable Homes standard	100% of eligible applications	In house monitoring

Figure 9, Policy CS15

There is the inherent understanding that in order to reduce local carbon emissions and meet national targets, a policy approach that supports and reflects the 'significant challenge ahead needs to be adopted'. Any renewable energy schemes, it states, should also be efficient –

[22] http://www.westberks.gov.uk/CHttpHandler.ashx?id=31637&p=0

although how this is to be defined and to what purpose is unclear. This policy is to be delivered through the Development Management process. The amount of renewable energy generation and developments meeting the policy criteria is to be reported in the Annual Monitoring Report. Finally, the council intends to achieve **a presumption in favour of sustainable development** (in accordance with the National Planning Policy Framework which was issued in March 2012) through application of this policy.

Currently, Code Level 3 or 4 is required for new build. Then progressively from 2013, Code Level 4 will be required and then Code Level 6 by 2016 (zero carbon). These changes will ensure that increasing amounts of micro-renewables are deployed. Likewise for non-residential, from 2013 BREEAM excellent will be needed reaching zero carbon by 2019. Although of slower impact, this change should encourage the greater deployment of renewable energy technology.

So, is this policy strong enough to achieve the dramatic early change that might enable WB to move up the league and to achieve a contribution in RE terms that would keep pace with national targets (so 15% by 2020)? The Core strategy recognises that WB is one of the highest electricity users in the SE, is in the upper quartile of local authorities for CO_2 emissions within the region and has high fuel poverty levels compared to other authorities. This is clear evidence and justification that West Berkshire needs to do more to meet national targets in relation to CO_2 emissions reduction. Hence, should the Council be looking to show greater leadership by adopting best practice across its own property portfolio and by influencing other stakeholders?

Under 'Strategic Objectives' the following relevant statement is also made: (1) To **exceed national targets for carbon dioxide emissions reduction** and deliver the District's growth in a way that helps to adapt to and mitigate the impacts of climate change. *Since renewables are one of the most effective ways of reducing carbon emissions this would tend to point to the need to seek delivery of higher targets for renewable energy (so at least Business+).*

A major challenge relates to the considerable non-technical barriers that restrict developments of significant scale across much of the District. For example, some 74% of the land area lies within an 'Area of Outstanding Natural Beauty' and as such has considerable influence on the scale and nature of any developments put forward within its boundaries. The AONB is mindful of the need to respond to the challenges of climate change, however, this does not include allowing developments that might negatively impact on the landscape or character of the area.

In effect this policy approach massively reduces the potential to generate RE within West Berkshire. Is this reasonable and what weight should be given to such policies and their impact on Core Strategy objectives?

RELATED PLANS

North Wessex Downs AONB Management Plan: The Plan is driven by the primary purpose of AONB designation - **conservation and enhancement of natural beauty**. It places a strong emphasis on the delivery of an integrated and sustainable approach, with vibrant rural economies and communities.

NWDAONB Vision: A vision of vast, dramatic, undeveloped and locally distinct chalk downlands with extensive areas of semi-natural chalk grassland, contrasting with well-wooded plateaux, arable lands and intimate and secluded valleys, all rich in biodiversity and cultural heritage; a national landscape that stands apart from the increasing urban pressures that surround it; where people live, work and relax; and where visitors are welcomed and contribute to a vibrant rural economy.

On sustainable development
• Ensuring that all decisions take account of climate change.
• Taking an integrated approach by thinking of the environment, economy and community together to identify, encourage and support those aspects of the local economy that can positively contribute to maintaining and enhancing natural beauty.
• Encouraging the integrated management of land that delivers multiple benefits such as protection of water resources, enhanced flood control, habitat creation, and landscape enhancement.
• Promoting landscape-scale responses to ensure that the protection of the environment permeates all aspects of land use rather than being considered on isolated sites.

Acceptable mitigation measures include:
• Increased reliance on renewable energies, biomass heating from local fuel stocks and appropriately scaled renewable energy generation.
• Enhanced domestic and commercial
energy efficiency.
• Greater availability of alternative fuels for cars, commercial vehicles and plant machinery e.g. batteries, LPG, bio-fuels.
• Improved availability and accessibility of sustainable modes of transport (bus services, cycling).
• Greater use of timber from sustainable woodland in construction .
• Carbon capture as an objective of habitat creation and management of woodlands.

The Atomic Weapons Establishment (AWE) has two bases in this area, at Aldermaston and Burghfield. AWE is an important provider of local jobs but has implications for the future level of development in the immediate area.

In the interests of public safety, residential development in the inner land use planning consultation zones of AWE Aldermaston and AWE Burghfield is likely to be refused planning permission by the Council when the Office for Nuclear Regulation (ONR) has advised against that development. All other development proposals in the consultation zones will be considered in consultation with the ONR, having regard to the scale of development proposed, its location, population distribution of the area and the impact on public safety, to include how the development would impact on “Blue Light Services” and the emergency off site plan in the event of an emergency as well as other planning criteria.

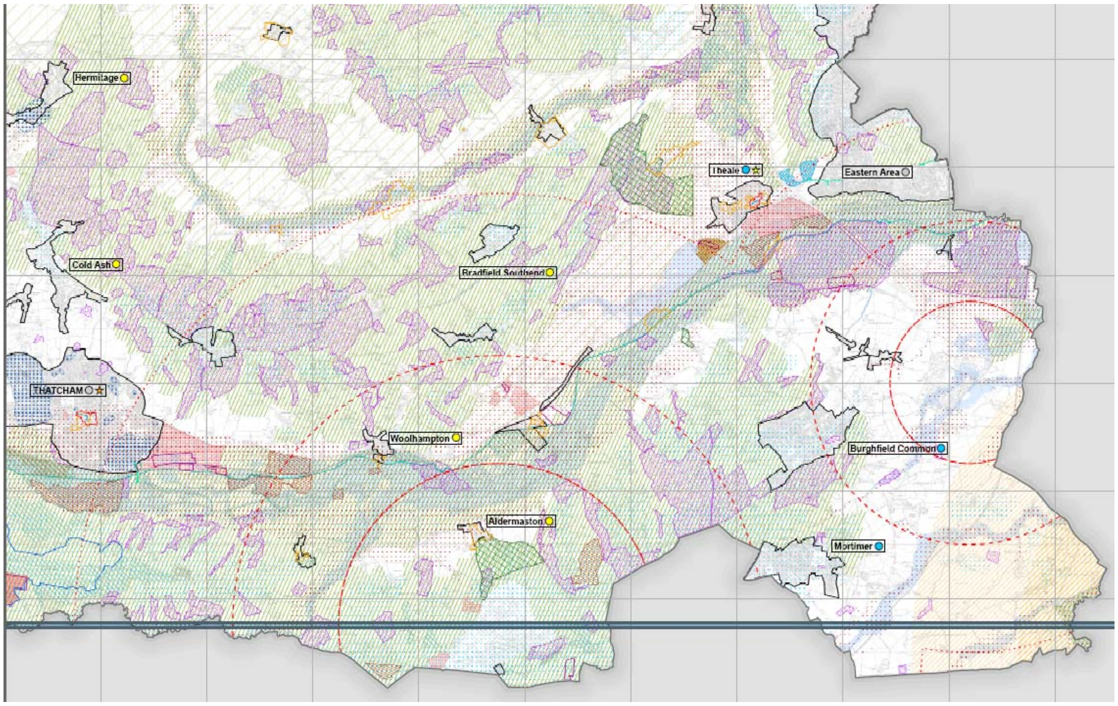

Figure 10, AWE consultation zones

ANNEX 1: RENEWABLE ENERGY RESOURCE ASSESSMENT

1 INTRODUCTION

1.1 Background

Renewable energy (RE) can play a major role in sustainable development and mitigating Climate Change effects. As the government is bound legally to source a proportion of its energy from renewable sources, it is imperative that all local governing bodies take action to help meet the target. This requires long term strategies such that targets can be achieved in the most economical and environmentally friendly way. Above all, with the UK becoming a net importer of fuel in 2004[23], the UK needs to diversify and build up its indigenous energy sources and thereby reduce the reliance on foreign fuels including coal, gas and electricity.

The key drivers for renewable energy can be summarised as:

- Climate Change mitigation (emissions reduction)
- Energy security and sustainability
- Local employment, business growth and economic benefit

The report is the result of desktop study carried out to assess the renewable energy resource that can be realised in the short term in West Berkshire and the possibility of harnessing such resources. During the assessment, wherever possible, every effort has been made to follow the recommendations made by the DECC methodology[24] for resource assessment as closely as possible.

Previously, Thames Valley Energy (TVE) has carried out a series of strategy projects embracing West Berkshire over the past 12 years on behalf of the following organisations:

- Government Office of the South East (GOSE) on behalf of DTI
- South East England Regional Assembly (SEERA)
- South East England Partnership Board (SEEPB)
- South East England Development Agency (SEEDA)

These studies have given a solid foundation to understanding the potential for West Berkshire. Further work to refine the study and to give a clearer view of local conditions has been required. In particular, to make sense of the constraints imposed by the North Wessex Downs AONB.

1.2 Objectives

This strategy is set out in order to help shape the future development of renewable energy in West Berkshire and focuses mainly on renewable electricity and heat. The study maps out the level of deployment of different energy resources across West Berkshire.

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[23] www.parliament.uk/briefing-papers/SN04046.pdf
North sea declining: Link
[24] Renewable and Low-carbon Energy Capacity Methodology. Methodology for the English Regions, January 2010 [available at: http://www.decc.gov.uk/assets/decc/what%20we%20do/uk%20energy%20supply/energy%20mix/renewable%20energy/ored/1_20100305105045_e_@@_methodologyfortheenglishregions.pdf]

The key objective of this strategy is to illustrate how West Berkshire can move towards a more sustainable (low carbon) and energy secure future. The report aims to:

- Show the current level of renewable energy deployment in West Berkshire
- Illustrate the potential of the renewable energy resource in West Berkshire
- Examine constraints to deployment
- Consider target setting to underpin future deployment
- Provide some insights for other related strategies which directly affect the district's sustainability

1.3 Policy background

The UK Government is committed to progressively reducing the nation's carbon emissions resulting from the production and use of energy. The Climate Change Act 2008 sets out a binding UK national target for greenhouse gas emission reduction of 34% by 2020 and 80% by 2050, as compared to 1990 levels. As a part of this overarching strategy, the UK is seeking to satisfy 15% of energy use through deploying renewable energy technology rising to some 50% by 2050.

The EU by contrast, aims to tackle Climate Change by sourcing 20% of its energy (for transport, electricity and heat) by 2020 from renewable energy. The UK government has agreed to assist the EU in the Climate Change effort by signing up to EU Renewable Energy Directive (2009) and committing itself to sourcing 15% of its total primary energy through sustainable means. The Low Carbon Transition Plan (2009) along with Renewable Strategy (2009) sets out how the UK is going to set targets and reduce emissions. The lead scenario in the strategy anticipates 30% of electricity, 12% of heat and 10% of transport energy to come from renewable source (making 15% of all energy use).

The Energy Act (2008) has put in place financial incentives to stimulate deployment in the renewable sector viz. The Feed-in-tariff (FIT) and the Renewable Heat Incentives (RHI) from which private, public and even domestic consumers can benefit. Additionally, the 'Green Deal' is to be introduced in autumn 2012 which will have significant implications for investment in the sector.

Regional Planning Guidance, since rescinded nationally, nevertheless helped to set a benchmark for renewable energy development through the South East Plan. This aimed to have 209MW of installed capacity in the Thames Valley by 2016. The target set for West Berkshire was 18.5MW by 2016[25]. However, by the end of 2011, the district was well short of this figure (see later).

1.4 Limitation

This report seeks to provide estimates of the technical/ theoretical potential for renewables in West Berkshire concentrating on those technologies and resources that can make a real difference to heat and power generation, namely:

[25] Council Motion: Renewable Energy in West Berkshire. [Link to the file]

- Wind power (electricity)
- Biomass and waste (heat and electricity)
- Solar power (heat and electricity)

Other technologies that can have a limited impact include low head hydro (electricity) and heat pumps (heat). Waste (MSW) is dealt with elsewhere and will only be referred to here.

Various constraints are then applied to show a more pragmatic view of the local potential. These constraints are discussed but it is not possible to consider all of these in detail given the required brevity of the assessment. Nevertheless, it is possible to give a reasonable indication of the actual capacity of the district.

2 WEST BERKSHIRE AREA

The district known as West Berkshire covers an area of 272 square miles (704 km2)[26] and has a total population of approximately 154,000[27] giving a population density of about 218/ km2, making West Berkshire one of the least densely populated areas in the South East. In 2001, census data indicated a population of 144,500 showing that there is steady growth in numbers. Newbury and Thatcham are the most densely populated areas with a combined population of around 50,000. There are approximately 64,790[28] residential properties in the district.

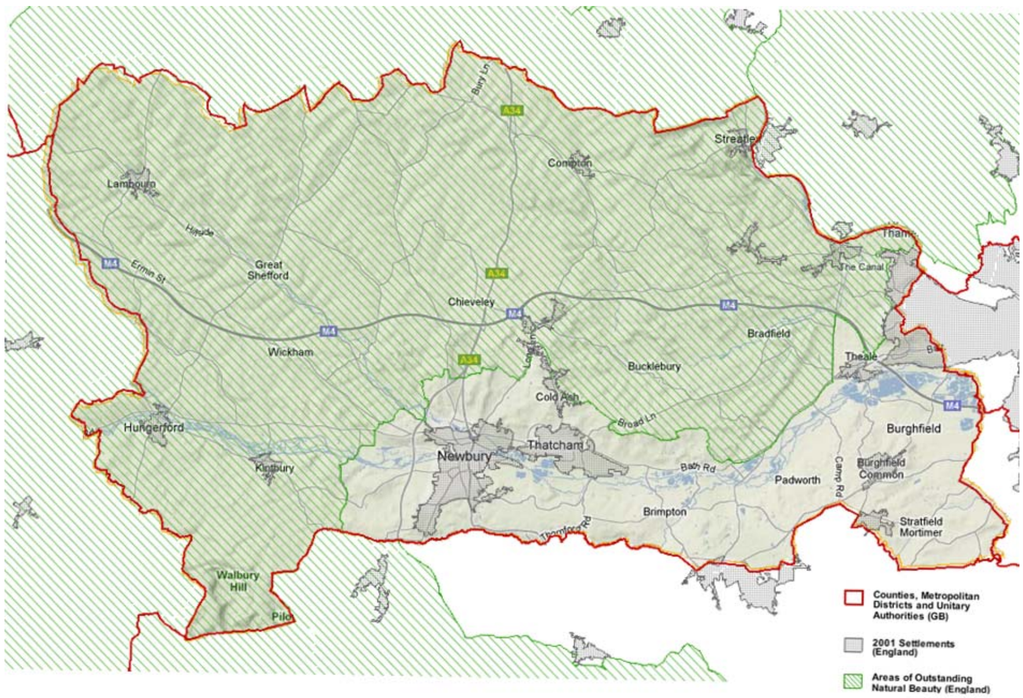


Figure 11, Boundaries of North Wessex Downs AONB (in green) West Berkshire district (in red)

Approximately 74% of the district lies within the boundary of the North Wessex Downs AONB which is a protected landscape based upon its scenic beauty and ecological value. The remaining area includes the towns of Newbury and Thatcham plus is also the home of the Atomic Weapons Establishment (AWE). There are a number of airfields including RAF Welford where restrictions will apply. Each of these designations has major implications for the deployment of RE schemes and will be discussed later.

[26] Westberks.gov.uk: http://www.westberks.gov.uk/CHttpHandler.ashx?id=29521&p=0

[27] Office of National Statistics: http://www.neighbourhood.statistics.gov.uk/HTMLDocs/Excel%20Local%20Profiles/Demography%20Local%20Profile.xls

[28] Communities and Local Government (CLG): http://www.communities.gov.uk/housing/housingresearch/housingstatistics/housingstatisticsby/stockincludingvacants/livetables/

3 WEST BERKSHIRE ENERGY USAGE

3.1 Energy Usage

The total energy consumption of West Berkshire in 2008 is shown graphically below.

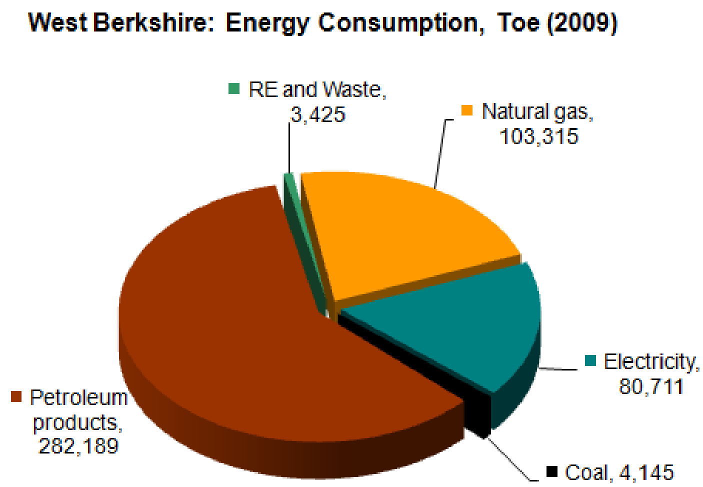


Figure 12, Energy Consumption of West Berkshire (Source: DECC2008)

In 2010, West Berkshire used approximately 342 GWh of electricity and 712 GWh of gas in the domestic sector. Additional data is shown in table 8 below from which the total CO_2 emissions of the district for 2010 (from gas and electricity use) can be estimated. The CO_2 emissions were 484 kilo-tonnes (from electricity) and 246 kilo-tonnes (from the gas usage[29]). The district also has additional CO_2 emission of approximately 83 kilo-tonnes from heating oil and coal usage. These emission figures do not include emissions from other sources such as road transport.

	Electricity (kWh)		Gas (kWh)	
	Total	Ave. /household	Total	Ave./ household
Domestic	341,921,619	6,199	712,040,739	16,132
Non-domestic	578,674,917		486,477,712	
Total	920,596,536		1,198,518,451	

Table 8, Estimated gas and electricity demand in West Berkshire (2010)[30, 31].

In addition, the district consumed 3.3 ktoe and 18.7 ktoe of coal and heating oil respectively in 2009. Based on these consumption data, the per capita CO_2 emissions (excluding road transport) of the district is approximately 5 tonnes per year which is around 60% more than the national average[32].

[29] Conversion factor: 0.526kg/kWh (electricity) and 0.205kg/kwh (gas). This factor is used throughout the report.
[30] Compiled from MLSOA data published in March 2012 found at:
http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/regional/mlsoa_llsoa/mlsoa_2010/mlsoa_2010.aspx
or http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/regional/gas/gas.aspx (loads faster)
[31] http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/regional/regional.aspx
[32] This accounts for gas and electricity usage only. Transport emission is not included.

3.2 Existing use of Renewable Energy Systems

TVE has monitored the use of renewable energy across the SE Region for 12 years through the SEE-STATS and TV STATS projects. Currently, TVE continues to monitor project progress across the Thames Valley, including West Berkshire. This data collection and collation feeds into the national database RESTATS maintained on behalf of DECC.

Towards the end of 2011, there were 273 renewable energy installations in West Berkshire with a combined installed capacity of 2.7 MW. This includes both heat and power and supplied approximately 1% of the district's total energy needs. Figure 13 shows the relative capacity of the technologies installed in the district. The current installed capacity is about 15% of the previously designated 2016 target.

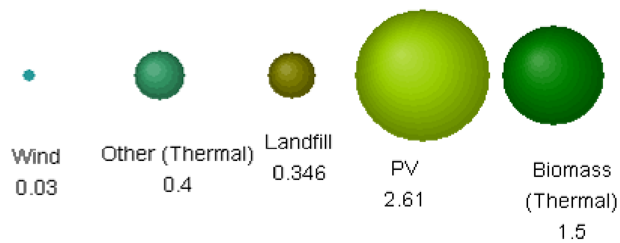


Figure 13, Installed capacity of current projects in West Berkshire (in MW)

Figures 6 and 7 show heat usage by the sector and the residential heat demand in the district as taken from the National Heat Map.

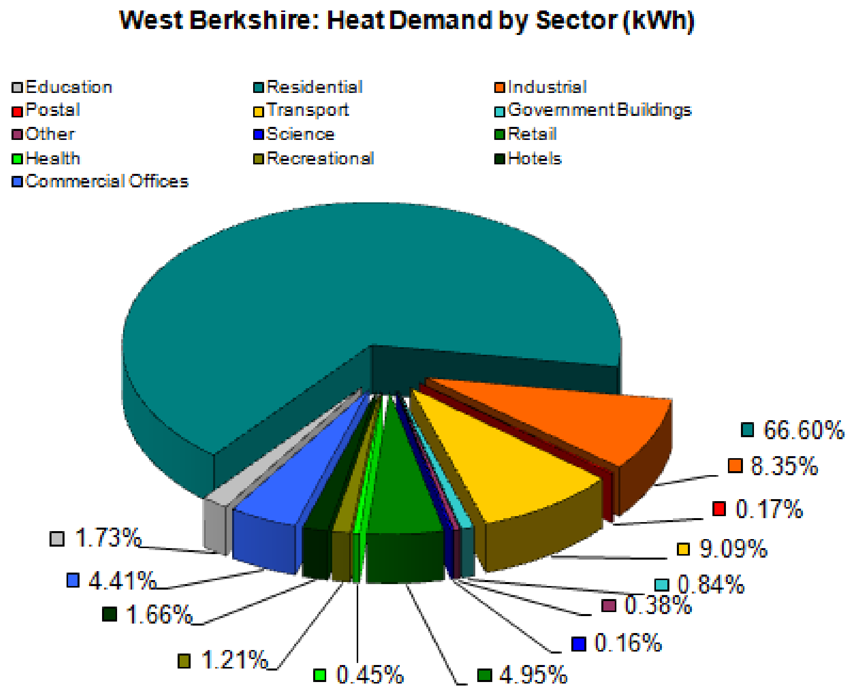


Figure 14, West Berkshire heat usage-Heat usage by sector.

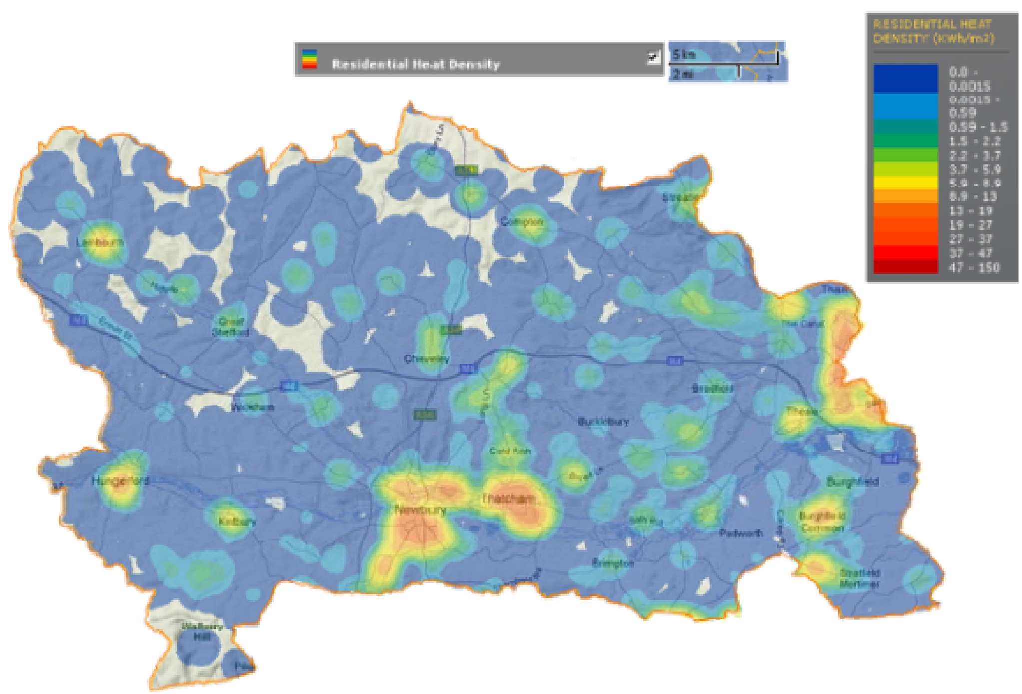


Figure 15, West Berkshire heat usage map, residential heat density[33]

Maps: [Link]()

[33] DECC. National Heat Map

Figures 8 and 9 are snapshots of current energy state of the district. It is apparent that majority of the energy comes from conventional sources and renewable energy constitutes only a small fraction of it.

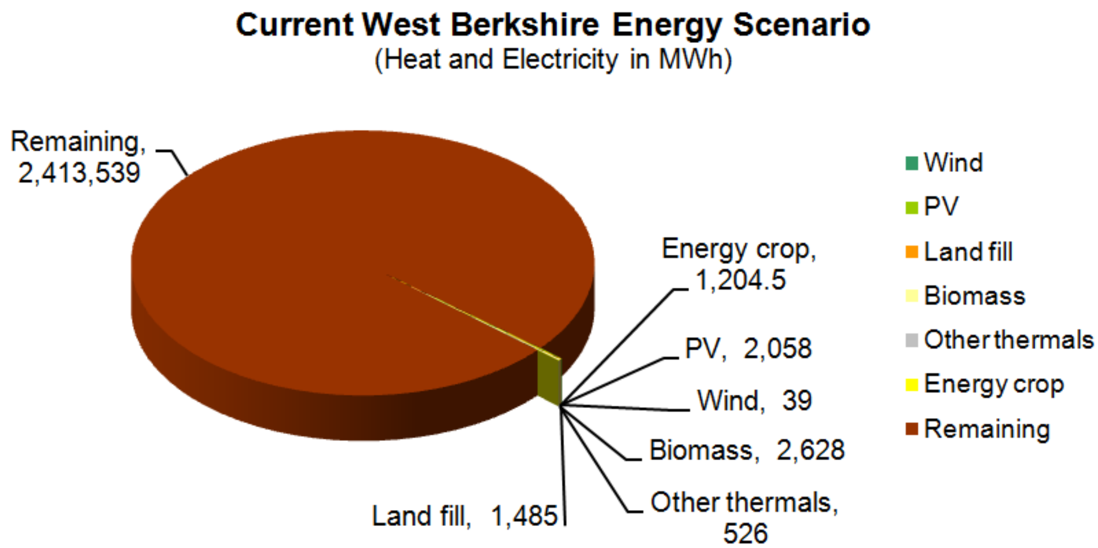


Figure 16, Current mix of the district pie chart

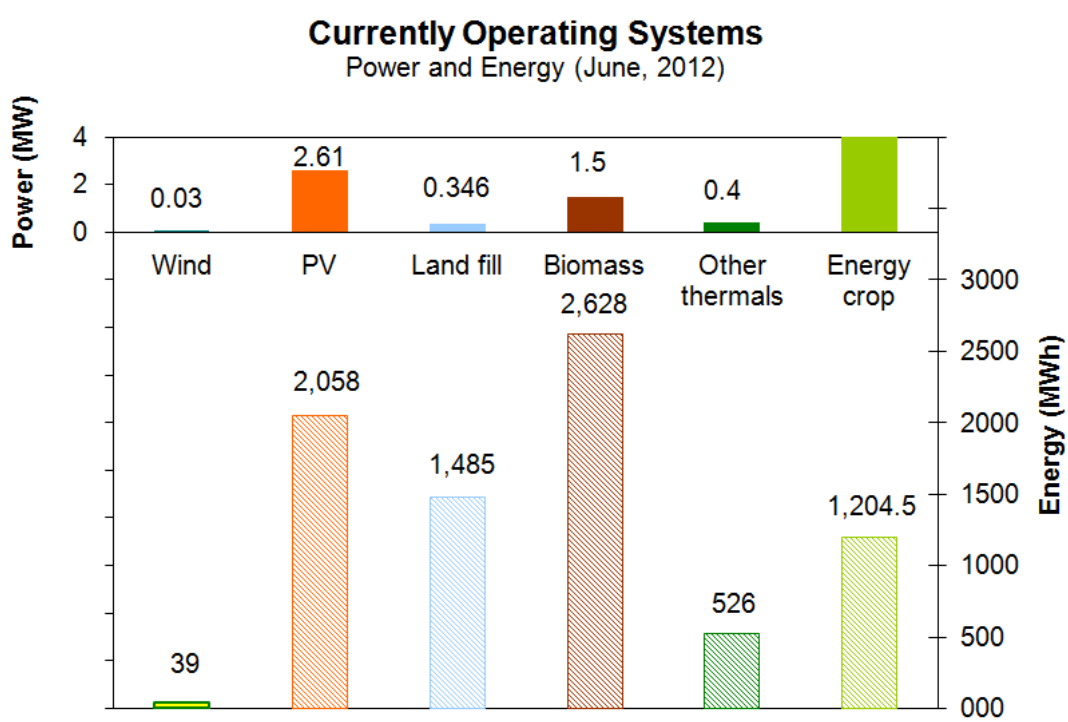


Figure 17, Current renewable energy capacity and associated energy generation with West Berks

However, renewable installations have increased in the past year, notably in the solar PV sector which has grown by a factor of three (Figure 17). Other technology seems to show little or no increase in capacity between the periods.

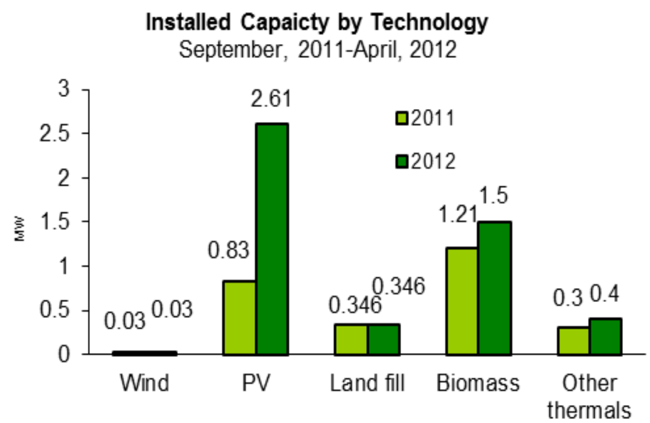


Figure 18, Installed capacity of various technologies in the district (2011-2012)

Figures 11 and 12 show WB's current consumption and compares it to current generation and relevant target the district can work towards.

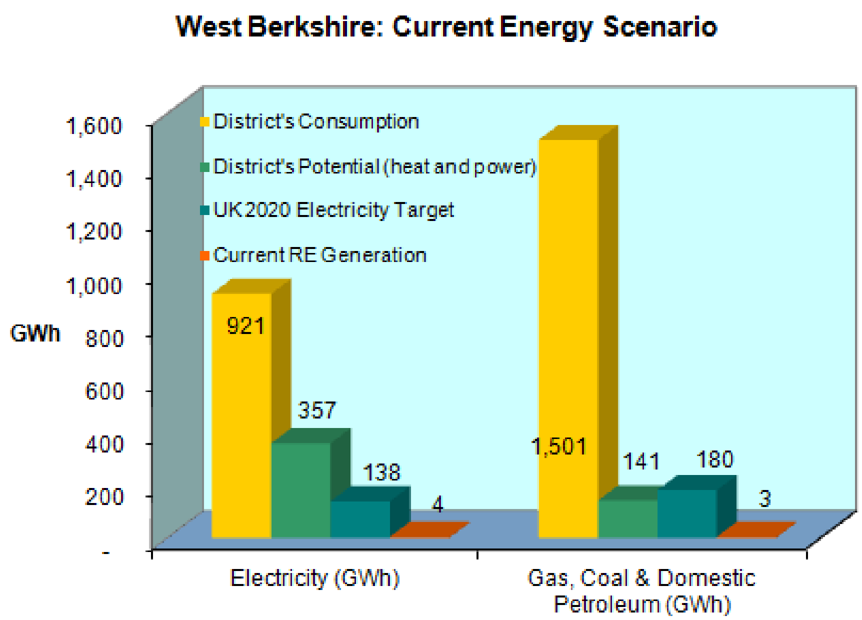


Figure 19, Current energy consumption of the district

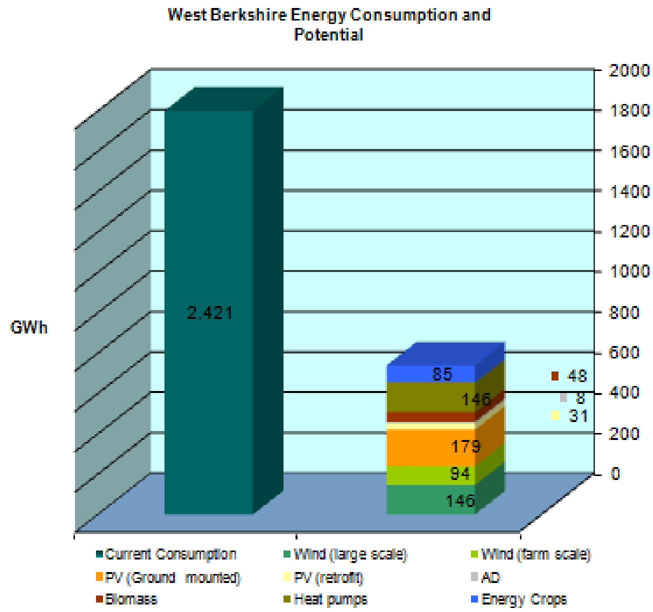


Figure 20, Current energy generation, consumptions and UK government targets. The potential capacities are subsequently discussed below.

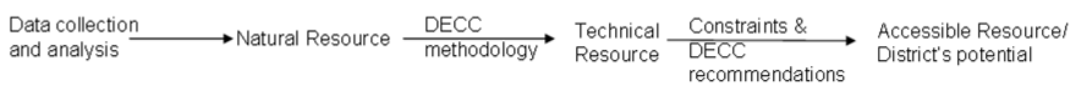
3.3 Sustainable Transport

Sustainable transport encompasses a number of alternative transportation means (cycling, walking, public transport) that reduce consumption of transport fuels, mainly petrol and diesel. Figure 129 shows the consumption of petroleum in 2008. Electric propulsion i.e. the use of electric vehicles (EVs) is a method of environmentally friendly personal transportation. In this limited review it is not possible to consider transport in greater depth, however, to note that **currently, the district does not have any electric charging points which is the first step in promoting EV.**

4 THE RENEWABLE ENERGY RESOURCE

4.1 Methodology

To assess the potential of the renewable energy in West Berkshire, first the natural resource available was considered. The energy resource that is technically possible to extract was then calculated. The technical resource represents the maximum which the district can extract using existing commercial technology. Although this figure assumes covering entire district with RE systems, which is not practical, it indicates the upper limits of the district. DECC's recommended methodologies[34] (*the methodology hereafter*) were followed as much as possible to arrive at the technical potential. The availability of the materials and time limited the execution of the methodology strictly. The following flow diagram illustrates the method which was mostly adhered to in the desktop assessment.



The natural resource is reduced significantly by various factors as shown in Figure 21as reproduced from the methodology. The natural resource is what is theoretically available and also represents the absolute maximum that a site could produce. The Technical Resource is what is possible to generate by using existing and proven technologies. Further constraints are then considered that will reduce the technical potential. These constraints include the physical environment (e.g. towns, roads), planning and regulatory issues (e.g. the distance of a turbine from roads) and economics. A combination of these factors reduces the actual resource that can be exploited at a given site. Other designated sites and exclusion zones also affect the actual installed capacity at a site. Note that the economic viability is not considered here.

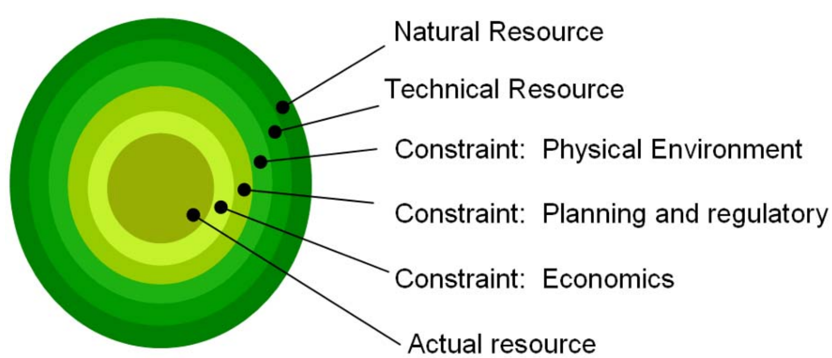


Figure 21, Resource availability

In this report, every effort has been made to quantify the technical resource and to identify opportunities for developing renewable energy in the district. Although the DECC methodology advises on technology specific constraints that are applicable, it is beyond the scope of this study to consider them in detail. Hence, it is necessary to perform further site specific assessments to identify the actual capacity that can likely be installed in the district.

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[34] Renewable and Low-Carbon Energy Capacity Methodology, January 2010.

4.2 Resource

The following sections cover technologies that the district can deploy and illustrates approximate capacities. This desktop study does not indicate potential sites but merely indicates the potential capacities of the district.

4.2.1 Wind

In this report onshore wind is considered and the assessment is based on the NOABL data sets only. The maps included are based on NOABL data and hence should be used for indicative purposes only. In this section, both large commercial scale and small domestic scale turbines are considered.

Figure 23 and figure 23 show that the wind resource within the North Wessex Downs is significant. Although the windspeeds in the figures are less accurate than on-site measurement, it does give the general idea of the wind climate in the region. However, given the purpose of the AONB, large commercial scale wind farm development will have serious effect on its designation and as such are unlikely to be developed. Smaller scale developments e.g. single MW scale and sub 100 kW could be developed within the area without contravening designations in principle (and as seen in other AONBs).

For most scenarios, in order to reach a significant renewable energy contribution in WB wind energy will eventually need to be a major component of the energy resource mix. This has implications on how the AONB and planning authorities consider such developments.

Wind Energy: A brief note on wind climate assessment.

The desktop study is generally based upon NOABL data. NOABL is a data set acquired from the simulation of air flow in the UK at three different heights, namely 10 metres, 25 metres and 45 metres (from the ground) at a resolution of 1 kilometre square Ordinance Survey grid. The system accounts for the topography at a larger scale but does not reflect the effects of local variations such as tall structures and local thermal affects, both of which can modify local wind climate significantly. Because of this limitation, an inherent discrepancy is built-in into the NOABL data at finer resolution viz. overestimation in lowlands[1]. However, it is capable of indicating potential candidate sites. For MW scale systems, the developer of a wind array at a site would almost always erect a met mast to measure actual windspeed. This is standard industry practice whereby desktop study using NOABL data is used to indicate potential sites and each site weather data is refined further by direct measurements.

Figure 22, 275kW Vergnet wind turbine (East Lothian, Scotland, panoramio.com)

For larger turbine installations, given the associated investment costs, the onsite windspeed measurement is ideally taken for a year to assess annual variation. This allows a more accurate estimation of likely annual energy generation. Large wind farms also use the concept of measure, correlate and predict (MCP) to make a reliable estimation of long term energy generation. Under MCP, the developer measures site windspeed, compares it with historical local met station data and predicts potential energy yield for the life of the windfarm in light of the correlation between the two data.

The cost associated with such detailed site specific windspeed measurement is generally deemed prohibitive for smaller turbines such as farm or residential sized turbines. There are alternative low cost windspeed measuring systems which are available for less than £500 and are enough to evaluate sites for wind microclimate.

Wind Potential

For assessing small scale wind turbine installations, sites with wind speeds of above 4.5 m/s are usually considered to be adequate to be economically viable. Figure 233 shows NOABL wind speeds at 10 metres height from ground level (relevant to small wind turbines) as they are usually installed at hub height of 10m - 20m.

The figure shows that there are very few location in WB that have a wind speed of less than that considered to be economical.

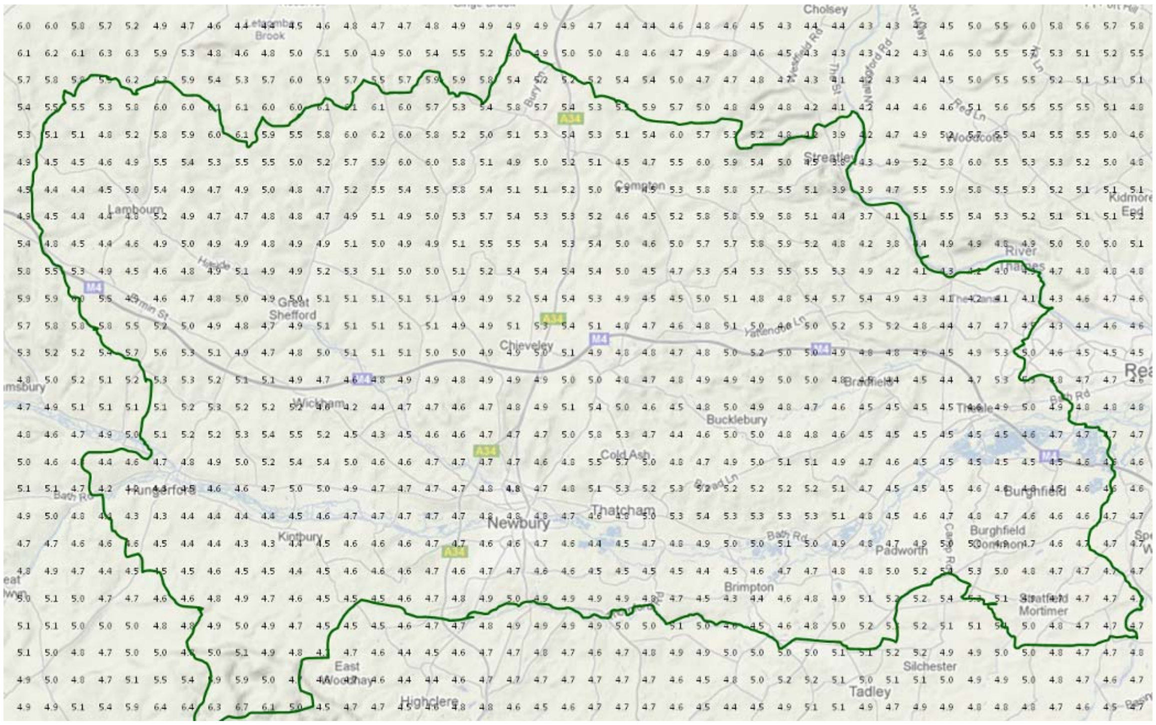

Figure 23, Wind speed in m/s at 10m height above ground level (agl)[35]

Some examples of small scale turbines are shown below. These turbines can have hub heights of 10m to 25m depending upon sites and planning conditions and are more likely to be acceptable than larger turbines.

Figure 24, Examples of 5kW to 11 kW systems

[35] Tolerance:+/- 0.7km

Larger turbines, rated in MWs, have hub heights of above 40 metres. Figure 255 is the map of NOABL windspeeds at 45m height (relevant to larger machines) rated at few hundred kW to MW scale turbines are shown below. For example, a 1MW turbine might have a 50m hub height i.e. height of hub from the ground.

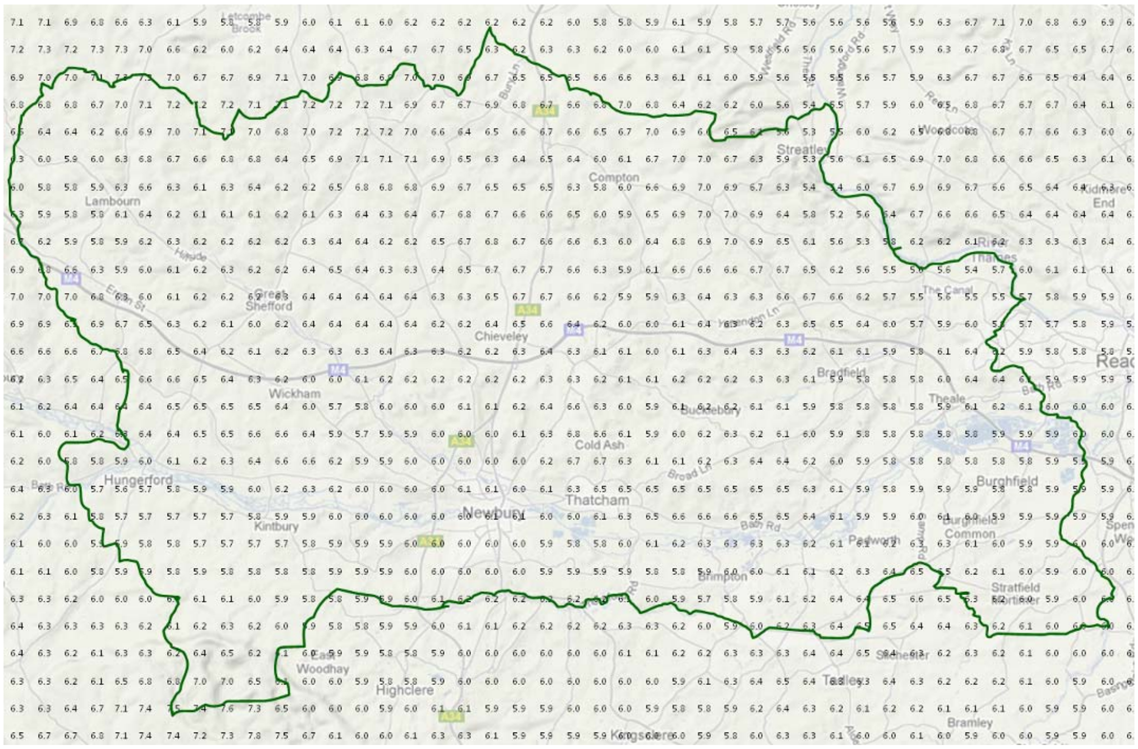

Figure 25, Windspeed in m/s at 45m height above ground level (at 1km resolution).[36]

Figure 23 indicates that the whole of West Berkshire experiences wind speeds of above 5m/s which is DECC's benchmark figure at and above which wind energy should be considered (although commercial wind developments occurs at sites with windspeeds of above 6m/s). **This implies that the wind *natural resource* at 45m hub height is available in the entire district of West Berkshire for potential utilisation.**

[36] Tolerance: +/- 0.7km

Figure 26, 2 MW Enercon wind turbine cluster at Bristol Port

After careful consideration of various major constraints to windfarm development, it is estimated that the district can accommodate 0.7GW of commercial scale wind turbines, assuming that wind turbines are erected in NWD AONB. On past track record, the NWD AONB is bound to object to any significant wind turbine development (see Annex 1). Hence, excluding the AONB, the district can accommodate 0.08GW of commercial grade wind turbines within its boundary.

In the UK, commercial wind turbines operate at a rated power of 20% to 30% of the year. Assuming a conservative capacity factor of 22%, the electricity generation from wind in WB can be estimated at about 146-1200GWh per annum, depending on the development within AONB boundary.

Wind Energy: Constraints

The estimation of wind energy potential in the district of West Berkshire was based on various constraints and factors. These factors include:

- Windspeeds
- Infrastructures e.g. road, rail, inhabited areas, power lines, microwave links.
- Conservation sites e.g. SSSI, AONB, national parks, scheduled monuments
- Other natural factors e.g. rivers, woodlands

The buffer zones for the infrastructures and natural factors were applied to reduce the area available for wind turbine development. DECC's recommended benchmark figure was then used to estimate the wind energy capacity based on the remaining area.

This method does not indicate potential sites but simply states what area of the district (or area under study) is suitable for the wind turbines which can then be used, in conjunction with benchmark figures (such as DECC;s) to estimate the potentials. Computerised software in using more accurate data (which have to be bought from organisations such Ordinance Survey) will help indicate potential sites and more accurate potential of the district.

These factors were not considered in the estimation of small wind capacity as they are less severe due to the small size. Also, the buffer zones (for noise and topple distance figures) are based on turbine parameters which reduces the exclusion zone around the turbine.

These figures are for indicative purposes only and are very conservative. This fact is indicated by the map in Figure 277 which shows a large area of the district to be suitable for windfarm development. The yellow coloured area represents an 'opportunity area' for commercial windfarm development. This map is the reproduced from the work completed jointly by Land Use Consultants and TV Energy in 2010. An important feature that this map highlights is that the majority of the sites are within the NWD AONB.

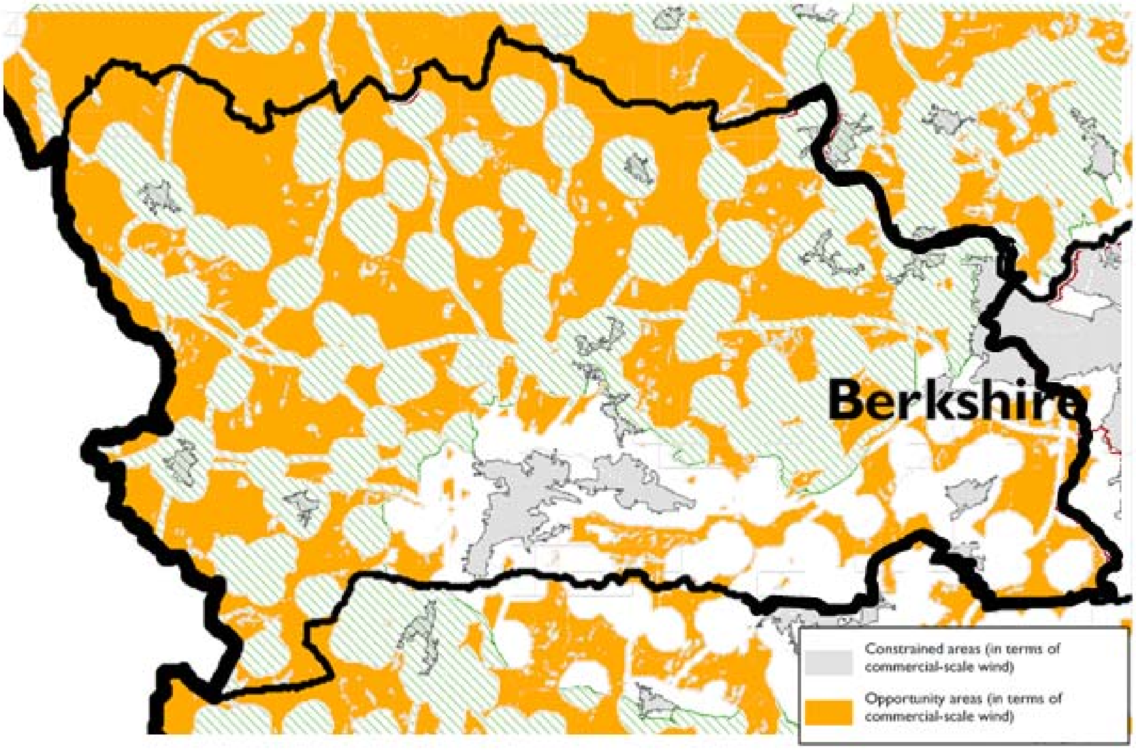

Figure 27, Potential commercial windfarm sites in West Berkshire (Land Use Consultant and TVE)

A separate study commissioned by AONB (2006)[37] classified the entire AONB, to be either moderately or highly sensitive to wind turbine erection. This is a major barrier to any commercial windfarm development in the district.

Figure 28, 1.3 MW Siemens (left) residential scale Proven turbine (right)

To put matters into perspective, an area the size of New Greenham Common Airfield (approx. 1.5 sq. km) could accommodate a 10MW commercial grade wind system with turbines sited 300m apart[38] in a single row.

Smaller systems are usually installed on farms but they have comparatively small system ratings and require a large number of them to make significant contribution to the district's overall energy use. On the positive side, these turbines can blend easily into the surroundings and would likely be more acceptable to the AONB (Figure 27).

[37] A study of Landscape Sensitivities and Constraints to Wind Turbine Development (March, 2006)
[38] An operational windfarm just outside NWD AONB has similar layout and has a capacity of 6.5MW

The estimation of the potential of small scale wind was based upon the population of rural residents as it was the only reliable publicly available data for the purpose. Also, urban properties are less likely to install kW-range wind turbines due to planning constraints. In the process, it was assumed that the each household comprised of three residents and the number of households deduced on this assumption. 70% of the properties were then assumed to have installed a 6kW wind turbine system (DECC's benchmark size).

This reasoning exercise showed that the district can potentially have 90MW of small scale wind turbine systems, generating around 94GWh of electricity.

This rationale does have drawbacks in that flats (which is a household and can be in a rural setting) are very unlikely to be able to install wind turbines. Planning issues in an urban area are also applicable in a villages (albeit less technically limiting) which is assumed to have no effect on the above estimation. However, wind turbines on farms are usually 10kW and upwards which should diminish the discrepancy in the rationale.

4.2.2 Solar

The energy from the sun received by West Berkshire is shown in Figure 299. This energy can be harnessed by either using a solar thermal system (SHW) or a photovoltaic system (PV). The map below represent the annual sum of global irradiation on an optimally inclined surface in kWh/m^2 along with the potential solar electricity generated by a unit kWp PV system (kWh/kWp). These figures assume that the PV is mounted at an optimum pitch and has a system performance ratio of 0.75[39]. Some PV modules can have performance ratio of as high as 0.8.

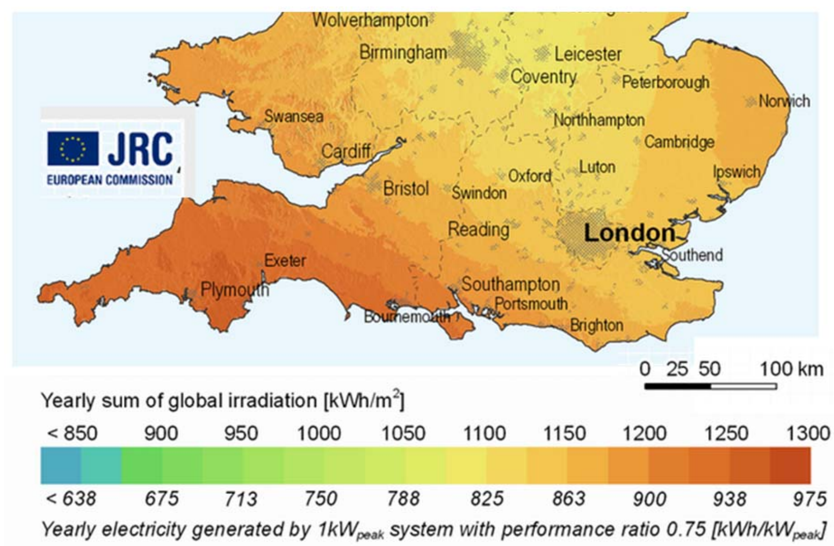

Figure 29, UK Irradiance level (source: PVGIS, JRC)

A PV system installed in West Berkshire can generate between 800 – 900 kWh of energy per installed kW annually.

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[39] This is used by PVGIS software widely used in the desktop study for PV systems.

Solar Potential

For the purpose of assessing the potential solar power, DECC's methodology relies on the number of different types of properties in a region viz. residential, commercial and industrial properties and also assumes a certain percentage of that stock to be suitable for installing solar technology (e.g. orientation, construction, lack of shading). The numbers of commercial and industrial properties in West Berkshire are shown in Table 9.

Type of Business	No. of Premises	Percentage	Total floor-space (m2)
Offices	1,347	51	396,117
Miscellaneous/unclassified	4	0.2	15,876
Business units and workshops	647	24	204,675
Factory, Industrial, Mineral, Vehicle Repair	42	1.6	120,189
Warehouse, Storage	619	23.2	558,178
Totals	2,659	100	1,295,035

Table 9, Commercial and Industrial properties in West Berkshire [40]

The premises, presented in table 10, are grouped into commercial and industrial categories to estimate potential capacity. Based on these figures, and the total number of residential properties of 64,790 houses[41], the solar power potential can be estimated as shown in Table 10. Although some of the figures are slightly outdated, they are the most reliable source available at the time.

Property type		Number of properties	%	No. of suitable properties	Guidance Capacity (kW/property)	Potential Capacity (MW)	Energy (MWh/yr)
Residential		64,790	25%	16,198	2	32.4	26,959
Commercial							
	Offices	1,347					
	Miscellaneous	4					
	Business units	647					
	Warehouse & storages	619					
	Total	2,617	40%	1,047	5	5.234	4,356
Industrial	Factories, Industrial, mineral and vehicle repair	42	80%	34	5	0.168	140
Total				17,278		38	31,455

Table 10, PV technical capacity (retrofit)

Table 10 indicates that the district can potentially generate about 31GWh of energy annually if all the sites deemed suitable are developed. This represents around 3.5% of the district's net

[40] These figures are 2006 figures from Valuation Office Agency and can be found in Local Economic Assessment (2011), West Berkshire p23

[41] http://www.communities.gov.uk/housing/housingresearch

current electricity needs.

The above mentioned figures are only for retrofitted installation capacities and do not indicate potential ground mounted stand alone systems or systems on new built properties. Ground mounted systems are generally in MW scale and will easily distort the above mentioned figures. Ground mounted PV systems are low profile and can be developed in close proximity to other developments (e.g. wind farms). This allows sharing the grid connection substation and access to roads thereby reducing the cost of the overall project. Westmill Farm (Watchfield) is an example of such a combined development.

Figure 30, PV Farm A section of 5MW ground mounted PV systems at Westmill. (Picture: TV Energy)

The ground mounted PV capacity for the district was estimated at 220MW generating around 180GWh of electricity annually (see box titled 'Solar Power: Rational for ground mounted systems').

Solar PV systems are deployable with comparatively less expected opposition as compared to wind systems. The district can mass deploy the PV system on council owned properties including open parking spaces in canopy configuration. Such installation can also have integrated electric vehicle charging points which is essential to achieve *true zero emission* transportation systems.

Figure 31, Solar PV array over parking area
The Richard Stockton College of New Jersey parking array

Solar Thermal

Solar thermal systems mainly supply or supplement domestic hot water system (DHW). They are sized to meet only a portion of DHW requirements, usually around 50% as it cannot provide 100 of the entire DHW requirements. They are not suitable as the primary technology for space heating as the system's energy capture pattern varies with season and is opposite to space heating requirements i.e. generates the least amount of heat during the times of highest demand.

Resource wise, solar thermal and PV systems have similar requirements. Any site suitable for PV system is also suitable for a solar thermal installation. This is because they can occupy the same roof space and require a comparable area for a given power rating. Note that only the PV component is indicated in table 10 as the maximum solar power that can be harnessed from the district's rooftops is 38 MW (excluding ground mounted capacity). 38 MW can be a combination of PV and thermal system. The thermal system is not quantified here as it will be within the 38MW capacity and its installation will decrease the PV capacity to limit the total solar power at 38MW.

Solar Energy: Rational for ground mounted systems.

For the estimation of the ground mounted PV systems, similar approach to wind energy estimation was used apart from technology specific differences. As such, this undertaking does not indicate potential sites but rather indicates potential capacity of the district.

For this estimation exercise, factors such as roads, rivers, conservation sites etc. were excluded. As the PV systems are close to ground and emit virtually no noise during operation, very small buffer zones (5m wide) were used. Although even 5m could be thought of as being too large, it is site specific and depends upon factors such as proximity to residences and shadings due to, very common, treelines. The arable lands were also excluded completely for PV system installation. The 220MW capacity also assumes that no systems exist within NWD AONB.

The resulting remaining area was used to estimate the district's' PV capacity by comparing it against the existing solar farms figures (i.e. MW/km^2) which is around 40MW per square kilometres.

The aircrafts approaching/leaving Heathrow Airport will reach WB but the map released by the airport indicates that the aircrafts will be around 6000 feet above ground and are less likely to cause any visual interference.

4.2.3 Biomass

The term 'Biomass' covers a wide variety of products which are derived from living organisms. It includes animal waste, food waste, virgin woods from woodland management, arboriculture activities, waste wood from wood processing or demolition and agricultural arising. The definition also includes dedicated plantation of energy crops such as elephant grass (*Miscanthus)* and willow (*Salix*) the latter generally being referred to as short rotation coppice (SRC).

In this desktop assessment, only the woodland management and SRC resource are considered as it is the most significant source. Although other sources also contribute to the total resource, not all of the wood from woodland management will go to wood fuel production. Some will be diverted to alternative uses such as wood industry, mulch etc. Thus the inaccuracy due the assumption of all woodland product going into wood fuel production is somewhat reduced by other sources left out in the study. Food waste is considered under the Waste section.

Figure 32, Woodland management (Pictures: TV Energy)

The output of woodland management and small tree surgeons is mostly converted into woodchips for use in small boilers. This chip, along with chip produced from dedicated crops, can also be used to fuel large scale centralised power plants (e.g. Slough Heat and Power, 35MWe). Agricultural arising such as straw bales can also be used in generation plants similar to the Elean Power Station (38MWe) in Cambridge. Waste from the wood industry, such as sawdust, is generally processed to form pellets and can be used in both small and large scale heat generation systems. .

Animal wastes, food wastes or Municipal Solid Wastes (MSW), which generally has higher moisture content, are usually treated using Anaerobic Digesters (ADs). Anaerobic Digesters can also use grass silage which is mixed with animal waste to generate biogas using AD systems.

The woodland management output is most likely to be used in boilers rather than in power stations. The type of biomass heating system installed will depend on the type of property, heat needs, access and a range of factors. Woodchip will mainly be used by larger heat users such as schools and offices due to space requirements. Logs and pellet systems are suitable for smaller applications such as in residential homes.

Figure 33, Typical biomass (heating) system.
Left: Large scale system. Centre: Residential Pellet boiler (height: 1.2m). Right: Residential log burner (height: ~1m)

The fossil fuel alternative heating option, electricity and oil, has a higher operational cost, approximately 15p/kWh and 7p/kWh respectively, as compared to 3p/kWh for a woodchip system. In addition, to these financial benefits, there are also other benefits that accrue from using biomass such as increasing local employment within an area (e.g. in fuel preparation, maintenance) and increasing fuel security, which ultimately means a less volatile fuel market.

Given this backdrop, local people in the district are more likely to be inclined towards using a biomass system. However, the council should lead the way by installing biomass systems in their properties (e.g. schools, offices). It will help build confidence within the area and will help the supply chain grow which in turn will drive down the cost and uncertainties of an ever growing local energy source.

Woodland Potential

This section details the potential resource which arises from the output of local woodlands destined for generating heat in small boiler operations. Only the output of the woodland is considered as the district does not have any significant wood processing sites which can produce a sizable raw material for wood pellet production i.e. sawdust. The district also has two energy crop plantations (willow) but as they are already used they do not contribute towards additional future resource.

The district has a significant amount of woodland coverage. However, as there is no data in the public domain about the extent of their management, some assumptions have been made to assess the district's resource. The woodland coverage data held by National Forest Inventory for West Berkshire is shown in the region's map in Figure 34. The output of woodland can be either woodchip or logs. As a consideration of both will result in double counting, only woodchip is used to quantify the resource.

Approximately 17% of the district is covered by woodland (Table 11). These woods can be managed to produce fuel (woodchip) for heating. Currently, only a small proportion of this resource is managed for woodfuel production.

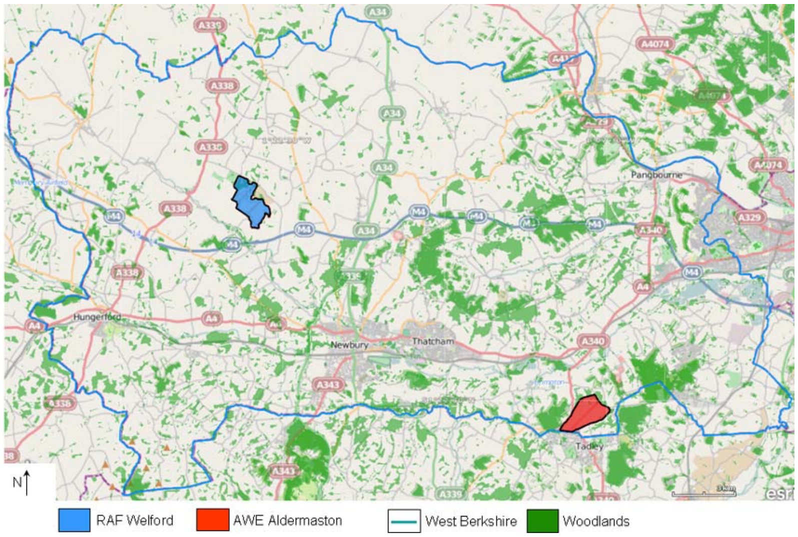

Figure 34, Woodlands in West Berkshire (woodland data taken from National Forest Inventory)

Total woodland	11,897	Hectares
	119	Sq km
District's area	704	Sq km
Woodland cover	17	%
Current heat generation	2,567	MWh (Approx generation by current biomass systems)
Current usage	484	tonnes
Operation efficiency	75%	
Net Current usage	646	tonnes

Table 11, West Berkshire's woodland and wood usage summary

Table **12** shows the potential output of the district's woodland and the amount of heat that could be supplied through chip. The 'higher' column shows an optimistic potential of the district whilst the 'lower' column indicates a more conservative figure. Either way it can be seen that there is a significant potential of wood fuel in the district with a potential to displace as much as 20% of the district's gas demand. The table assumes that each hectare of existing woodland can produce 2 tonnes of arising on a sustainable basis with energy content of 19GJ/tonne which is similar to DECC's recommended figure.

	Maximum		% medium		% low	
% of woodland currently not managed for woodchips	100%		50%		25%	
District's total unmanaged woodland	11,897	Ha	5,949	Ha	2,974	Ha
% of woodland willing to produce woodchip	100%		100%		100%	
District's total potential woodland	11,897	ha	5,949	ha	2,974	ha
Av. ODT per hectare	2	t/ha				
District's output	23,794	t/year	11,897	t/year	5,949	t/year
Energy equivalent of potential production	126	GWh	63.05	GWh	31.53	GWh
Remaining Energy equivalent	123	GWh	60	GWh	28	GWh
Operational efficiency (DECC)	80%		80%		80%	
Net energy (heat) from district's woodland	**98.15**	**GWh**	**47.71**	**GWh**	**22.48**	**GWh**
District's total gas demand	1199	GWh				
Percentage of District's gas demand potentially met through woodland management	8	%	4	%	2	%
Availability (DECC)	80%		80%		80%	
cp/load factor	20%		20%		20%	
Equivalent power	**0.06**	**GW**	**0.03**	**GW**	**0.01**	**GW**

Table 12, Potential wood fuel usage at West Berkshire

As a source of energy, wood fuel can also be used to generate electricity. From DECC's approximation, around 6000 t/yr (oven dry) can power a plant rated at 1MW at 80% availability. In other words, the district can power about 2.4MW power station generating as much as 17GWh of electricity from woodland management arising if so desired. This is about 2% of the district's total electricity consumption.

Biomass heating systems are most attractive in the regions which are off the mains gas network. Figure 355 indicates the connectivity of various areas of the district to gas pipelines in 2001[42]. It indicates that a majority of the district was *not* connected to the gas network and is potentially suitable for biomass system installation. Although the data is from 2001, the rural nature of the majority of the district means that the picture would have changed very little over the time.

[42] http://www.ruralfuelpoverty.org.uk/rural2.php?mopt=1&pid=gas_areamap&step=3&county=9

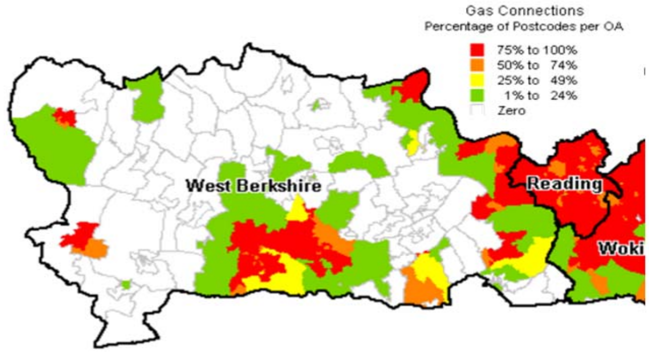

Figure 35, Mains gas connection of Output Areas of Wet Berkshire (source: Rural Fuel Poverty)

Although the land use map (Figure 36) indicates that the majority of off-gas grid areas are fields, they do give a general indication of potential sites which could benefit from biomass systems.

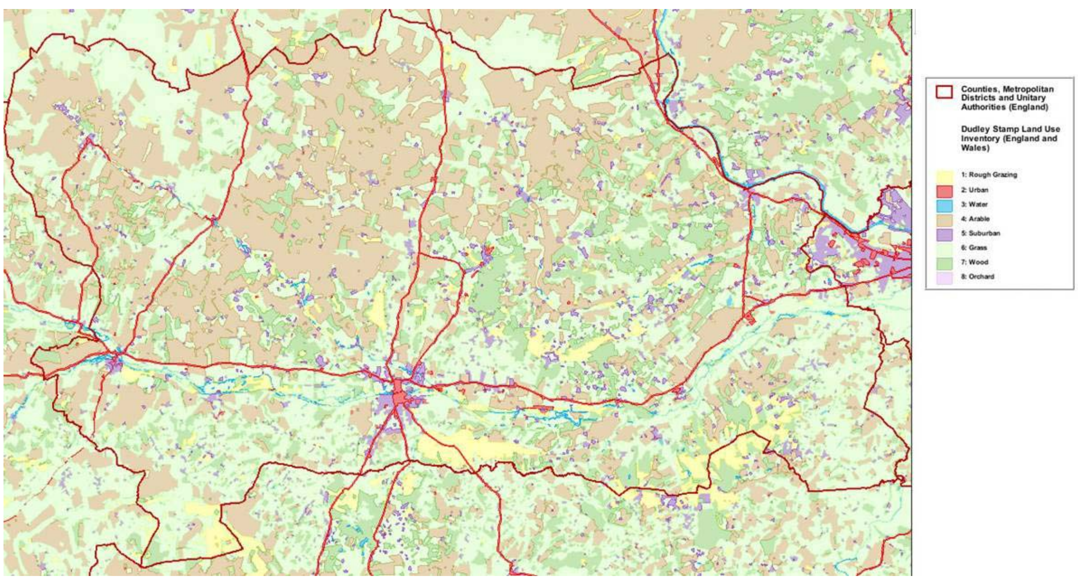

Figure 36, Land use map (Source: magic map)

Energy Crops Potential

WB is suitable for energy crops cultivation, mainly Willow and Miscanthus. The district currently has two energy crop plantations both of which are SRC and recently produced the first harvest producing around 1GWh of energy. The additional energy crop potential of the district was estimated at approximately 85GWh. This estimation is based on the 'set-aside' land percentage and the DECC's benchmark figures and is briefly explained below.

WB has around 49,500 hectares of agricultural land (source Defra). Until recently, farmers were required to set-aside certain portion of their land to limit food production in the EU region. In return, farmers were paid for the land that was set aside. For WB, this was 7% in 2007. Although change in policy means there is no longer a set aside land, it is safe to assume that some percentage of arable land can be 'set-aside' for energy crops plantation without producing the scarcity of food. Besides, although there is no set-aside land, farmers are still paid if their land is kept in an arable state. Hence, 5% of the agricultural land was assumed to be able to grow energy crop without reducing food production capacity. Based on this assumption along with DECC's recommended figures in the methodology, the above mentioned potential was deduced.

85GWh represents about 7% of the district's gas demand, both domestic and non domestic.

4.2.4 Heat Pumps

Heat pumps 'recover' heat from air, water of ground and are correspondingly called air source, water source and ground source heat pump. They multiply energy input by a factor of around three. However, a very careful design and sizing is required to achieve such factors. Heat pumps are ideally suited for off gas grid properties and do need electricity for its operation.

Majority of the UK is suitable for heat pump installation. A separate report prepared by TV Energy (TVE198), also indicates that the district does have suitable geology for Heat Pumps installation. Heat Pumps can be installed either in residential or public properties such as village halls. Residential properties will require drilling bore holes unless it has large area in which case it can employ horizontal heat exchangers to extract heat from the ground. Heat Pumps requiring bore holes are comparatively more expensive.

This desktop study to assess the potential of the deployment of heat pumps is based on the number of houses in the rural area of the district. These properties are likely to be inaccessible by mains gas network and lend themselves to such deployment. Similar to small wind systems study, the number of properties in the district was estimated on the basis of the rural population. Furthermore, the types of properties are also considered for this purpose. This breakdown is based upon *West Berkshire: District Profile 2011* report which breaks down the type of properties in the district into detached, semi-detached, terraced and flats. It was assumed that the given proportion held true for *rural only* properties as well. Although in the DECC's methodology, 100% of the rural properties are said to be suitable for heat pumps, for this study 100% of detached and semi-detached properties, 50% of the terraced properties and 0% of flats were assumed to have installed a heat pump of some sort. This is because the flats are less likely to be able to install heat pumps including air source heat pumps. Despite air source heat pumps being able to be deployed for flats, noise issue during planning phase *may* prove to be prohibitive. Each installation is assumed to have a power rating of 5kW as recommended by DECC.

Under these assumptions, the total potential capacity was estimated at 83MW or 146GWh of energy (heat) displacing around 12% of district's mains gas demand.

4.2.5 Hydropower

Hydropower energy is the energy of water at heights due to gravity. The hydropower schemes in the district will be of the type generally known as run-of-the river. These schemes are usually developed in existing weirs and do not include any additional water impounding structures. The hydropower turbines for the district are most likely to use, like most of low head sites in the UK, an Archimedes's Screw turbine coupled to a generator (Figure 37). Other systems such as siphon systems also exists which require minimal amount of civil works but its usage is not as wide spread. Kaplan turbine is another system that could be used for low head systems but could cost considerably more to install and operate.

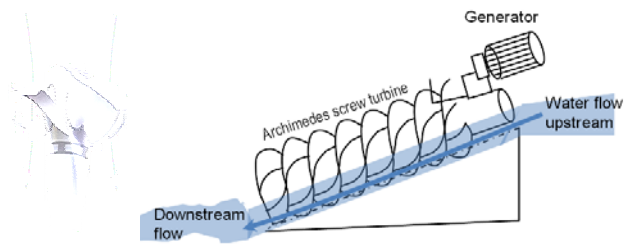

Figure 37, Low head hydro turbines. Kaplan (left) and Archimedes' turbine (right)

Wherever possible, it is best to exploit hydropower as they generate electricity at the rated power for more parts of the year than wind or solar system.

Figure 38 shows roughly, the amount of energy generated per installed kilowatt of hydro, wind, biomass and PV in the UK for system. Although hydro systems generate more energy than the others comparatively, hydropower is also generally more expensive per kilowatt to install. The factors affecting the cost of a hydro system include environmental requirements (e.g. fish-pass installation, flood risk study), civil works (e.g. strengthening of weirs, power house) and electrical works (e.g. strengthening the grid in the immediate vicinity).

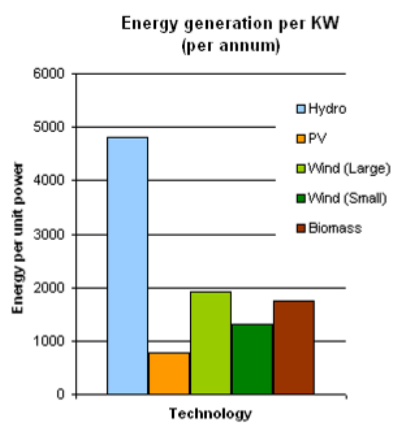

Figure 38, Comparative energy generation.

Another useful concept which allows comparison of different technologies' energy performance is *Energy Payback Ratio* which is defined as the total energy produced in the system's lifetime divided by the energy required for building, maintaining and fuelling it. It shows energy payback ratio for some technologies. The figures are based on Life Cycle Assessment (LCA) data. A higher payback ratio implies that the system uses as much power as it generates throughout its operational life. The higher the number, the more environmentally friendly the system is.

Brief note: Dauntsey Park Hydro, Wiltshire

Head: 1.25m

Flow: 1.5 cumec

Power: 12.5 kW

Expected energy: ~43MWh /yr

Energy Payback Ratio	
Hydro power	>170
Large wind turbines	~34
Biomass	3 to 27
CCGT	2.5 to 5
Coal	2.5 to 5.1

Table 13, Energy ratio[43]

Coal and gas figures are set to decline further as fossil fuel extraction becomes more difficult and sourced from further afield thereby increasing the hauling distance and hence the cost.

Hydropower Potential

In 2010/11, Sustainable Newbury did consider putting in hydro power in Newbury at Victoria Park and Lock Island in Newbury. A company called IT Power also carried out feasibility study for the same river stretch in mid 2000s but the site was never developed siting high cost associated. The cost was estimated at £8800/kW which is typical of low head hydro schemes but the system size was only around 20kW.

A 2010 study carried out by IT Power and British Hydro Association (BHA) states that within Thames Region, there is a potential of up to 30MW[44] of hydropower at 125 sites. Although this report, given the scale of maps in the report, does not indicate any potential site within West Berkshire, a report from Environmental Agency[45] (EA) does indicate a number of sites along River Kennet of various capacities (Figure 399) that can be developed. Interestingly, these sites are also classified as highly sensitive to hydropower development.

River Kennet is a part of Kennet & Avon canal route. This and along with various SSSI sites along the river will make it difficult to exploit the resource at River Kennet. However, it is crucial to develop any possible sites because of reasons indicated in figure 39.

The IT Power report also anticipates that any sites with less than 1m head is likely to be too expensive. Although they are expensive, they will help with emission in the long run. Besides, there are a number of micro hydropower systems manufacturers in the UK who can supply systems creating 'local' employment and income. Hydropower schemes can have an operational life of as much as 50 years which can be further extended by overhauling the site and machinery. Hence hydropower can be developed as an environmental project rather than one just aimed for financial gains.

A map from the EA study relevant to the district has been reproduced below. The EA report does not indicate any sites for River Lambourn, River Pang and their tributaries.

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[43] Comparing Energy Option (July 2005) , Qubec hydro: http://www.hydroquebec.com/sustainable-development/documentation/pdf/options_energetiques/rendement_investissement.pdf]

[44] IT Power & BHA http://www.british-hydro.org/UK%20Hydro%20Resource/England%20and%20Wales%20Resource%20Study%20Oct%202010.pdf

[45] Opportunity and environmental sensitivity mapping for hydropower in England & Wales

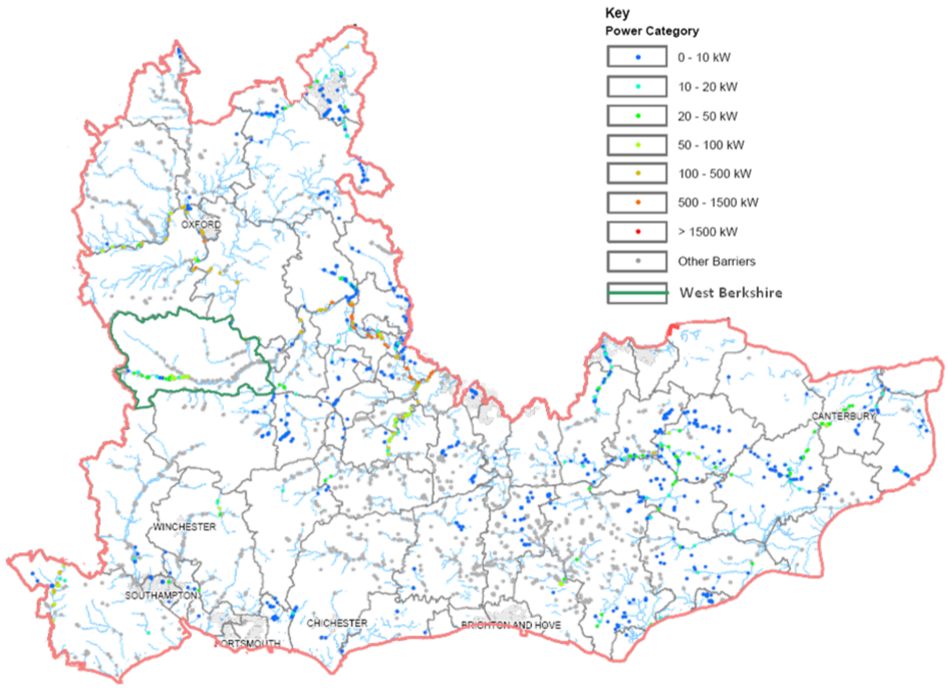

Figure 39, Potential hydro resource in South East Of England (compiled from EA report)

National River Flow Archieve (NRFA) indicates that for a gauging station in River Lambourn at Shaw, Newbury, the Q50[46] flow is 1.5 cubic meters (cumec). If 30% of this flow is used[47], any hydro schemes installed at head of 2m along River Lambourn can generate as much as 25MWh electricity annually displacing 13 tonnes of CO2. In comparison, River Kennet has larger Q50 flow of 3.84 cumec. Developing hydro schemes along River Kennet at 2m head will generate approximately 70MWh annually. Hence, schemes in River Kennet can potentially generate three times the energy than schemes at River Lambourn for similar site condition due to larger flow.

The power ratings of the hydro schemes in both the rivers will be less than 20kW. But, intrinsically, hydropower systems generate more energy per year than either wind or solar systems for a given power rating. For example, to generate similar energy stated above for River Kennet, wind and PV system will need to have a system rating of 32kW and 80kW respectively. It is the energy that is of more interest, both environmentally and economically, than power.

4.2.6 Waste

Waste collected by the councils, generally called Municipal Solid Waste (MSW), is one of the sources of energy and emission. In addition to the renewable targets there are international binding targets in the waste sectors as well. For example, EU Landfill Directive requires that the UK reduce its biodegradable MSW going to landfill by 35% as compared to that of 1995 level.]

Using waste as energy is made possible by technologies such as Anaerobic Digestion (AD), Waste Incineration and Pyrolysis & Gassification. AD involves breaking down the food waste component of the MSW by biological means and collecting the gas given off (biogas) during the

[46] Taken from Flow Duration Curve and is the flow that exceeds 50% of the time in a year in m^3
[47] How much water can a river give? Copestake and Young

process. Whilst gasification is the thermal degradation of the waste material to form a mixture of gases (normally referred to as synthetic gas), waste incineration is simply the burning of waste to generate heat which can be used for power generation using steam turbine. Waste incineration projects are difficult to realise due to strong public and environmental group oppositions to the concept. They have more stringent construction and operation requirement which tend to escalate the costs associated.

Figure 40, AD digester (Austria)

Only AD is quantified here as West Berkshire already collects kitchen food waste for composting and data is available to make the assessment. AD is also technically more mature and frequently deployed. This makes it possible for the district to realistically deploy AD in a relatively short period of time.

West Berkshire has a relatively high level of recycling with the following amount of waste collected in the years 2008/09 and 2008/10.

Year	2008/09	2009/2010
Total, in tonnes	82,077	79,854
Landfill in tonnes (%)	53,788 (65.5)	37,718 (47.2)
EfW in tonnes (%)	261 (0.3)	9,357 (11.7)
Recycling in tonnes (%)	28,015 (34)	32,780 (41)

Table 14, Waste Berkshire waste arising[48]

The majority of the food waste collected in the district is converted into compost and sold as fertiliser. Although composting is helpful in reducing waste, ADs are a better option because they not only reduce waste but also displaces fossil fuel and produce a fertiliser as a by-product. Composting also takes up a larger space than a well designed AD. Defra indicates that capturing the gas produced (e.g. through AD) by one tonne of food waste will save between 0.5 and 1 tonne of CO_2 equivalent. Composting is also said to create volatile organic compounds which are pre-cursor to smog formation[49].

AD utilisation overview

The gas produced by an AD plant is a mixture of different gases, mainly CO_2 and methane. The gas mixture (biogas) contains 55-70% of methane and require further processing before being

[48] Source: 2008/9, 2009/10 http://www.westberks.gov.uk/CHttpHandler.ashx?id=29273&p=0
[49] Anaerobic Digestion of Food Waste, US Environmental Protection Agency, 2008

used either in a local CHP unit or 'injected' into the mains gas. The percentages of different gases depend upon feedstock and plant operational parameters. The following diagram summarises the AD plant and associated potential processes.

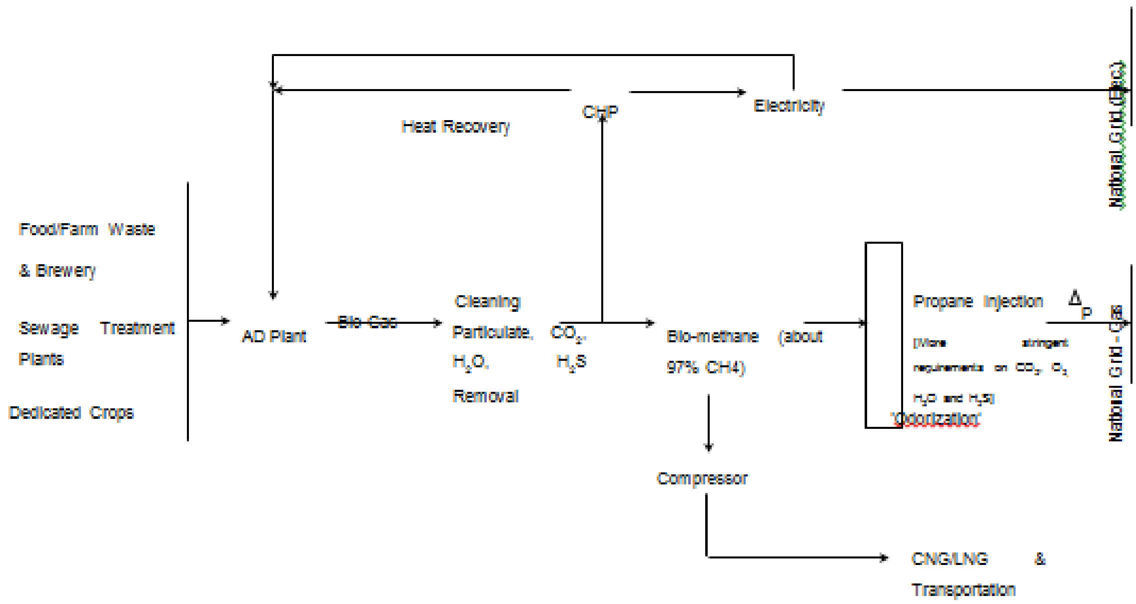

Figure 41, Process diagram of AD based systems

If a site has heat load in addition to parasitic heat load (heat used by the plant itself), it is best to use gas on site in CHP unit environmentally. This is because it displaces grid electricity that is more carbon intensive. Injecting methane to mains gas needs additional processing and consumes energy (e.g. pressurising), decreasing the net output energy.

Depending on what the biogas is used for, i.e. CHP or 'injected', the biogas requires various further processing such as cleaning, pressurising, upgrading (to increase energy content of the gas using additives such as propane) and odorizing (to give the gas the distinctive mains gas smell).

AD Potential

In 2011/12 the district sent 17,000 tonnes[50] of food waste collected through kitchen food collection services for composting. A tonne (dry) of food waste can potentially generate about 1200kWh equivalent of methane gas. If this gas is used to power CHP unit, it will generate about 241kWh of electricity and 725 kwh of heat, assuming 80% system efficiency. Compared to an existing plant's expectations, these figures are slightly optimistic but conservative as opposed to Defra approximation[51]. A laboratory test carried out in California by Environmental Protection Agency found that each dry ton of food waste can generate as much as 1300kWh energy.

[50] Westberkshire.gov.uk [email]
[51] http://www.defra.gov.uk/environment/waste/

AD Example: Westwood AD plant
BiogenGreenFinch, Northamptonshire

Processing capacity: 45,000 t/year
Feed type: Food waste
Electricity output: ~2 MW/ 9GWh[1]

The figures for West Berkshire are based on a number of assumptions and AD plant's output is affected by a multitude of factors some of which are discussed in the annex. Hence, diversion of 50% of the annual food waste collection to an AD plant can *potentially* generate around 2GWh of electricity and 6GWh of heat.

4.2.7 Others

Other renewable energy technologies which can potentially be deployed in the district include biomass and natural gas combined heat and power (CHP). Both of the options are *not* quantified here.

Combined Heat and Power (CHP) are best suited for properties with high heat load year round e.g. sports centres with swimming pool facilities. The system is sized based on the heat load. Although there are a number of such installations, they use natural gas from the grid. In this configuration, emission reduction will be achieved but energy security will not be addressed as UK is a net importer of gas. Small residential systems are also available for small properties. They are usually rated at 1-2 kW.

Biomass fired CHP (e.g. Waitrose, Bracknell) are an alternative approach which reduces emission and address energy security. A locally sourced biomass also increases local employment.

Both type of CHP employ reciprocating engines which require overhauling (i.e stripping down and rebuilding the engine, restoring it to almost new state) every few thousand hours. Overhauling can be quite expensive, especially if it has to be shipped out to its manufacturer overseas.

4.3 Potential Energy Mix

This section discusses what the district might achieve with a proactive policy on renewables. In essence, it is a snapshot of the previous resource section. The starting point is that the district currently generates less than 1% of its energy needs from renewable energy. By any measure – this is modest! The total could be increased to as much as 29% if the district makes maximum effort towards a progressive sustainability policy. Figure 42 indicates the mix of renewable energy technology capacity that the district can achieve in the near future. Figure 43 shows the equivalent power rating for each technology generating energy indicated in figure 42.

Note that the wind system actually generates more energy (per power rating) as compared to a solar energy system. Retrofit PV, biomass, AD, heat pumps and energy crops do not show variation as these are less affected by AONB. Although small scale wind systems are deemed to be affected by AONB, but the approximating method used here to estimate capacity means that it does not show variation.

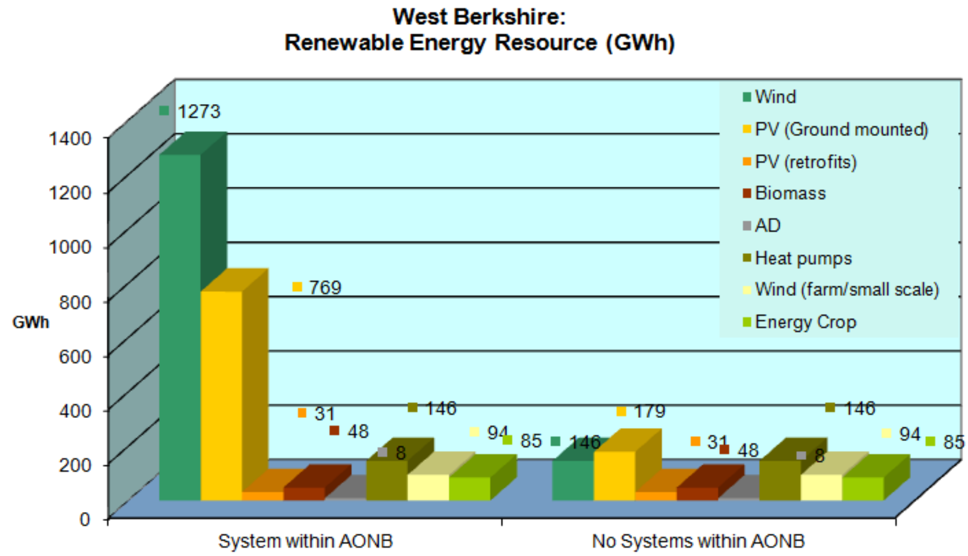

Figure 42, Renewable energy resource of West Berkshire

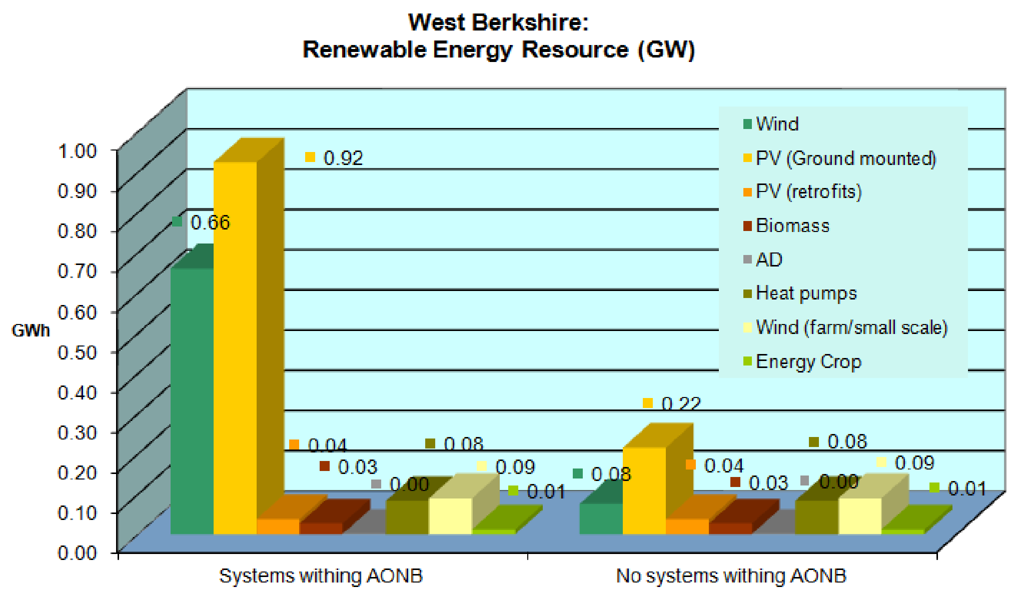

Figure 43, Equivalent power of the resource of the district

Figure 44 shows what the district's energy state if it is very committed to development of sustainable future. This does not come easily and it is absolutely necessary to have suitable policies and strategies to achieve this scenario. Compare with figure 19 which shows the current state of affairs.

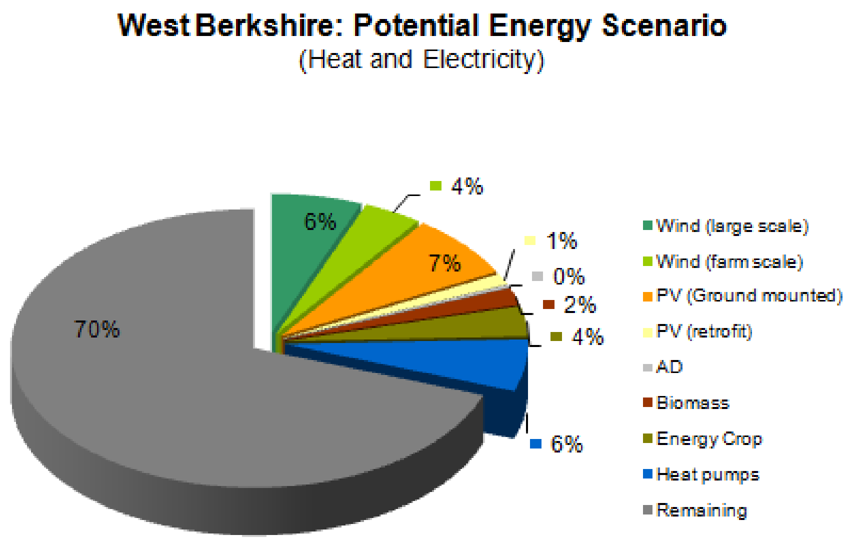

Figure 44, West Berkshire: Potential energy supply mix

4.4 Discussion of physical constraints

Physical constraints include infrastructures like roads, rivers, rail lines, power lines, microwave links, settlements, airports etc. These elements reduce the available land area, thus the resource, of an area. In addition to physically taking up space, these factors have exclusion zones around them which further diminish the potential sites. These limitations are specific to each of the technologies are discussed under respective headings below.

Generally, the physical constraints are considered using a computerised system and will show potential sites. However, this desktop assessment is not intended for scouting for potential sites but rather to ascertain the potential of the district. The method used here is sufficient to achieve that objective i.e. the district's potential.

Wind

Modern turbines are quite tall and because exclusion zones are based on turbine height and blade diameters, wind turbines are particularly affected by physical factors. For instance, turbines cannot be closer than the topple distance of the turbine from any public roads, rivers or railway line.

Figure 45, Wind Turbine and animals 50kW Endurance, East Lothian Farm. (greenenergynet.com)

Another factor which imposes a significant exclusion zone around itself is the residential areas. This is mainly due to the potential issues with noise and shadow flicker. Residential properties generally have around 600 metres (for commercial scale turbines) of exclusion zones. To put it into perspective, a single house at a candidate site can remove around 1km^2 area which, according to the methodology, could accommodate almost a 9MW wind system. Hence,, with majority of the population concentrated in the south-east of the district, a significant area of this part of the district is unsuitable for wind farm development. However, the part of the district within AONB is scarcely populated and will in principle present more opportunity within the AONB than outside it. These facts are reflected in Figure 27 prepared by LUC and TVE jointly.

Another effect of built up areas upon wind project is the modification of the local wind flow regime. This results in reduced windspeeds. Sites with windspeeds below 6m/s are less likely to attract any commercial developers. However, smaller turbines such as the 11kW Gaia and 50kW Endurance turbines can be considered at the outer perimeter of built-up areas like towns and farms even if the windspeed is as low as 4.5m/s. Turbines rated at 100kW are also available in the market (100kW Northwind).

Airports, airfield and military installations can also be an issue. Apart from protrusion into the skyline by tall structures, they are also concerned with potential turbines' effect on radar system. A busy airport may require more than 5km wide exclusion zones within which no turbine may be erected. The Atomic Weapons Establishment (AWE) present in the district, in its Energy Strategy (2006), does indicate that the establishment is not opposed to renewable energy including wind and solar systems.

Photovoltaics

Most of the PV systems currently being installed in the UK are installed on residential properties. These are mostly small systems and do not generate much opposition. However, there are limited available properties and the capacity stated under '*PV (retrofit)*' is likely to be the one that the district can install. The infrastructures have little effect on such deployment if at all.

Airports and airfields may be concerned with PV systems in general if located near the airport. They are usually concerned about PV system's potential to distract and dazzle the pilots and also incorrect identification of them as navigational lights during approach and takeoff at certain times of the day. This should not be an issue with installations in the district because although the flight path of aircrafts from Heathrow International Airport does cross WB, the aircraft are above 6000ft[52] and the concerns are unlikely to materialise.

Comparatively, ground mounted systems require more rigorous consideration both in terms of technical and planning appraisals. Some physical structures such as microwave links and powerlines have minimal effects in ground mounted PV systems. However, roads, rail and rivers will require some exclusion zone for safety reasons. e.g. PV systems too close to a road may dazzle drivers.

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[52] http://www.heathrowairport.com/noise/noise-in-your-area/aircraft-tracking-maps

Examples of current ground mounted systems include Westmill Farm with 5MW capacity situated on about 0.12km^2 and Wheal Jane Solar Park with 1.4MW capacity at approximately 0.03 km^2 land. Wheal Jane Solar Park is actually situated on contaminated land and demonstrates the potential of PV systems.

Biomass

Biomass encompasses a variety of resource and each has a different set of limitations. Generally, biomass systems are less likely to be opposed on the basis of visual impacts, noise issues and safety to general public. However, they are affected by various other concerns such as potential smoke emission, stack size, displacement of arable crop land, heavy vehicle movement etc.

The energy crop potential of the district is based on a 'set-aside' land area and will not compete for land with food. The food waste usage is also based on current setup (i.e. food wastes are already collected) and will not cause any issues with increased vehicle movement. Biomass for heating (e.g. woodchips and pellets) has to deal with possible smoke issues. Although, usage of correct moisture content fuel is enough to avoid smoky condition, some smoke free areas will require the use of approved equipment. Design of smoke stack of biomass heating systems is also a crucial factor in smoke creation. More importantly, it affects the efficiency of a plant.

Another set of limitations for biomass heating system is, they intrinsically require comparatively a larger space than oil fired boilers or gas boilers. Also, a biomass system is more hands on as compared to oil and gas. However, this aspect of biomass system has the potential to create local jobs and benefit the community.

Table 122 is the maximum resource of the district. A portion of woodland output will go to *alternate use* and not all of the woodland's output is available for wood fuel production. Also, some of the sites may be uneconomical to use for wood fuel production. Unlike other forms of renewable energy, the economic case of the production of biomass will depend on the distance of production site from the 'consumption' site as transporting for longer distance raises cost and reduce environmental benefits. This will bring down the capacity of a region. As the number of installations and wood fuel production sites increases in the region, the wood fuel hauling distance will decrease which, in turn, brings down the cost and also increase the level of emissions averted due to displacement of fossil fuel such as heating oil.

Woody biomass can also be used for electricity generation using a combination of gasification and CHP plant. However, this is not a widespread practice and woody biomass are generally limited to heat production. Co-firing is currently unavailable to the district.

Agricultural arisings are also not assessed here.

Hydropower

The main objections with any hydropower development are the danger to fishes and potential flooding. This could increase the cost of the hydropower development significantly. Usually, the EA would ask for a fish study for that particular stretch of river to be carried out and depending upon the outcome, installation of fish-pass may be required. Fish passes are expensive both in terms of cost and the available resource as the flow is diverted to the fish pass. The amount of water flow that can be used for hydropower is determined by the EA and indicated in the abstraction licence. The EA will also dictate when the installation can extract energy by specifying residual flow level that has to be in the river. Generation has to be stopped when the flow is less than residual flow. Increased risk of flooding could also be of concern at some sites. EA has identified the entire Kennet Valley as high flood risk area. As such, any hydropower development in the district will have to address the potential flooding issue. The two major rivers of the district are covered with SSSI (figure 46) and will limit the installation of hydropower.

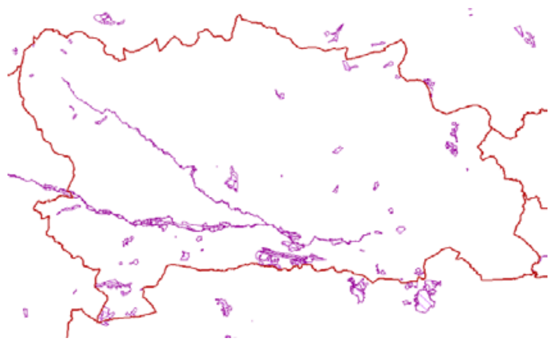

Figure 46, SSSI in West Berkshire

Development of hydropower has to be carried out in close cooperation with EA. Local users like rowing/canoeing clubs also have to be consulted from the outset.

AD and Landfill

AD plants are limited by the availability of resource only. Although they cannot be developed in built-up areas. However, it is essential to plan carefully to reduce hauling distance.

The organic material going to the landfill sites will decline increasingly as more house/kitchen waste is diverted to AD and composting. With decreasing organic material going to the landfill, this landfill resource will decrease. As such energy from landfill sites has not been quantified. Although EA webpage indicates historical and authorised sites, no detail about the site's fill-material, date of closure etc. is included which is essential. The knowledge of duration of the site closure is needed to assess a site's potential. (See separate 2012 study by TVE on the decline in landfill gas production as a part of the evidence base review).

Also it is best to divert resource (i.e. organic waste) to sites where its use can be controlled actively. Therefore, councils should rely on purpose build AD plants rather than AD process in landfill sites.

Heat pumps

Deployment of heat pumps is dependent upon the local ground conditions. Air source heat pumps require less work as they lack outdoor exchanger coils. Ground source types are generally more efficient but do require additional work of lying down or drilling into the ground to extract heat. This could be costly depending upon ground conditions. Air source heat pumps are inherently less efficient than ground/water source system. This fact is supported by the field trial carried out by the Carbon Trust. The study found that ground source system could have a COP of more than 3 while the air source system had less than 2.5. The lower operational achievement is due to the fluctuation of mean air temperature and the requirement for defrosting of the external coil.

A more challenging barrier to heat pump deployment is the availability of cheaper mains gas. The gas system also has a smaller capital cost and is more easily installed as compared to heat pumps.

4.5 Economic Limitations

This desktop study does not consider the economic limitations as they are very project and site specific. More detailed and focused work is required to assess the economic viability of any site. However, an effort has been made to discuss its implications to any project.

The proximity of a site, be it PV, hydro or biomass, to National Electricity Grid (National Grid) and to national road networks is an important factor in determining the economic viability of a scheme. Long cable runs are expensive. Likewise upgrading lines to receive power is also expensive and can lead to project delays.

Current large wind turbines are rated at around MW scale. These turbines connect to National Grid at 33kV to transport extracted energy to keep electrical losses to the minimum. It is essential to have such a highly rated electricity grid close by. If it is not available, the scheme developer must install necessary equipment to 'strengthen' the grid. Even small wind turbines are generally rated at higher power than residential PV systems. This may requires a site, e.g. farms, to strengthen their electricity supply before incorporating wind turbines at a cost.

In the case of biomass system heating, a site (depending on power rating) may require upgrading the electricity supply to three phase system as motors in the system are relatively high powered. If such projects are located in a 'weak' part of the distribution network, it will introduce voltage fluctuation in the grid. Fluctuations in supply voltage also tend to cause the system to shut down temporarily.

The proximity of the site to the national road network is also an important factor in economics of wind farms. Modern day wind turbines, especially the blades, are shipped as a single unit and require wide roads for delivery. If the roads are not wide enough, they have to be widened at the expense of the developer and this could be a very significant cost depending on the distance involved. Even if the sites are well served by the road network, it is still necessary to construct site access roads which, sometimes, may be required to be taken apart once the construction is finished. For example, whilst transporting wind turbines for re-powering Goonhilly in Cornwall, some traffic lights had to be taken off to allow lorries to navigate the roads.

A combined project, wind and ground mounted PV, also increases the economic viability of a site as some infrastructure e.g. grid connection, security and accessibility, may be shared.

The incentives provided by the government do increases the economic viability of a site. The installations in the district will mostly benefit from Feed-in-Tariff and Renewable Heat Incentive but some projects such as AD and large wind systems will benefit from the Renewable Obligation. Residents can also benefit from the Green Heat Scheme once it is introduced. The incentives will bring in finance to the district which would otherwise be distributed to other areas. However, given the changing nature of these policies, it is imperative that the council act fast and decisively if they are to benefit to any significant degree.

4.6 Conservation area and AONB

Wind energy is a major source of renewable energy available in the district. Ironically, wind energy is also heavily opposed by AONBs and in the context of WB, NWD AONB covers almost 3/4 of the district and is set to play an important part in the district's ability to develop into a sustainable region. Although AONBs cannot stop a development within their boundary, they are an important stakeholder consultees. The land use within the AONB is also the local authority's responsibility[53]. Additional complications may arise as the AONB overlaps different authorities. Figure 426 and figure 47 indicate the extent of NWD's affect in the total wind and PV resource.

However, not all AONBs are opposed to development of large commercial scale wind farms within its boundary e.g. Goonhilly Windfarm located within Cornwall AONB in the Lizard Peninsula (Cornwall) has six 2MW turbines. It is also surrounded by various conservation areas[54].

A study commissioned by the NWD AONB has identified the entire district to be moderately to highly sensitive to wind farm development. As such, it is highly unlikely that WB will see any wind farm development at the large scale and density. The most likely scenario of wind system deployment is going to be in a cluster of 1-3 turbines and placed at large distances apart.

West Berkshire has around 51 other conservation sites.

[53] http://www.malvernhillsaonb.org.uk/faqs.html
[54] http://www.cornwall-aonb.gov.uk/documents/aonb_lizard.pdf

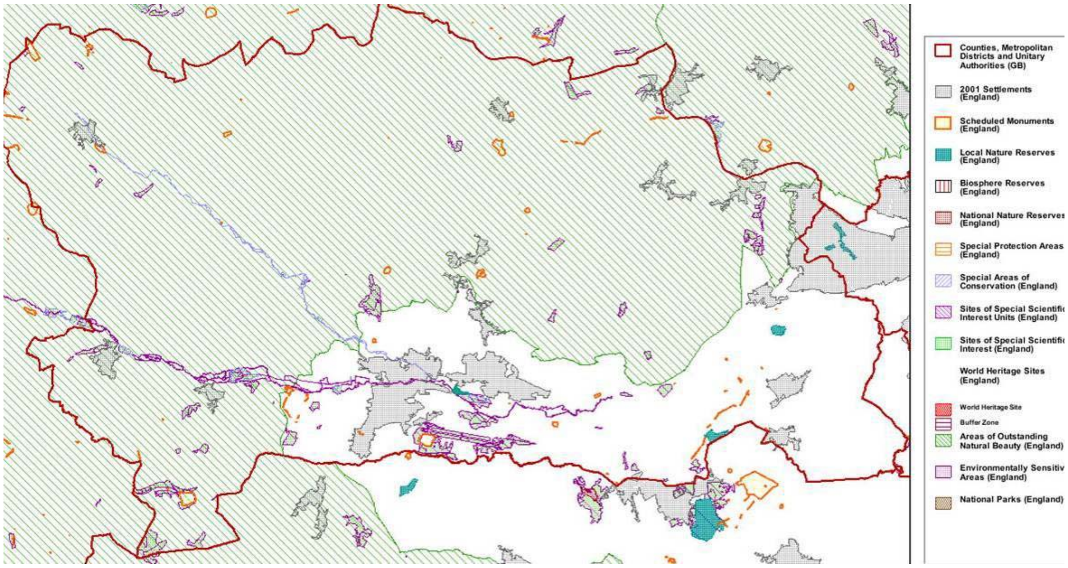

Figure 47, Conservation sites in West Berkshire. (Source: magic map)

The portion of the district outside NWD AONB is covered by major towns such as Newbury, Thatcham and Theale. With almost half[55] of the population based around the south-east of the district, a large part of the area is unavailable for wind energy projects. The area within the AONB is sparsely populated and could potentially offer more sites for turbine erections than south-east of the district.

Natural England, during the formulation of the methodology, has advised that the conservation areas and AONBs are *not* completely out of bounds for renewable energy exploitation. The methodology also provides 5-step guidelines for the assessment of a site within a conservation boundary which is reproduced here from the methodology:

Step1: Identify purpose of designation e.g. AONB, SSSI
Step2: Identify technology that affects the purpose of designation.
Step3: Identify how they affect e.g. habitat, view
Step4: Identify the level of renewable energy projects that can be developed without compromising the designation purpose.
Step4: Prepare guidance on how renewable energy projects can be developed without compromising the purpose.

A mid 2000 study commission by NWD AONB concluded that all landscapes within the AONB have medium to high constraints to turbine with hub height of 25m and above, including single and multiple cluster turbines. A chapter on sustainability in its Management Plant does indicate that the AONB recognises Climate Change and believes that it can be mitigated through reliance on 'appropriately scaled renewable energy generation'. An independent study may be necessary to ascertain the true impact of the turbines as the appearance of turbines in a landscape is completely subjective.

[55] http://www.westberks.gov.uk/media/pdf/l/c/2_-_People_and_Place.pdf

Another AONB (High Weal) in the South East also commissioned a study of wind energy resource within their boundary. The study found that, after allowing for various constrains, the AONB is not suitable for large commercial scale wind farm but suggested that an installation of a single or cluster of up to 3 turbines with rated capacity of around 2MW each is a possibility[56].

Turbines designed to be installed at less than 25m hub height are rated at less than 50kW some of which are shown in figure 24. It must be noted while considering proposals for larger turbines that although small height system may have less effect in the landscape, it would take a considerable number of them to generate the equivalent amount of electricity as would be generated by a single MW-scale turbine. A report published in Environmental Science and Technology shows that the bigger the wind turbine the more environmentally friendly they are[57].

AONB's and conservation sites are less likely to oppose other forms of renewable energy systems. However, these systems do have smaller potential as compared to wind and ground mounted PV systems.

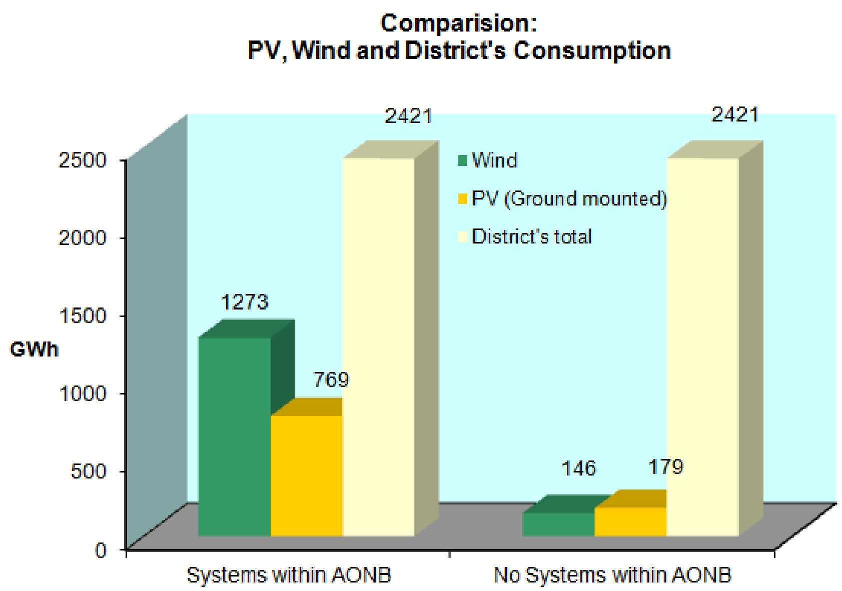

Figure 48, NWD AONB and its effect

5 REALISING FUTURE PROJECTS

Policy & Targets

Setting up targets is an important step in developing West Berkshire into a sustainable future. Having a goal can also motivate people to do more to move towards its achievements. It gives something to aim at and develop tactics to reach the goal.

The planning policies are an important form of tactics. The type of planning policy implemented will be pivotal in any renewable energy project development, especially wind. The

[56] Digital Landscape Co-operative. Wind Energy Regional Assessment for High Weald AONB, 2009. [Accessed on 26/06/2012]
[57] http://pubs.acs.org/doi/pdf/10.1021/es204108n

government's Planning for a Low Carbon Future in a Changing Climate, which is to consolidate Planning Policy Statement (PPS)1 and PPS22 will help the council in formulating future policies.

Addressing Issues: Heat and Electricity

From the discussions in the above sections, it is clear that exploiting wind energy is vital for the district. The main issue with deployment of wind turbine in the district is the AONB coverage. Hence, the district must address this issue for any kind of wind energy development. The majority of the area not covered by the AONB is densely populated rendering wind power unsuitable for larger turbines.

The retrofitted PV systems are mainly for residential houses. To make a dent in the district's electricity consumption, ground mounted systems have to be considered. Ground mounted systems do attract opposition, though not as much as wind. Installing PV system in highly visible place such as parking spaces and public building will help to increase PV profile and may increase PV uptake.

TV Energy is active in the district and also has a trading arm, TV Bioenergy, which works in biomass procurement and supply. TV Bioenergy, which has its own SRC, is also active in the energy crops cultivation and management. Involvement of such a company along with the Forestry Commission will be important in efficient management of the woodland resource. In terms of supply and demand, demand dictates what can be accessed economically. Hence, if the biomass heating installation increases in the district it will create demand and sources which are currently not being used will be brought to market which in turn will drive the cost down.

In terms of AD, acquiring segregated feedstock is important as feedstock contaminated with inorganic material will decrease the AD's performance. The district already has kitchen waste collection service in place. Although currently being diverted to composting sites, some of it should be diverted towards AD for heat and power. The gas obtained from AD can also be injected into the mains gas grid but will require extensive cleaning, upgrading and pressurisation which in itself are an energy intensive procedure. Adnams Brewery has such project in operation. Composting is an environmentally friendly way of disposing of waste, ADs are better due to their potential to displace fossil fuel.

Promoting small wind system and hydropower has the benefit of generating more local employment as the UK has the capability to manufacture them. Heat pump is another technology which is manufactured in the UK. As such, adopting their use will help the UK economy as well.

Addressing Issues: Alternative Transportation

Reduction of fuel consumption (efficiency) can also be achieved in transportation. The fuel saving measure will mainly be in the form of change in the way we drive. This can be brought about by making the public aware of the methods to run vehicle efficiently and clearing misconceptions. For instance, modern vehicles do not require 'warming up'. It is also widely believed that driving at constant speed is an efficient form of driving. This is only true while driving on a level road. Cruise controls waste fuel if the road is undulating.

Internal Combustion Engines (ICEs) are inefficient machines. Although fuel consumption is reduced by alternative modes of transportation (cycling, walking, car-share, public transportation), careful planning of their deployment is required. For instance, inappropriately placed pedestrian crossing at a busy road could cause more emissions as vehicles decelerate, idle and accelerate to allow for a single pedestrian to cross the road. There is also an increased level of emission at low gears as ICEs use more fuel to travel the same distance. A badly planned bus service will also result in inefficient use of fuel, man and machine as they travel around near empty.

Alternate means of powered transport include hydrogen fuelled, pure EV and Hybrid vehicles and are available in the market (e.g. Nissan leaf, Mitsubishi IMiEV). However they are only as green as the electricity they use. Unless the district installs renewable energy powered charging station (figure 49). The EVs will have emission through national electricity grid which currently is around 0.5kg/kWh. Hybrid vehicles such as Toyota Prius and Honda Insight are also available and give better fuel mileage.

Figure 49, Left: Hydrogen refuelling station (Honda, Swindon). Right: Solar powered EV charging station (Mitsubishi)

Developing EV charging infrastructure will not only help West Berkshire but will also help nationally in the mass deployment of EV. The government, through Office of Low Emission Vehicle, provides grants to consortium undertaking EV charging point installation in the form of match-funding. Although at first glance EV may be perceived as impractical to the district, that perception is likely to change when one considers the fact that the majority of the 154 thousand residents reside within 26% of the district, mainly in the south east of the district and that the modern EVs have as much as 100 miles per charge range.

ANNEX 2: BAYDON WIND TURBINE APPEAL DECISION

Site visit made on 31st July 2012

by T. Cookson MRTPI DipTP FRGS

An Inspector appointed by the Secretary of State for Communities and Local Government
Decision date: 6 September 2012

Appeal Reference: APP/W0340/A/12/2174074
Baydon Meadow, Baydon Road, Lambourn, Berkshire, RG17 7TR

- The appeal is made under Section 78 of the Town and Country Planning Act 1990 against a refusal to grant planning permission.
- The appeal is made by Mr. Matt Partridge against the decision of West Berkshire Council.
- The application (reference: 11/01918/FUL), dated 2nd September, 2011, was refused by notice dated 22nd March, 2012.
- The development proposed is "***erection of a wind turbine up to 35 m. tip-height above existing ground level for a period of 25 years and erection of an anemometry mast of up to 35 m. height above existing ground level for a period of 18 months***".

Decision

1. In exercise of the powers transferred to me I dismiss the appeal.

Main Issue

2. From my inspection of the site and surroundings and from my consideration of all the representations I find that there are three main issues in this appeal. The first is the effect of the proposed development on the character and appearance on the landscape and surrounding countryside. The second is the effect of the proposal on the safe operation of Membury Airfield. And the third issue is if there is any identified harm caused by the development, whether or not such harm would be outweighed by the national objective of promoting renewable energy generation.

Reasoning

3. The appeal site is a field some 1.2ha. in size located between the M4 motorway to the south-west and Ermin Street linking Woodland St. Mary to Baydon to the north-east. There are hedgerows on the boundaries with the roads, whilst the other boundaries are open. The site lies within the North Wessex Downs Area of Outstanding Natural Beauty (AONB).

4. The scheme involves erecting an anemometry mast some 35m. high about 60m. into the field from Ermin Street. The mast would be replaced after 18 months with a wind turbine of the same overall height, the hub height being some 25m. above ground level. No details of the model of turbine are provided. The electricity generated would be fed into the National Grid. In Appeal Decision APP/W0340/A/12/2174074

www.planningportal.gov.uk/planninginspectorate 2 addition to the turbine there would be a small, single-storey building and an access track.

Planning Policies

5. The National Planning Policy Framework (NPPF) states that planning plays a key rôle in helping shape places to secure radical reductions in greenhouse gas emissions and supporting the delivery of renewable and low carbon energy and associated infrastructure. Paragraph 98 of the Framework recognises that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions.

6. The South East Plan (SEP) provides the adopted regional spatial strategy for the region. It currently remains part of the development plan and is a material consideration notwithstanding the Government's stated intention to abolish regional spatial strategies. Policies NRM13 and NRM14 of the SEP establish regional and sub-regional renewable energy targets and Policy NRM15 deals with the location of renewable energy. The supporting text indicates that small-scale renewable energy development should not necessarily be precluded in AONBs. It cites as an example proposals of between 1 and 4 turbines generating not more than 5MW. And Policy NRM16 details renewable energy criteria.

7. Paragraph 109 of the NPPF requires the planning system to contribute to and enhance the natural and local environment by, inter alia, protecting and enhancing valued landscapes. And paragraph 115 states that great weight should be given to conserving landscape and scenic beauty in AONBs which have the highest status of protection in relation to landscape and scenic beauty.

8. Policy C3 of the SEP gives high priority to conservation and enhancement of natural beauty in the region's AONBs, and indicates that planning decisions should have regard to their setting. The policy states that in considering proposals for development the emphasis should be on small-scale proposals that are sustainably located and designed.

9. Since the decision by the local planning authority the West Berkshire Core Strategy has been adopted. The development plan now constitutes the Core Strategy and certain specific policies. Those detailed in the decision notice have been deleted. In the Core Strategy, Area Delivery Plan Policy 5: North Wessex Downs Area of Outstanding Natural Beauty, amongst other things, recognises the AONB as a national landscape designation and states that development will conserve and enhance the local distinctiveness and the sense of place and setting, whilst preserving the strong sense of remoteness. It states also that opportunities for appropriate small-scale renewable energy schemes which use local resources will be encouraged if they can be accommodated within the landscape of the North Wessex Downs. Appeal Decision APP/W0340/A/12/2174074 www.planningportal.gov.uk/planninginspectorate 3

10. Policy CS 14 and CS 15 of the Core Strategy relate to design principles for new development, including minimising carbon dioxide emissions. And Policy CS 19 seeks to ensure that the diversity and local distinctiveness of the landscape character is conserved and enhanced.

Visual and Landscape Impact

11. The landscaping proposed on site would help screen the access track, the switchgear building and the base of the tower, although the proposed mounding would not help screen the mast and turbine to any worthwhile degree because of its low height and design.

12. Beyond 5km. owing to the size of the mast and turbine there would not be a significant adverse visual effect. The turbine would, however, be mainly visible in near views, that is, up to 1km. away, even allowing for the screening effect of areas of woodland. These near views would be obtained from points along the B4001 from the entrance to Lodge Farm in the west to Great West Wood in the east. Also, views would be obtained from the public right of way over the M4 motorway and along paths immediately north and south of the bridge, and from a footpath north-east of the site and from adjacent properties.

13. Between the more wooded downs to the south and east and the more open downland to the west and north there would be clear views of the turbine. Up to 2km. away owing to the woodland around the site, views would be more limited, although the turbine would be evident from the east. In views between 2-5km. distant there is unlikely to be a significant visual impact on views from south of the motorway. However, north of the M4 there would be a significant visual effect on the wider landscape. The turbine would be visible above the wooded skyline in a number of locations within the open downland, especially between Lambourn and the site, on rising ground north-east from
Lambourn, and from paths and roads at Bailey Hill to the north-west.

14. Altogether, I find that views of the turbine from public viewpoints in the AONB would display high sensitivity. The turbine would introduce a highly visible, vertical, alien moving structure above the wooded skyline. As such I find that it would detract markedly from the special qualities of this part of the AONB. In particular the development would have a major significant adverse impact on the more sensitive open downland. I acknowledge the visual impact of the M4, its service areas and the telecommunications mast. However, I agree with the findings of an Inspector in an earlier appeal who concluded that such impact is limited in extent and does not erode the sense of visual seclusion and remoteness of the area.

Membury Airfield

15. Membury is an unlicensed airfield and its usage is limited to a maximum of 120 flights per month, with no more than 20 a day and no flights on Sundays and Bank Holidays. It has 5 runways, two of which are tarmacadamed, the Appeal Decision APP/W0340/A/12/2174074 www.planningportal.gov.uk/planninginspectorate 4 others being grass. The local planning authority is concerned that the turbine has the potential to have a combined psychological and physical impact on pilots using the airfield, especially in poor weather conditions. This is understood to be the distraction caused to pilots by the combination of the turbine and the motorway on take-off and landing. The

Membury television and telecommunications mast adds to the potential hazards.

16. The appellant has produced a report that details the landing and take-off flight paths necessary in order to avoid existing distractions, including model aircraft flying that takes place at the airfield. It concludes that considerable distances would exist between the approach and take-off paths used by pilots operating at the airfield and the proposed turbine and that it would have a negligible impact on the likelihood of pilot distraction. I attach considerable weight to this evidence.

17. In an appeal1 into an earlier proposal for a wind turbine on this site, the Inspector found that the proposal would result in wake turbulence that could affect aircraft taking-off and landing. This conclusion was based on a turbine some 81m. high. The present scheme is for a considerably smaller turbine. Evidence produced by the appellant shows that the effect of wake turbulence of this turbine in respect of baseline turbulence would be insignificant. I find this evidence persuasive in the light of the size of the turbine and the distances involved between the turbine and the runways. Accordingly, on the question of the effect on the operation of Membury Airfield I find that the proposed scheme would not be a potential risk.

Other Matters

18. A number of representations have been made concerning the potential impact of the proposal on the local horse racing industry and general equine safety. 19. In the earlier appeal1 for the 81m. high tower the Inspector concluded that the proposed turbine would not have an unacceptable effect on the operation of nearby stables or the future of equestrian activity in the area. I have considered his reasoning and I find it to be comprehensive and sound. Taking account of his findings, the representations in this case, and the fact that it is a notably smaller turbine, I find that what is proposed here would equally not have an adverse effect on equestrian activity.

Conclusions

20. I accept that however small in scale, the scheme would result in savings in emissions. In this regard national policies are such that the landscape and visual effects of a scheme are capable of being outweighed by the environmental benefits a renewable energy scheme would bring. However, on balance, after considering the representations and assessed the details of the 1 APP/W0340/A/08/2077166 Appeal Decision APP/W0340/A/12/2174074 www.planningportal.gov.uk/planninginspectorate 5 scheme, especially its siting, I judge that the harm this scheme would cause on this part of the landscape of the AONB would be sufficiently substantial to clearly outweigh the benefits it would bring.

21. Notwithstanding that I find that the proposal is acceptable in terms of the effects on Membury Airfield and equestrian activity, I conclude that the appeal should be dismissed. In doing so I have had regard to the report: *Study of Landscape Sensitivities and Constraints to Wind Turbine Development*. It is necessary, however, to assess each proposal on its own merits, and in this case I find that the proposal is unacceptable for the reasons given. I have had regard also to all other matters raised in the

representations, but none is sufficient to outweigh the considerations I deem to be paramount.

T Cookson
INSPECTOR

ANNEX 3: RENEWABLE ENERGY PROJECTS IN SENSITIVE LOCATIONS

1. **The Charterhouse Centre *(small scale wind)***

The Charterhouse Centre sits within the Mendip Hills AONB. They have a single, small wind turbine to produce clean renewable electricity for the centre and its guests. The wind turbine harnesses the power of the wind to produce clean renewable electricity for the Centre and its guests.

Over a single year it will produce enough electricity to power four houses without polluting the environment. It reduces the centre's production of CO_2 - the main greenhouse gas - by 5.5 tonnes per year.

March 2011: Total energy generated since being switched on 16,405 kWh
Total carbon dioxide saved by not using electricity from power stations 7,054 kg

2. **Faccombe estate *(small scale wind)***

Planning permission was granted for a small wind turbine on the Faccombe estate, to the south of Newbury in 1993. The estate is located 260m above sea level and in an Area of Outstanding nation beauty (AONB). The turbine is a Vestas V39 with a 39m rotor and 35m tower and is expected to deliver 800MWh of electricity a year. The electricity produced is used on the estate and any surplus goes back to the grid and is consumed by houses within the village

3. **12m wind turbine erected within Conservation Area & World Heritage Site**
http://www.urbanandruralplanning.co.uk/sub_category.php?cat_id=4&sub_id=31

Planning permission was gained for a 12m turbine at Minions on Bodmin Moor which has now been erected. This is within a heavily designated part of the countryside but it is seen not to be obtrusive.

The owners prepared a supporting statement and acted as agent for the proposal. This included a Heritage Baseline Appraisal to help to demonstrate why the development would be suitable. Reference was made to Planning Policy Statement 22 "Renewable Energy" and the accompanying guide.

Initial concerns from the Council's Environmental Health officers were also overcome.

4. **Solar in a Conservation Area *(PV)***

System size: 3.3 kWp
Annual system electricity generation: 2805 units (kWh)
Annual income from the Feed-in Tariff: £1,215 per year
Annual electricity savings: £219 per year
Annual income from exporting electricity: £34 per year
Total benefit over 25 years: £36,675
CO_2 savings per annum: 1,403 kg

The Scilly Isles installation is an excellent domestic case study showcasing Solarcentury's new C21e solar slates on a new building within a conservation area.

In early 2011, a resident of the Scilly Isles decided to power their home with a 3.3kW array of Solarcentury's award winning C21e solar slate. This photovoltaic (PV) array covers 36m2 of roof space, blending seamlessly with the existing slates on their south facing home.

The Challenge: The new property is ideal for a solar installation, but the owners were concerned that the aesthetic of their home would be affected by micro generation. The house is located in an Area of Outstanding Natural Beauty (AONB), in a Conservation Area, next to an ancient monument, and the isles form part of the Duchy of Cornwall estate.

The Solution: It was essential to find a solar solution that was compatible with the slates already on the roof. Solarcentury's C21e slate was ideal since it fits with all conventional roof slates and can be supported by lower pitched roofs. C21e slates are straight forward and fast to install with simple components. They fit directly to the roof battens, taking the place of the conventional slates, and give a sympathetic finish in an area of aesthetic sensitivity.

5. **Shooters Bottom Farm, Chewton Mendip *(large scale wind)***

http://www.ecotricity.co.uk/our-green-energy/our-green-electricity/from-the-wind/wind-parks-gallery/shooters-bottom-somerset

Running Since: **June 2008**
Number of turbines: **1**
Rotor diameter: **70m**
Hub height: **65m**
Capacity: **2MW**
Green electricity per year: **5.26 million units**
Homes powered (equiv.): **1,269**
Tonnes of CO_2 saved p.a.: **2,265**

This is just one turbine but it will provide enough power for 3% of homes in the Mendip District. Quoted as stating "So just another nineteen then and all the homes in this part of Somerset could be powered by a clean, (endless) local power source. We're working towards that goal right now. But why on earth did it take four years to get permission for this one? Since it's been up, we've been inundated with e-mails and calls from local people – who just love it. Another classic example of the two truisms of wind energy in the UK. Local people think it's a good idea, they want to see more, but local councils stand in the way."

6. **Hughenden Manor- (*Biomass)***

Hughenden Manor is a Grade I listed building on the edge of High Wycombe. The mansion is located on top of a steep, wooded hill within the Chilterns Area of Outstanding Natural Beauty (AONB).

To satisfy planning and to sit unobtrusively within the Hughenden estate and within the AONB the new fuel store was faced with brick and flint panels, a style common to the Chilterns. The bricks used were handmade using Chilterns clay and were supplied by one of the few remaining Chilterns brick makers.

Fröling 220kW turbomat boiler , 4,500l thermal store
Rotary out feeder, Top loading

7. <u>**Goonhilly wind farm- *(wind)***</u>

The Goonhilly Wind Farm has been a feature of the Lizard Peninsula since 1993. It has made its own quiet contribution by generating clean, renewable electricity equivalent to the usage of some 2000 homes annually. The wind farm is located in an Area of Outstanding Natural Beauty (AONB) and minimising the impact on the landscape was a key aspect of the design process

Six new wind turbines replaced the 14 old models at Goonhilly Wind Farm with the new turbines rated five times as powerful as the previous ones. In 2010 the final new wind turbine was installed and in full production, Goonhilly is forecast to power around 5,500 homes with green electricity from wind and estimated savings of over 12,000 tonnes of carbon dioxide (CO_2) a year. That's the equivalent of 70,000 lorry loads of CO_2, the main greenhouse gas, saved every year and will provide a carbon-free future for homes on the Lizard.

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The Goonhilly Greenpower Project has attracted strong local interest and support and a visit programme for local groups including schools, Scouts and community groups began this month to enable visitors to see the new turbines first hand and to learn more about wind energy