

LDP Renewable Energy Submission

Richard Martin BSc MIET ID 6533

Contents

1. Soundness Tests.
2. Government policies.
3. Powys LDP revised renewable electricity targets.
4. Appendix 1 Why the WAG analysis is flawed.
5. Appendix 2 The effect of storage on capacity requirements.
6. References

1. **Soundness Tests** The renewable energy section of the Powys LDP is fundamentally unsound. It demonstrates the urgent need for some central authority to coordinate the planning of the renewable energy requirements across the UK.

1.1. Does the plan fit?

1.1.1 The Plan is not consistent within itself or with the renewable energy policies of the Welsh Assembly Government (WAG) or the UK Government. The UK Government policy is particularly important as the UK Government retains the planning and regulatory responsibility for energy supply. Energy policy is not devolved to the WAG.

1.1.2 Although the renewable electricity targets have been reduced by a factor of ten from those proposed in the Further Focused Changes they are still too high when compared with these policies.

Section 2 of this submission details these policies.

1.1.3 The Powys maximum electricity demand is about 100MW. The LDP aim to “seek a realistic **contribution** towards meeting a **proportion** of the total demand “ (ED061 5.01 and ED059 11.3.2.1) suggests a Powys renewable electricity target of less than this total demand.

The WAG aim would also suggest a renewables target of 100MW but its (incorrect) calculations give 180MW.

The UK govt policy would give a target of 30MW renewables for Powys.

1.1.3 The existing renewables within Powys amount to 326MW (ED059 3.4.1) and therefore already greatly exceed UK Government, Welsh Assembly targets and the stated aim in the Powys LDP. The LDP also states that there is an additional 468MW of submitted renewable electricity applications awaiting consent, although this is ignored in all subsequent analysis.

1.2. Is the plan appropriate?

1.2.1. The revised renewable electricity target in the Plan is inappropriate for the area representing over ten times the Powys electricity demand. (See Section 3 of this submission).

1.2.2. By producing vastly in excess of local need the Plan is most definitely industrialising the County (ED061 7.02).

- 1.2.3. The plan gives no reasoning for proposing additional renewables above the national targets for electricity generation or how this would be compatible with the aims of other Local Authorities or National requirements.
- 1.2.4. The plan has a superficial vision. ‘The more renewables the better’. It has no strategy for dealing with a demand with a high percentage of renewables let alone renewables at a level vastly exceeding demand. The viability of future energy storage solutions is not considered. An aspiration plan would deal with a workable renewables future including storage options (Batteries, pumped storage and Hydrogen). With viable storage less generation capacity is required. (See appendix 2 of this submission)

1.3. Will the plan deliver?

1.3.1 The plan will be ineffective as it does not fit with UK policy guidelines. These deal exclusively in electrical power (MW) because electricity cannot at present be stored in meaningful quantities. The AECOM assessment (ED059 1.8.2) recognises the distinction between power (MW) and energy (MWh) as important but does not elaborate on its effects in the analysis. Its analysis is incorrectly carried out in energy (MWh). Tables 3 & 4 ED059.

1.3.2 A Toolkit for Planners Recommendations Report (4.1.4) also recognises the fundamental importance of this distinction. The authors of this document plead for guidance on this matter. “In relation to the setting of area wide renewable energy targets, it would be helpful to have clear guidance from the Assembly Government as to the nature of these targets. Should renewable energy targets be in terms of installed capacity (MW) or energy generation (MWh) or”

Was it ever resolved? It would appear not as the confusion continues in subsequent documents such as ‘A Low Carbon revolution’ and the AECOM renewable energy assessments

1.3.3 The LDP states correctly (ED061 7.0.3 and ED059 11.3.1)” that renewable heat is by its nature dependent on a demand for its use” but fails to realise that this is even more true of renewable electricity as it currently cannot be stored in any meaningful way.

1.3.4 By having electricity generating capacity vastly in excess of local need if this surplus cannot be exported for use elsewhere or stored, under the current electricity market system it will be paid, at the consumer’s expense, not to generate. No analysis has been done to show the viability of exporting electricity outside Powys or to the viability of storage.

1.3.5 In future as storage increases much of the proposed renewable capacity will not be required or viable.

2. Government Policies

2.1 UK Government Policy – The Carbon Plan: Delivering our low carbon future.

2.1.1 This document sets a target of 100% electricity generating capacity from low carbon sources and within this 30% from renewables. Low carbon sources include Nuclear, Gas and Coal generation with carbon capture and storage (CCS) and renewables. Renewable electricity is an important part of this generation mix to reduce carbon emissions at a national level, however various technical and economic constraints limit its use.

Further information on these technical constraints can be found in National Grid document (Ref 1) and Royal Society of Engineering document (Ref 2).

2.1.2 The Carbon Plan recognises these constraints and accordingly sets a renewables target of 30% electricity generation by 2030. **It states that a target of 40% may be possible by 2030 if various technical challenges are overcome.** (Page 79 Sections 2.167, 2.168 and 2.169).

2.1.3 All electricity targets in this document are correctly set as electricity capacity (MW) not energy (MWh).

2.1.4 The initial Powys LDP (Section 4.10.2 – Schedule of Further focused Changes Oct 2016) recognised this UK renewables target of 30% but ignored it in all subsequent analysis. The current revised LDP is silent on the matter.

2.2 WAG Policy – A Low Carbon Revolution.

2.2.1 The WAG document is deeply flawed, its target calculation is incorrect and its resulting renewable energy targets far too large. This is detailed in Appendix 1.

2.2.2 Taking for the moment the WAG targets at face value. **WAG policy is to produce 100% of electrical energy (MWh) for Wales from renewables.** From this the document calculates an onshore wind target of 2GW and a total renewables target of 22.5GW.

2.3 The Powys demand is 3% of Welsh demand (ED059 3.1 5th Para). The Powys share of the onshore wind target is therefore 90MW. The total renewables target for Wales includes 18.5GW from offshore wind and tidal power and as Powys cannot provide a share of this element its share of the renewables total is 180MW.

3. LDP revised renewable electricity targets for Powys

3.1 The AECOM assessment document (ED059 3.4.10) states that there are 326MW existing renewables in Powys and also that 468MW of renewables are in the application process. Why are these, making a potential total of 766MW, not included in subsequent analysis?

The section states that 326MW is 16% of the 2GW WAG onshore wind target. (766MW is a share of 38%)

Section 3.1 5th Para states correctly that Powys demand is 3% of Wales demand. How is 16% or 38% a fair and reasonable portion of the total onshore wind target when 3% represents 60MW?

3.2 Looking locally at the peak Powys demand of about 100MW.
Existing renewables 326MW is 326% of this peak demand.
Proposed additional renewables 48MW is 48%
Potential additional renewables 240MW is 240%
Renewables already in planning process 468MW is 468%
Adding together **gives total renewables capacity of 1080MW which is 1,080%!! of local capacity requirement.**

3.3 In total 1080MW of electricity renewables are under discussion for a Powys peak demand of 100MW. **Eleven times greater than local need.** The winter peak demand of Wales is 2800MW. The renewables in Powys will meet 39% of this. This conflicts with the objectives stated in ED061 5.01 and ED059 11.3.2.1.

3.4 Table31 ED059 and Table 2 ED061 should be worked in electrical power (MW) as in my analysis above.

However to show that the energy targets are themselves too large I continue their analysis.

Existing renewables (326MW) 163% of Powys energy requirement (as quoted in text 11.1 Para 2 ED059)

Existing plus proposed (+48MW) 181% (as quoted in the Table31)

Existing plus proposed and potential (+288MW) 400%

Total renewables (1080MW) is 2,504,492 MWh (2,505GWh) or **over five times the annual Powys electrical energy requirements.**

A1 Appendix 1 **Why the WAG analysis is flawed.**

A1.1 Because electricity cannot be stored in a meaningful way, to obtain a workable plan, instantaneous power (MW) and not average energy (MWh) must be used to calculate capacity targets. The National Grid system is not a pool of electricity to be filled and drawn on as required. Demand and generation are actively matched second to second not on average over a year.

A1.2 'A Low Carbon Revolution' incorrectly uses average energy in its calculations. It also incorrectly uses capacity factors to derive a capacity requirement. By this incorrect logic a renewable electricity target for Wales of 22.5 GW is calculated. This target does not include significant contributions from nuclear and other low carbon sources (although other WAG documents Energy Wales: A low carbon transition refers to the nuclear and gas being required to compensate for the intermittency of renewables (in reality nuclear cannot perform this function)). Even with these omissions this target still far exceeds the Wales winter peak demand of 2.8 GW. It is 45% of the total UK (England, Scotland and Wales) winter peak demand of 50GW.

A1.3 Briefly explaining why this logic is incorrect using a simple example.

A1.3.1 A 1MW wind turbine if running at capacity for a year will generate 8760MWh of renewable electricity (365x24x1). Because of variable wind speeds and maintenance outages it will not run at capacity all of the time.

On average over the year it will produce 27% of its potential output 2365MWh (8760 x 0.27).

A1.3.2 If a consumer with a constant demand of 1MW wishes to be supplied 100% from renewable electricity they will require 8760MWh of energy. On average, in energy terms, this requires just fewer than four of the 1MW wind turbines ($3.7 \times 2365 = 8760$).

A1.3.3 However in electricity power system terms the four wind turbines will produce at any one time, depending on wind speed, between zero and 4MW. The consumer needs are not met, as sometimes he will need 1MW from additional non renewable sources. The wind turbine generator will sometimes have 3MW of surplus capacity and be a non productive investment. Storage, if economically viable in future, would in this case be the answer to soak up the surplus 3MW for later use.

A1.3.4 However if the consumers 1MW peak demand varied throughout the day and throughout the year in line with the UK total electricity demand, storage would not be required to soak up the 3MW of surplus output, as some commentators claim, because with storage only one wind turbine would be required. (See Appendix 2).

A1.4 A bizarre consequence of this incorrect use of capacity factors is that it encourages the development of the least effective technologies. For example using this faulty logic if you required 1MW of demand you would build 10MW of solar panels (capacity factor 0.1), 3.7MW of wind turbines (0.27) or 1.1MW of nuclear generation (0.9). See Appendix 1 of A Low Carbon Revolution.

A1.5 The Planners toolkit correctly uses capacity factors to calculate energy output it does not use them as the WAG document (and the Further Focused Changes) to calculate capacity targets from energy.

A1.6 The WAG document should be using electricity power requirements but instead uses energy consumption figures. These are also highly inflated. In the text it inconsistently refers to energy consumption per day per person (kWh/d/p) being either 18, 22, 43 or 48. For the calculation by which the renewable energy target is set it uses 43kWh/d/p. Official publically available statistics show consumption being less than 15kWh/d/p.

UK annual electricity consumption = 304,625 GWh

UK population 64 million.

Average energy consumption per person per day = 13 kWh/p/d

A2 Appendix 2 The effect of Storage on capacity requirements.

Powys annual electricity consumption = 500 GWh

Average power requirement = $500 / 365 \times 24 = 0.057\text{GW} = 57 \text{ MW}$

Powys winter peak demand is about 100 MW.

This simplistic calculation shows that if you had perfect electricity storage capacity to meet the Powys demand you would only require a generation capacity of 57MW rather than 100MW.

Similarly for the UK you would need 35GW of generation although the peak demand is 50GW.

6. References

Ref 1: System Operability Framework. – updated annually

Ref 2: Wind Energy – Implications of large scale deployment on the GB electricity system- April 2014