From: Jonathan Dean
To: NDF
Subject: to supplement my online response
Date: 07 October 2019 21:34:52
Attachments: Draft NDF policy 10 - 13 consultation feedback v0.2.pdf

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FYI my response is not complete without the attached

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Dr Jonathan F Dean
[redacted]

https://you.38degrees.org.uk/petitions/anglesey-says-no-to-pylons

Feedback on draft National Development Framework

1. Introduction

1. In the draft National Development Framework[1], the Welsh Government presents a bold and ambitious picture of how Wales will develop between 2020 and 2040.

2. The majority of the proposed policies seem sensible, non-contentious and merit little further comment, so this feedback will focus on policies 10 – 13 but also makes reference to policy 22:

    - Policy 10 – Wind and Solar Energy in Priority Areas;
    - Policy 11 – Wind and Solar Energy Outside of Priority Areas;
    - Policy 12 – Wind and Solar Energy in National Parks and Areas of Outstanding Natural Beauty (AONB); and
    - Policy 13 – Other Renewable Energy Developments.

3. Policies 10 and 11 cover large scale, on-shore wind and solar power, using wind turbines of up to approximately 250 m in height[2] (see map at end of document).

4. The Welsh Government is right to focus on, and promote, renewable forms of energy, and to set targets for generation from these low carbon sources, as a means of addressing the issues caused by climate change.

5. The key concerns identified focus on Anglesey being selected to be Priority Area 1 for large scale wind and solar power generation. The majority of concerns relate to wind turbines, and can be summarised as:

    - there is no overarching economic or energy policy covering all forms of generation available to the Welsh Government. The proposed energy developments appear to be trying to meet the whole of Wales efforts to address climate change whilst ignoring other, potentially more valuable, sources of carbon free power generation;
    - the selection of the area designated as Priority Area 1 appears to be based on sound and rigorous analysis, but the final selection deviates from this and appears to be quite arbitrary;
    - the impact on the landscape of Anglesey will be dramatic, turning a low, undulating, agricultural landscape into a “pin cushion” of wind turbines. The impact on the setting on the Anglesey AONB, as well as Snowdonia NP and Llŷn AONB, will be devastating;

[1] https://gov.wales/sites/default/files/consultations/2019-08/Draft%20National%20Development%20Framework.pdf

[2] https://gov.wales/sites/default/files/publications/2019-08/stage-2-refinement-of-priority-areas-for-wind-and-solar-energy_0.pdf

- the socio-economic impacts of landscape change will result in an “energy zone” of high land values and low house values and an “affluent zone” of higher house values and lower land values, none of which will help social cohesion;

- the protective measures of the planning process are poorly defined and could be interpreted to make development inappropriate, and so selection of Priority Area 1 meaningless, or could be interpreted to provide no protection at all;

- the scale and type of generating technology, particularly 150 - 250 m high wind turbines, is simply not appropriate for an island rarely more than 100 m above sea level; and

- the Welsh Government is repeating all the mistakes of Westminster with the approach of engaging the public in the development of energy policy. Wales can, and should, do better.

6. While it is clear that a lot of detailed work has gone into the background research and analysis, it would appear to have not gone quite far enough to confidently select areas suitable for setting policy. This may be due to time constraints or political direction. Further refinement of the Priority Areas is required to avoid rejection at the planning stage and the initiative being discredited.

2. Lack of economic and energy policies (P10, P11, P12, P13, P22)

7. Policies 10-13 are presented **without** the context of any economic or energy policies for Wales, and while a target for the proportion of renewable generation is set, there is no information as to how much of this may be obtained from onshore or offshore technologies, or which generation technology – wind, solar, tidal reach, tidal flow, wave, biomass thermal, hydrogen or biogas.

8. It would appear that the entire target is to achieved through onshore wind and solar, although this is not explicitly stated. There are no projections of future energy use, particularly those covering the decarbonisation of transport and heating, or how energy consumption is likely to evolve in future. The stated objective is therefore seriously flawed.

9. There appears to be no consideration for any forthcoming Welsh National Marine Plan[3] covering Welsh Territorial Waters and the Welsh Renewable Energy Zone. Offshore windfarms to the north of Anglesey[4] have the potential to provide the whole of Wales with sufficient power, and several tidal schemes[5] are in development, but neither of these sources of considerable power have been incorporated.

10. There is no consideration of the impact of land use for producing biomass for thermal generation. The NFU have recently published a strategy[6] for making UK farming carbon

[3] https://gov.wales/draft-welsh-national-marine-plan
[4] https://www.thecrownestate.co.uk/media/3321/tce-r4-information-memorandum.pdf
[5] http://www.tidallagoonpower.com/projects/
[6] https://www.nfuonline.com/nfu-online/business/regulation/achieving-net-zero-farmings-2040-goal/

neutral by 2040, and the impact of this potentially overlaps with the draft National Development Framework.

11. There is no consideration of the impact on other aspects of the economy – the principal ones being agriculture and tourism.

12. The area of land allocated for onshore wind and solar in Wales is vastly greater than that required to meet current, and potentially future, energy requirements and appears somewhat arbitrary. For example, the area allocated for Anglesey is probably sufficient to meet the majority of the current electricity demand for the whole of Wales. In total, the Priority Areas may generate x10 current Welsh demand, and possibly x3 Welsh demand with fully electric transport and heating[7]. There is no information as to whether generating the maximum possible is the stated aim, or the economic impact of exporting the excess power to England (and beyond).

13. Policy 22 – North West Wales and Energy – demonstrates explicit support for nuclear power, mentioning the Wylfa Newydd development on Anglesey[8] and a small modular reactor (SMR) at Trawsfynydd, and further SMRs would be possible at other locations (eg Penrhos at Holyhead). With Wylfa Newydd having the potential to supply all of Wales current electricity demand, and a substantial export to England, the impact of these developments on the framework appears not to have been evaluated.

14. Without a coherent, joined up strategy, covering all energy sources and demands, both now and in the envisioned future, and the socio-economic impacts of these, it is impossible to know if the proposed framework is appropriate and cannot be supported.

3. Approach to selecting the Priority Areas for wind and solar (P10)

15. The two consultant reports(stage 1 and 2)[9] that provide the background to the Priority Areas in Policy 10 would appear to follow a rational methodology up to the point where the Priority Areas are defined. In the case of Anglesey, the final proposed area seems to have been arbitrarily selected, almost as if coffee had been spilt on the map.

16. For Anglesey the proposed area:

    - excludes the majority of those areas where wind and solar schemes either exist or are currently being considered by planning;

    - excludes those areas with the greatest potential for solar power (the south west of the island); and

[7] https://news.files.bbci.co.uk/include/newsspec/pdfs/bbc-briefing-energy-newsspec-25305-v1.pdf

[8] https://infrastructure.planninginspectorate.gov.uk/projects/wales/wylfa-newydd-nuclear-power-station/

[9] https://gov.wales/assessment-shore-wind-and-solar-energy-potential-wales

- includes those areas where structures above 50 m have already been rejected due to compromising the approach to Mona airfield[10] (the relief landing ground for RAF Valley). It is not clear if the intent is to pursue power generation as an economic strategy at the expense of the RAF being based on Anglesey.

17. The section in the methodology where visual impact on National Parks (NPs) and Areas of Outstanding Natural Beauty (AONBs) is considered could easily be interpreted as demonstrating that on-shore wind and solar are inappropriate technologies for a vast amount of Wales. However, as this doesn't enable the (flawed) objective (see section 2, above) it has been ignored, whereas it could easily have been used to direct the power generation strategy off-shore.

18. The methodology used is detailed, clear and transparent except for the most important part, selecting the actual Priority Areas, which is densely opaque and gives the impression other, undeclared reasons are behind the finally selected areas. Without clear explanation of the rationale behind these decisions it is impossible to know if the framework is appropriate.

4. Impact on the landscape of Anglesey and the AONB (P10, P12)

19. Policy 12 – Wind and Solar Energy in National Parks and Areas of Outstanding Natural Beauty – is to be applauded in recognising that these designated landscapes should be protected from inappropriate development.

20. Including buffer zones, and considering the impact on the setting, views into and out of these areas gives the impression the framework is giving due regard to the visual amenity enjoyed by both Anglesey residents and visitors.

21. However, much of this has been ignored, and the impact on the Anglesey landscape will be considerable:

    - wind turbines of the proposed size will be visible from all areas of Anglesey. There will be nowhere where at least one turbine will not be visible;

    - views across the low, undulating plateau of Anglesey into the Snowdonia National Park and Llŷn and Anglesey AONBs (eg from Rhosgoch or Mynydd Eilian) will be severely compromised;

    - views from within the Anglesey AONB across Anglesey (eg from Mynydd y Garn, Mynydd Bodafon or Holyhead Mountain) will be radically changed;

    - the assumption that views from within the Anglesey AONB are always out to sea is simply not true; and

    - The framework makes no allowance for areas which may become NPs or AONBs in the future due to them currently having comparable landscape value.

[10] https://infrastructure.planninginspectorate.gov.uk/projects/wales/north-wales-connection/?ipcsection=overview

22. Policy 10 – Wind and Solar Energy in Priority Areas – states "The Welsh Government supports large scale on-shore wind and solar energy development … there is a presumption in favour of development … and an associated acceptance of landscape change." The "acceptance" of landscape change due to wind turbines is simply not borne out by facts. Opposition to National Grid's proposals for a second overhead transmission line on Anglesey, which would have brought a similar number of smaller structures has been widespread.

23. National Resources Wales have developed a baseline of the Welsh landscape termed LANDMAP[11] to assist sustainable decision-making and natural resource planning. It covers:

    - geological landscape;
    - landscape habitats;
    - visual and sensory;
    - historic landscape; and
    - cultural landscape.

24. The Anglesey AONB includes landscapes rated:

    - moderate, high and outstanding on the visual and sensory dimension;
    - mainly high and outstanding on the geological landscape dimension (minor area rated moderate); and
    - mainly high and outstanding on the historical landscape dimension

25. The rest of Anglesey has exactly the same quality of landscape as the AONB and it can be argued requires a similar level of protection.

26. The whole of Anglesey is recognised by UNESCO as a GeoPark. The British Geological Survey[12] describes the importance of the whole of the Anglesey landscape:

    - " … Anglesey … is widely considered to be a 'classic' area of British geology. It's classic status also extends to the glacial landforms …"
    - "The low lying, gently rolling hills of Anglesey preserve the unique 'footprint' left on the landscape by the ice stream. The landforms, such as egg-shaped drumlins, and glacial sediments … provide a record of the processes occurring beneath the Irish Sea ice stream."

27. The impact on the Anglesey landscape will be considerable, and will devalue the current designated landscapes and settings and GeoPark.

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[11] https://landmap-maps.naturalresources.wales/

[12] https://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/anglesey/home.html

5. Unacceptable socio-economic impact on Anglesey (P10, P11)

Tourism

28. Anglesey currently receives about £305 million[13] a year in revenue due to tourism.

29. Every visitor to Anglesey will have their own reasons for visiting (beaches, walking, fishing etc) but a major part of the attraction, the "Anglesey offer", is the unspoilt countryside. Visitors come to get away from day to day urban lives, not to view industrial scale turbines.

30. The Office of National Statistics (ONS)[14] has defined "holiday hotspots" as having the following characteristics, compared to England and Wales averages:

    - higher proportions of jobs in accommodation for visitors;
    - higher percentages of main jobs in tourism and tourism enterprises; and
    - higher percentages of inbound trips for a holiday purpose.

31. Anglesey is a holiday hotspot, for example:

    - Gwynedd has the highest percentage of main jobs in tourism (14.9%) followed by Anglesey (14.0%);
    - Cornwall has the highest percentage of visits for a holiday (61.4%) followed by Pembrokeshire (57.9%) and Anglesey (53.3%); and
    - Cardiff has the highest spend per day (£50.08), followed by Anglesey (£48.92), far higher than Greater London (£38.04).

32. The term "holiday hotspot" is describing the socio-economic importance of tourism to that area. It describes what is currently being achieved.

33. Adding large scale wind and solar energy schemes to approx. 25% of the island cannot improve tourism for Anglesey. At absolute best they will have only a small impact.

34. If the value of tourism fell by only 1%, or failed to rise by 1% in line with projections, over the assumed 25 year life of the developments, £60 million would be lost (assuming current value of tourism revenue, no inflation, 3.5% discount rate) to the Anglesey economy. This does not include the devaluation of "sunk costs" - costs already spent by the IoACC, the WG, holiday

[13] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010007/EN010007-002423-Isle%20of%20Anglesey%20County%20Council%20-%20Local%20Impact%20Report%20Annex%205C%20-%20Anglesey%20Tourism%20Topic%20Report%20%20by%20Swansea%20University%20(November%202018).pdf

[14] Sub-National Tourism: A spatial classification of areas in England and Wales to show the importance of tourism, at county and unitary authority level, 2011 to 2013 (2015)

home owners, caravan sites etc in promoting Anglesey and getting tourism to the level it is today.

House value

35. Anglesey has ca 34,000 homes worth on average £128,000 each[15].

36. Online valuation sites such as Zoopla use complex algorithms to estimate house values, with an input to these calculations being current market sales value, and average regional value. If a few houses are highly devalued, on average, all will be devalued.

37. A 1% decrease in value (£1,280 for every home) would reduce the value of the Anglesey housing stock by about £40 million. Some houses will be hit very badly, and the owners will probably suffer negative equity.

Land value

38. Agricultural land within the Priority Area has the potential to be sold or leased for energy schemes. These are likely to generate greater income than agriculture and will drive up land value within Priority Area 1 relative to comparable land outside the area.

39. Conversely house values within the area are likely to fall, leading to stratification of communities.

Locally owned generation

40. Setting targets for locally owned generation capacity is laudable, however within the proposed definition of "local" it is a relatively simple matter to structure and finance a company such that the majority of revenue is not generated locally and will have minimal benefit to the local community.

Landscape change creates socio-economic risk

41. The impact of policies P10 and P11 on the Anglesey landscape, a major driver of tourism and a significant contributor to house value, will be considerable, and the risk of the associated socio-economic impacts is too great, unfair and undemocratic, and cannot be supported.

6. Insufficient detail of planning process and protection (P10)

42. Policy 10 – Wind and Solar Energy in Priority Areas - states "Planning applications must demonstrate how local social, economic and environmental benefits have been maximised and the following adverse impacts have been minimised:

    - landscape and visual impacts;
    - cumulative impacts;
    - the setting of National Parks and Areas of Outstanding Natural Beauty;

[15] http://www.assembly.wales/NAfW%20Documents/anglesey.pdf%20-%2018042008/anglesey-English.pdf

- visual dominance, shadow flicker, reflected light or noise impacts;
- electromagnetic disturbance to existing communications systems; and
- the following identified protected assets: archaeological, architectural or historic assets; nature conservation sites and species; natural resources or reserves."

43. It goes on to say "Further guidance on the development of on-shore wind and solar energy schemes in Priority Areas will be produced to assist in the development process". Such guidance is currently lacking, with the available information from the Welsh Government being suitable for ca 2 MW turbines (maintain a 500 m distance from residences) although the scale of the turbines envisaged in the policy is over five times larger.

44. Superficially, this appears to be a comprehensive set of protective measures to safeguard against adverse impacts. However it hides a number of points that could be critical to an application for development being acceptable or not:

- will the environmental net benefits include the embedded carbon necessary to build equipment and erect the schemes as well as the fossil fuels displaced from the future generation mix?
- how will the environmental cost of wildlife habitat loss and loss of life through bird/bat strikes be evaluated?
- will the loss of visual amenity for both designated and non-designated landscapes be evaluated financially following the guidance of the Treasury Green Book[16] for public policy measures?

45. The protective measures of the planning process are poorly defined and could be interpreted to make development inappropriate, and so selection of Priority Area 1 meaningless, or could be interpreted to provide no protection at all.

7. Inappropriate scale and type of development for Anglesey (P10, P20, P22)

46. Anglesey is a low, gently undulating island, typically no more than 100 m above sea level. There are few high points with Holyhead Mountain being the highest at 220 m then Mynydd Bodafon at 178 m in the AONB.

47. The framework assumes that "large scale" wind turbines would be used of between 150m - 250 m. At this scale the turbines could be higher than any physical feature on the island and significantly higher than any man made structure (a 250 m turbine erected at sea level at South Stack would still protrude 30 m above Holyhead Mountain).

[16] https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

48. Allowing for 7 x rotor diameter spacing[17], about 70 of the larger size could be accommodated in Priority Area 1. Should significantly smaller turbines be used, to better blend into the landscape, the number would have to significantly increase, resulting in a greater impact on the landscape and more residential homes being adjacent to a turbine. It is likely then that the mitigation measures suggested (but not detailed, see 6 above) would then reject any proposed development.

49. Should a single development be proposed for all of Priority Area 1 (eg 70, 12 MW turbines of 250 m) then the power generated would be sufficient to for this to be classed as an Nationally Significant Infrastructure Project rather than a Development of National Significance and decision making would reside with Westminster.

50. Such an array, arranged as say five off-set rows of 15 turbines with occasional omissions for communities, would fit in Priority Area 1. Within this array all homes would be within 750 m of a turbine.

51. Anglesey has the smallest resident population of all counties in North Wales and a low population density of 1 person/hectare (100/km^2, 260/square mile), compared with 1.5 for Wales as a whole. The main concentrations of people are in the wards of Holyhead Town, Porthyfelin, London Road and Morawelon where the population density is above 20. The wards of Llanddyfnan, Aberffraw and Llannerchymedd are the least densely populated wards, with population densities lower than 0.4. There are numerous small settlements scattered across the island, as well as many dispersed houses and farms. The Priority Area 1 has about 7,000 homes within a half a mile of a turbine.

52. A UK Government report[18] in 2011 concluded “areas like the Southern Uplands of Scotland and Mid Wales have sufficiently low population densities to allow large (>50MW+) wind farms”. Priority Area 1 could accommodate over 700 MW generating capacity.

53. Although there is no absolute rule, helicopters (eg air ambulance) and small planes are not advised to fly within six rotor diameters behind a turbine on safety grounds[19] due to turbulence. Due to the turbine spacing (seven rotor diameters), turbines would need to be switched off to allow air ambulance access.

54. A very small number of individuals, who happen to have an ideally placed field, will benefit greatly, while most people will have to suffer loss of visual amenity for no benefit.

55. Other renewable energy schemes are likely to be far more appropriate for Anglesey:

    - the growing of coppiced willow or other short rotation biomass crops, particularly in the wet and marshy areas, would fit well with the proposed biomass plant[20] at

[17] http://www.na-paw.org/Mitchell/Mitchell-Wind-Turbine-Separation-Distances.pdf

[18] Department of Energy and Climate Change, Review of the generation costs and deployment potential of renewable electricity technologies in the UK, Study Report REP001 Final Updated October 2011

[19] https://to70.com/dangerous-relationship-wind-turbines-aviation/

[20] http://www.orthios.com/holyhead-eco-park/combined-food-and-power/biomass

Penrhos which could also be supplied via the Port of Holyhead using exist conveyor infrastructure;

- off-shore wind would have far fewer landscape and socio-economic impacts while simultaneously have economic benefits, particularly to the Port of Holyhead during the construction, operation and decommissioning/renewing phases; and

- hydrogen generation[21] (eg using the former Octel brownfield site at Amlwch) to feed into the gas transmission grid, potentially via the existing "Shell pipeline".

56. Non-renewable, but associated energy schemes that may be appropriate:

- wind and other intermittent energy schemes need gas fired backup and peaking stations, which could be supplied by off-shore buoy (as in the past for crude oil) into Amlwch Port and the Rhosgoch brownfield site, with a gas fired station located on the former Octel brownfield site;

- battery storage to maximise the generating potential of off-shore wind located adjacent to the Wylfa substation or on existing brownfield sites (Amlwch, Rhosgoch, Penrhos etc)

- an SMR may fit on the Penrhos site alongside the proposed Orthios developments, and build on the current nuclear skills legacy; and

- Wylfa is one of the few UK locations designated for large scale nuclear generation under National Policy Statement EN-6[22]. As such, there is a high likelihood that some form of nuclear project will proceed here.

57. The type of development envisaged in the National Development Framework is inappropriate in size and scale for Anglesey, and does little to draw upon the existing assets and facilities, or address the current issues, of Anglesey.

8. Ineffective engagement with the public (all policies)

58. Engagement with the public for this consultation has been extremely poor – this is either deliberate or due to incompetence. Neither will produce a quality output.

59. The Institute for Government is a leading think tank working, with cross-party governance, to make government more effective. In February 2018 they published the report "How to transform infrastructure decision making in the UK"[23]. This drew together the findings of a year-long research programme that involved in-depth literature reviews, two roundtables,

[21] http://www.bbc.com/future/story/20190327-the-tiny-islands-leading-the-way-in-hydrogen-power

[22]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47859/2009-nps-for-nuclear-volumeI.pdf

[23] https://www.instituteforgovernment.org.uk/publications/how-transform-infrastructure-decision-making-uk

and almost 100 interviews with current and former senior civil servants, politicians, academics and other experts.

60. The Welsh Government is in serious danger of not learning lessons from this work.

61. Although focused primarily on Nationally Significant Infrastructure Projects (NSIPs) at UK level, the key points are relevant to Developments of National Significance in Wales:

    - effective public engagement is vitally important to ensure timely decisions on infrastructure projects. If communities do not feel that they have had a genuine say on projects that will have an impact on them, they often oppose them entirely;

    - the processes through which major infrastructure projects … gain planning permission can contribute to local feelings of antagonism and unfairness, which leads to opposition. This is often because local public input comes too late in the process to be part of a constructive dialogue about the available options;

    - most critically … the principle that particular types of developments should go ahead is established in National Policy Statements [in this case the National Development Framework]. Local communities can input into National Policy Statement drafts [draft National Development Framework] during their formal consultations, but they often find this difficult because National Policy Statements [National Development Framework]are generally vague …

    - the quality of consultations on individual infrastructure projects can be highly variable, with not all project sponsors aware of the benefits of deep public engagement.

62. Wales can learn from other countries. International case studies demonstrate three important lessons:

    - giving the public a real say in policy and planning can be extremely effective. It can build consensus and productive dialogue around controversial subjects – giving a voice to supporters as well as opponents, and linking local discussions about impacts to national discussions about need;

    - given the right resources and political commitment, the public are both interested and able to contribute to policymaking; and

    - to be effective, public engagement must happen early, consistently, and provide communities with a genuine opportunity to influence decisions.

63. With this consultation on the draft National Development Framework, the Welsh Government appears to be repeating all the failures of the Westminster government. Wales can, and should, do better.

9. Comments on the background research

Notes on Arup stage 1 report[24]

64. Focus appears to be primarily on wind, whereas solar has a higher energy density.

65. Table 4 - Geo Parks Forest Fawr (but not Geo Môn?).

66. Drawing 005 - which is the settlement in the middle of Anglesey, Gwalchmai? This area later gets added back in, but the figure is never updated!

67. Table 9 - "Energy Island designation." This carries no official status and could be revoked at any time. The term "designation" confers far greater weight to the term than is due.

68. "Proximity to Caernarfon castle" - but not Beaumaris?

Notes on the Arup stage 2 report[25]

69. pg 7 s2.2.2 regulation is anticipated after the Priority Areas have been set, whereas this regulation should be part of the framework.

70. Drawing 3.1 clearly shows onshore wind is a non-starter as there are so few areas where wind will not have a significant visual impact on designated landscapes.

71. Drawing 3.2 & 3.25 are hard to read and understand. Probably well meaning, but not as good as showing Zones of Theoretical Visibility (ZTV).

72. Table 5 - "Anglesey AONB surrounding this area is important due to the views outwards across the sea rather than into the priority area. On this basis, we have given the intervisibility analysis less weight".

73. Comments: the premise here is simply not true and ignores views into the area and views out of the area across the island.

74. Table 5 - "The southern edge of this Priority Area for Wind and Solar Energy has been reduced to reduce impact on Grade 1 parks and gardens and guardianship monuments."

75. Comments: what are these monuments?

76. Table 5 - "This Priority Area for Wind and Solar Energy originally contained a doughnut shape around a settlement in the centre of the area. However, the area has been re-introduced in the Priority Area for Wind and Solar Energy for consistency with other centres of population."

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[24] https://gov.wales/sites/default/files/publications/2019-08/stage-1-development-of-priority-areas-for-wind-and-solar-energy.pdf

[25] https://gov.wales/sites/default/files/publications/2019-08/stage-2-refinement-of-priority-areas-for-wind-and-solar-energy_0.pdf

77. Comments: which is this settlement? If Gwalchmai and not Llangefni this makes no sense! It would appear to be centred to the south west of Bodffordd where there is no settlement, but RAF Mona is situated. This appears to be the only area treated this way in the whole of Wales.

78. Table 5 - "The section of this Priority Area for Wind and Solar Energy south of the A55 has been identified for solar only due to the sensitive Malltraeth estuary and coastal level landscape."

79. Comments: the section south of the A55 includes an RSPB reserve!

80. Page A1 - "Although refined Priority Areas for Wind and Solar Energy contain some centres of population and small grey areas from Stage 1 analysis, development process regarding these areas should be treated through design guidance which accompanies the Priority Areas for Wind and Solar Energy in the NDF."

81. Comments: there is no design guidance!

82. Drawing 4.1 - Llantrisant DOES NOT have a population of 10,000 - 20,000!

83. Drawing 5.1 - hard to believe that Wylfa substation has red status generation headroom given there is no generation.

84. Table E3 - mentions that Priority Area 1 has a target of 701,606 MWh (where does this target come from?).

85. Drawing 6.1 - Anglesey does have roads!

86. Table F2 - there are A roads other than the A5!

87. Table 7.1 - not clear what this is all about.

88. Drawing 8.1 & 8.2 - what are these "guardianship monuments" and what class of listed buildings?

89. Drawing 9.2 - are the TAN8 areas still included or not?

10. How much electricity does Wales need?

90. Wales currently uses about 90 TWh of energy[26] of which nearly 15 TWh is electricity, although this is on a slight downward trend due to improving appliance and equipment efficiency. Roughly 30% of the electricity use is for domestic use.

91. Of the 15 TWh about 7 TWh is already generated from renewable sources, and 8 TWh comes from mainly gas and some coal.

92. The remaining 75 TWh is primarily gas, oil and coal for heating and petrol, diesel and paraffin for transportation.

93. Estimating future electricity consumption depends on the assumptions made for the:

- continued electricity use for those uses currently served by electricity e.g. domestic lighting;
- quantity of electricity required to displace gas, oil and coal for heating buildings (homes, factories, retail etc);
- quantity of electricity required to replace petrol and diesel for transportation; and
- degree of renewables desired in the mix.

94. To enable estimates to be made, four scenarios are considered:

- Scenario 1 - 70% renewable electricity, current consumption, no other changes;
- Scenario 2 - 100% renewable electricity, current consumption, no other changes;
- Scenario 3 - 100% renewable energy, current needs met but with full decarbonisation of heating and transport; and
- Scenario 4 - 70% renewable energy, as per scenario 4 but retaining some fossil fuels for eg road transport and hybrid heat pumps.

95. Scenario 1 - 70% renewable electricity, current consumption, no other changes

- Electricity consumption = 15 TWh
- 70% of 15 = 10.5 TWh
- Existing renewable = 7 TWh
- New renewable generation required = 10.5 - 7 = 3.5 TWh

[26] https://gweddill.gov.wales/topics/environmentcountryside/energy/renewable/energy-generation-in-wales/?lang=en

96. Scenario 2 - 100% renewable electricity, current consumption, no other changes

    - New renewable generation required = 15 - 7 = 8 TWh

97. Scenario 3 - 100% renewable energy

98. DUKES 2018[27] estimates[28] that a complete electrification of all heating (using air, ground and water source heat pumps) and light transportation (EVs), with hydrogen and biofuels for heavy transportation would lead to a threefold increase in electricity use

    - Total electrical demand = 3 x 15 = 45 TWh

99. This is half the current energy consumption as both EVs and heat pumps are considerably more efficient than the fossil fuelled technologies that will be replaced. It is, though, an extreme estimate making no allowance for CCUS on gas fired generation, biomass generation and domestic heating or widespread hydrogen usage.

    - Existing renewable = 7 TWh

    - New renewable generation required = 45 - 7 = 38 TWh

100. Scenario 4 - 70% renewable energy

    - Total electrical demand = 70% of 45 = 31.5 TWh

    - Existing renewable = 7 TWh

    - New renewable generation required = 31.5 - 7 = 24.5 TWh

101. The target of 70% renewable electricity by 2030 will be somewhere between 3.5 - 24.5 TWh, but without major changes to buildings and vehicles is likely to be nearer the lower end, more like scenario 2.

How much infrastructure is required for these scenarios?

Large wind turbines

102. The GE Haliade X 12 MW is a 260 m high turbine with 220 m diameter rotor. Each one can produce 67 GWh average over a year (63% capacity factor). With x7 rotor diameter spacing, each requires about a square mile of land area. The capacity factor for this turbine is particularly high (quoted by the manufacturer) and a figure of 35-38% is used in the Arup reports, so for a conservative estimate 35% is used, so generating almost 40 GWh per turbine.

[27] https://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes

[28] Page 61 of https://news.files.bbci.co.uk/include/newsspec/pdfs/bbc-briefing-energy-newsspec-25305-v1.pdf

- Scenario 1 - requires 88 turbines - slightly more than will fit in Priority Area 1 (Anglesey) and about half the number in the Hornsea 1 North Sea wind farm (174 turbines);

- Scenario 2 - requires 200 turbines, slightly bigger than Hornsea 1;

- Scenario 3 - requires 950 turbines - almost all the Priority Areas in total, and of a similar scale to the whole of Hornsea 1, 2 & 3 when fully developed; and

- Scenario 4 - requires 613 turbines - roughly 2/3 of all the Priority Areas and just over twice the size of Hornsea 2, which will be the largest wind farm in the world when operational in 2022.

New nuclear

103. Wylfa Newydd is rated at about 2.9 GW. Assuming 8,000 operating hours a year, it could produce 23 TWh (almost enough for scenario 4).

Tidal lagoon

104. Cardiff Tidal Lagoon (not Cardiff Bay!) is rated at about 3 GW capacity producing 5.5 TWh per year (more than enough for scenario 1).

How much power can Anglesey produce?

105. With 70 wind turbines Anglesey would produce almost 3 TWh (almost enough for scenario 1)

106. A benchmark "power density" figure[29] for wind power is 2-3 W/m2. The London Array produces 2.5 W/m^2. Using this figure, Anglesey could produce 3.7 TWh from Priority Area 1. These two figures are close enough to be confident the figure is about right.

107. If all 70 square miles of Priority Area 1 (44,800 acres) were fitted with PV at 400 kW peak/acre, Anglesey could produce almost 16 TWh at 10% efficiency factor.

108. Benchmark power density figures for PV range from 5 W/m^2 in Germany to 20 W/m^2 in open desert. Using a figure of 5 W/m^2, Anglesey could produce 7.4 TWh, much lower than the previous estimate, but a safer, more conservative estimate.

109. If both wind and solar are used, Anglesey could generate maybe 12 TWh, about half the amount needed for scenario 4. With two or three tidal lagoons as well, Wales could achieve 70% of all energy consumption from renewable sources using only Anglesey and the Severn estuary.

110. Offshore wind is more expensive to build and operate than onshore, but is significantly simpler in planning terms (no neighbours!) and therefore potentially more attractive to investors. The latest round of renewables auctions has set record lows in electricity

[29] https://www.energycentral.com/c/ec/future-energy-why-power-density-matters

prices. One wind farm of a similar scale to the complete Hornsea development could provide 70% of Welsh energy demand (scenario 4).

111. Biofuels have an energy density of up to 2 W/m^2, but 0.5 W/m^2 is typical. However they are an important part of the mix as used in thermal stations provide a constant energy source unlike wind and solar. If the total area of all the Priority Areas could be planted with biofuel crops (highly unlikely) about 10 TWh could be generated.

112. The energy density of the main land based renewable sources, for UK conditions, are:

- Solar PV 5.0 W/m^2
- Wind 2.5 W/m^2
- Biomass 0.5 W/m^2

Priority Area 1 designated for large scale wind and solar energy

Source: http://www.brecon-and-radnor-cprw.wales/?page_id=1730

Note: The area north of the A55 is designated for wind and solar, the area south for solar only