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NATIONAL ENERGY FOUNDATION

Pembrokeshire Coast National Park Local Development Plan (2015 to 2031) - 1st Review

Update to the 'Development of a Renewable Energy Assessment and target Information for the Pembrokeshire Coast National Park: Draft Final Report – Nov 2008'

Parc Cenedlaethol Arfordir Penfro
Pembrokeshire Coast National Park

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1. Study background and Brief

Background

1.1 The National Park Authority is conducting a formal Review of the Local Development Plan, with an expected new end date of 2031. The current Local Development Plan was prepared in 2006-2010. The 'Development of a Renewable Energy Assessment and Target Information for the Pembrokeshire Coast National Park Authority', jointly produced by NEF and LUC in 2008 provided an evidence base for the development of renewables policy and contribution targets in the current Local Development Plan and the production of Renewable Energy Supplementary Planning Guidance.

1.2 Some seven years on from this study, the Planning Authority's annual monitoring reports have highlighted some variance in the take up of certain renewables in the National Park from that predicted in the study. Consequently, with a new end date for the development plan of 2031, an update to the study is required to provide a new set of contribution predictions to 2031.

Aims and objectives of the Study Update

1.3 The study has three main components, namely to assess:

a) Advances in existing renewables technology that have improved efficiency, capacity factors, output, feasibility, and could have an impact on Local Development Plan targets;

b) Changes to the economic viability of renewable technologies and their likely uptake based on demographics of the national park;

c) New renewable technologies not covered in the original assessment and their likely impact in the context of the above two points.

1.4 In carrying out the study, the client has requested the use of the Welsh Government Toolkit for Planners[1] –Sept 2015 to update the study methodology where feasible. The Toolkit provides guidance for assessing theoretical energy potential, so cannot be relied upon for site specific decision making.

Outputs

1.5 This report provides an update for each of the chapters in the original 2008 report. Using new evidence from the assessments, the study will draw conclusions on the potential contribution that each renewable technology could make in the National Park towards the existing Welsh Targets for renewable energy use, taking account of all identified opportunities and constraints.

1.6 The report focusses solely on onshore technologies, but provides an update on the progress of marine based tidal technology and its relationship to the National Park.

1.7 The report also provides a recommendation as to whether there is a requirement for an update to the landscape capacity assessments for each technology and the existing Local Development Plan Policy context.

[1] Practice Guidance – Planning for Renewable and Low Carbon Energy – A Toolkit for Planners (September 2015)

2. Policy Context

2.1 The National Park has a resident population of almost 22,000 people (2011 Census figures), a slight reduction in numbers from the 2001 Census of 22,542.

2.2 The current settlement hierarchy for accommodating future household growth within the National Park will be maintained with housing allocations to be determined in the forthcoming Plan review to 2031.

Current Policy context for sustainable energy in the National Park

2.3 The Welsh Government, 'Well-being of Future Generations (Wales) Act' 2015, places a duty on public bodies to do things in pursuit of the economic, social, environmental and cultural well-being of Wales in a way that accords with the sustainable development principle. It requires sustainable development to be embedded in strategic decision making and risk assessment out to and beyond 2050.

2.4 Planning Policy Wales Edition 8 (2016) paragraph 12.8.9 states that local planning authorities should facilitate the development of all forms of renewable and low carbon energy to move towards a low carbon economy. Local planning authorities should consider the contribution their area can make and ensure development plan policies enable this contribution to be delivered.

2.5 The National Park Management Plan 2015 – 2019 outlines its role and actions to help fulfil this duty and the wider intentions of the Welsh Government in relation to sustainable development. The vision of the National Park as it might look in 2050 in regard to renewable energy is described as follows:

The local economy is lower carbon, and community and domestic renewable heat and electricity generation projects, and efficiency measures, help to insulate people from volatile energy prices. Communities are thriving, inclusive and active, and engaged with decision making in the Park. Sustainable design is inherent in all new buildings, and renewable energy schemes respect settlement character and the pattern of the landscape.

2.6 The Management Plan has a Climate Change Policy CC1 which sets out the measures the Park Authority will take towards reducing greenhouse gas emissions.

Policy CC1: Reduce greenhouse gas emissions

• Contribute to UK and Welsh targets for renewable energy generation and for energy conservation and efficiency in line with Local Development Plan policy and guidance, subject to the special qualities of the National Park, and with regard to cumulative impacts.

2.7 The Local Development Plan policy for renewable energy (see below - adopted in 2010) sets the scene for decision making for small, medium and large scale renewable energy schemes within the National Park.

Policy 33	**RENEWABLE ENERGY (Strategy Policy)**
	Small scale renewable energy schemes will be considered favourably, subject to there being no over-riding environmental and amenity considerations. Medium scale schemes also offer some potential and will be permitted subject to the same considerations. Large scale renewable energy schemes will only be permitted where they do not compromise the special qualities of the National Park. Where there are other renewable energy schemes already in operation in the area, cumulative impacts will be an important consideration.[125]
	Onshore connections to off shore renewable energy generators will also be permitted subject to there being no over-riding environmental and amenity considerations. Developers requiring an undeveloped coastal location for onshore connections to offshore renewable energy installations will need to clearly justify this need in relation to Policy 8i) with the least obtrusive approach to design being taken.

Permitted Development

2.8 Changes to Permitted Development rights introduced by the Welsh Government in 2009 and 2012 have made it easier to install small scale renewable energy technologies, both for domestic and non-domestic properties without the need for planning permission.

2.9 The technologies include wind turbines (domestic only), solar panels, stand-alone solar panel arrays, ground source, air source (domestic only) and water source heat pumps, flues forming part of biomass heating systems and flues forming part of combined heat and power systems. The guidelines for these developments are similar, although not identical, for both domestic and non-domestic premises.

2.10 In addition, permitted development rights apply to buildings on agricultural or forestry land to house microgeneration equipment, and in particular to house hydro-turbines, biomass boilers and anaerobic digestion systems.

2.11 Wind turbines still require planning permission on non-domestic premises, although a single stand-alone turbine up to 11 metres in height and less than 50kW can now be installed at domestic premises. Wall or roof mounted wind turbines require planning permission.

2.12 The relaxation of planning control has contributed, along with national renewable subsidies such as the Feed-in-tariff (Feed In Tariff) and Renewable Heat Incentive, to a considerable increase in the number of renewable technology installations within the National Park in recent years. These installations no longer contribute to the targets that the Planning Authority can influence through planning permissions, although they do contribute significantly in terms of the energy they generate.

Welsh Government Renewable Energy Targets

2.13 The Welsh Assembly Government published the *Renewable Energy Route Map for Wales* in February 2008, a consultation document setting out draft policies to guide Wales towards self-sufficiency in renewable energy generation. As part of the consultation The Welsh Assembly Government outlined its analysis of possible electrical and heat generation from renewable energy in Wales, concluding that by 2025 Wales could be producing some:

• 33TWh per year of renewable electricity; and

• 3TWh of renewable heat.

2.14 In 2010 the Welsh Assembly Government published its energy policy statement[2] indicating the need for a wider approach to a lower carbon economy through energy-saving and efficiency measures and increased localised and centralised renewable energy, ensuring:

"that this transition maximises the economic renewal opportunities for practical jobs and skills, strengthens and engages our research and development sectors, promotes personal and community engagement and helps to tackle deprivation and improve quality of life".

2.15 The statement also outlined the potential for sustainable renewable electricity generation in Wales to 2020/2025 of 31TWh per year, and a figure of 2-2.5kWh per person/ per day of renewable heat from biomass.

2.16 In 2012 the Welsh Government published its revised policy direction for energy[3] seeking to accelerate the pace of change by:

- Improving the planning and consenting regime,
- Updating energy infrastructure,
- A comprehensive prioritised energy programme
- Securing economic and community benefits from energy development

[2] A Low Carbon Revolution – The Welsh Assembly Government Energy Policy Statement – March 2010
[3] Energy Wales: A Low Carbon Transition – March 2012

- Improving energy efficiency
- Supporting the work of Marine Energy Pembrokeshire to harness energy from the sea
- Smart technology

2.17 In July 2015 the Welsh Government published National Policy document "Green Growth Wales: Local Energy" setting out its approach to local energy in support of the Wales 2012 strategic energy policy. Key actions include:

- Urging the UK Government to set appropriate levels of support for renewable technologies;
- Requiring local planning authorities to plan positively for renewable and low carbon developments in their local development plans;
- Moving to carbon budgeting to help guide delivery and prioritise action;
- Speed up abstraction licences for hydro power projects which are considered low risk schemes;
- Working with agriculture and land based industries to increase the supply of renewable energy projects;
- Reviewing the scope to further extend permitted development rights for non-domestic solar energy, and to reduce the need for environmental impact statements for smaller scale wind energy developments;
- Work to promote on-farm energy generation

2.18 Further statements from the Welsh Government on actions to accelerate investment in renewable energy generation in Wales are planned in the next 12 months.

2.19 In November 2015, the Welsh Government published the results of an assessment[4] of low carbon energy projects in Wales. There are now 51,303 low carbon installations recorded across Wales saving a total of 4,043,555 tonnes of CO_2 per annum. The estimated annual electricity generation is 8,156,862 MWh_e, with heat generation at 762,106 MWh_{th}.

2.20 Pembrokeshire is recorded as having 3,453 low carbon energy installations, some 6.7% of the Welsh total. These generate a total of 145,492 MWh of electricity (1.7% of Welsh total), and 30,116 MWh of heat (3.9% of Welsh total). The annual CO_2 saved is 76,430 tonnes (1.8% of Welsh total). PV accounts for 67% of the total renewable electricity generation in the County with onshore wind 25%. Heat energy from biomass is the largest contributor to county renewable heat generation at 96.6%, with solar thermal 3.3% and heat pumps less than 1%.

2.21 For the purposes of this update, the 2012 energy policy does not provide any revision to the targets for renewable energy or heat produced in 2008, nor are there any current signals that a review of targets is imminent. Consequently, to provide a target context for the Local Development Plan Review, we have assumed that the 2008 targets will be used. It is not possible however to assume what the target totals will be for 2031. In view of this, this update will assume that the Local Development Plan targets for 2031 will contribute to the 2025 national targets for Wales as outlined in paragraph 2.12 above.

[4] Low Carbon Energy Generation in Wales - Updated study of low carbon energy Welsh Government (November 2015)

3. Biomass

Resource Assessment Update

3.1 In Wales generally, analysis of current trends[5] suggests that limited progress has been made in recent years in terms of increased woodland cover or productivity. There has also been limited success in tackling the barriers to bringing unmanaged woodland back into management, despite appropriate forest management now being widely understood to be environmentally beneficial. The number of farmers currently generating income from timber is assessed to be very low with only 3% harvesting woodland products for sale. These trends appear to be mirrored within the National Park.

3.2 The potential within the National Park for growing energy crops such as miscanthus and short rotation coppice has, according to Pembrokeshire Bio Energy cooperative, diminished significantly in recent years. This is due to a number of factors:

- lack of start-up funding from the Welsh Government
- better income from cereal crops;
- lack of a local largescale end user;
- bulky and costly to transport;
- undulating land within the National Park which is difficult to access for planting and harvesting.

3.3 Pembrokeshire Bio Energy cooperative has ceased production of energy crops, and there is no known energy crop production within the National Park. Pembrokeshire Bio Energy cooperative consider it unlikely that this will change in the short to medium term.

3.4 Future viability of energy crops depends on cereal and wood prices. As a crop with a long term growth cycle, it is a long term investment which presently is too vulnerable to short and medium term price changes. Pembrokeshire Bio Energy cooperative forecast that it is unlikely to return as a potential alternative crop within the next 10 years, but if energy prices increase again (eg. with the advent of peak oil) it may become financially viable post 2025.

3.5 Consequently, the main biomass sources within the National Park are expected to continue to be:

- Forestry residues ;
- Waste from wood processing industry

3.6 There has been some recycling of timber waste for sale by timber merchants and carpentry companies, resulting in a slight growth in the number of local firms selling biomass products. There has also been an increase in the numbers of local firms selling and installing biomass stoves/boilers.

Financial incentives

3.7 Glastir is the sustainable land management scheme for woodland in Wales funded through the latest Rural Development Plan (2014-20). Through this scheme the Welsh Government offers financial support to farmers and land managers to establish, maintain and enhance woodland.

Biomass systems

3.8 The 2008 study focussed on the impact and likely heat contribution from biomass technologies rather than the biomass resource for the National Park area, primarily due to lack of local area data.

3.9 The conclusion was that large biomass plants would not be feasible on landscape impact grounds, but that there was scope across all sectors for medium to micro scale systems. The potential contribution by 2021 was as follows:

[5] Scoping a Roadmap for Delivering Sustainability and Growth of Welsh Woodlands - March 2015 (Wales Forest Business Partnership)

- Medium scale - 28.04GWh; Small - domestic scale 3.5 – 9GWh.

3.10 Micro and small biomass heating or combined heat and power systems under 45kW, both domestic and non-domestic are exempt from planning permission by virtue of their location within a building, and providing the flue location and height meets permitted development requirements. Since 2008, the National Park Authority have received and granted only two applications for ancillary works to facilitate the installation of biomass boilers.

3.11 Medium scale biomass heating and combined heat and power systems over 45kW require planning permission. The 2008 report identified considerable scope to expand the use of these systems within the National Park across all sectors for typical building types shown below. This is still the case where the size of the system exceeds the permitted development threshold of 45kW.

Small hotel (1000m^2)	Boiler size 60kW
Primary School (4000m^2)	Boiler size 200kW
Swimming Pool/Leisure Centre (1600m^2)	Boiler size 300kW
Small office/commercial premises (1000m^2)	Boiler size 50kW

Technology improvements

3.12 The technologies which enable renewable heating based on biomass remain as they were in 2008, with established types of boilers available at large, medium and domestic scales and a choice of fuels that varies from logs though wood chips and more highly processed wood pellets and heat treated pellets.

3.13 The efficiencies of boilers has improved significantly from 60 -90% in recent years. This has been achieved through automatic monitoring of flue gases and computerised controls. Further efficiency gains in the future are likely to be marginal.

3.14 The main policy change since 2008 is introduction of Renewable Heat Incentive; in 2011 for non-domestic buildings and in 2014 for domestic buildings. Due to delays to the introduction of domestic scheme, it was initially open to retrospective applications from the owners of 'legacy' installations commissioned in the period 2011-2014. The Renewable Heat Incentive replaced the Low Carbon Building Programme that covered the period 2006-2010 which is described in our original report. It pays plant owners per unit of heat they generate rather than offering an upfront contribution to the cost of installing renewable heating technologies.

3.15 Tariffs differ for domestic and commercial installations, with different technologies attracting different rates depending on their present commercial viability. The Renewable Heat Incentive was set up to be available until the end of March 2016. The UK Government's Autumn Statement (25th November 2015) announced the reform of the Renewable Heat Incentive to improve value for money, reduce costs and improve budget management. Renewable Heat Incentive funding will now be extended to 2020/2021 but with a smaller budget. Small biomass under 200kW will see a further 10% drop in the tariff effective from January 2016, whereas for medium sized biomass (200kW – 1MW) there are no changes to the tariffs for the forthcoming quarter. The Government is due to consult on the detail of the reform in early 2016.

3.16 In October 2015 the Department of Energy and Climate Change introduced new sustainability criteria for installations using biomass and biogas fuels, and producers of biomethane under the Renewable Heat Incentive. To continue to receive Renewable Heat Incentive payments all existing and new participants must now use fuels that meet specified sustainability criteria. The simplest way to meet the criteria is to use sustainable fuel bought through the Biomass Suppliers List. This lists suppliers selling wood fuels (i.e. materials which have undergone further processing into a fuel) that meet the Renewable Heat incentive

sustainability criteria. The Biomass Suppliers List has four fuel types: firewood, chip, pellet and briquette.

3.17 In Pembrokeshire, the introduction of the Biomass Suppliers List has recently resulted in Pembrokeshire Bio Energy cooperative ceasing their own pellet production due to the high cost of producing the quality standard (+A1) fuel required for new higher efficiency boilers. Instead pellets are brought in from Scotland and Avonmouth, stored and distributed to customers. Pellets have become the most popular fuel as it is easier to store and small enough to be used for mechanised boiler refuelling.

3.18 As a biomass boiler installer, Pembrokeshire Bio Energy cooperative anticipate that a reduction in Renewable Heat Incentive funding will result in a reduction in the numbers of boilers installed as payback periods extend. Smaller scale boilers in particular are expected to be hit the hardest. Only larger boilers of 350-400kW+ providing high volume constant heat output requiring large quantities of fuel, or boilers used in areas of the Park that are off the gas grid network are expected to be sufficiently economical when compared to other fuels. In the longer term after 2025, when retail energy prices may well rise in response to constraints on oil production and declining North Sea gas production, smaller scale biomass boilers may then become economically viable.

Potential Contribution

3.19 As small sized systems under 45kW by virtue of their size and location are now allowed under permitted development rights, they therefore fall outside the scope and control of the Planning Authority. Medium scaled systems offer some potential.

3.20 The reform of the Renewable Heat Incentive is expected to constrain the viability of biomass boilers in the Park area to medium sized systems of 350-400kW and above in the short term. Exceptions may occur where smaller systems are required in locations off the gas grid, or those with constant heat requirements like large hotels, or combined users i.e. a school and adjacent leisure centre. Other opportunities could include heat generation as part of district heating schemes for new housing developments identified in the Local Plan. A district heating or combined heat and power plant may initially be gas-driven but provides the potential for conversion to biomass at a later stage when economically feasible. Table 3.1 below indicates the potential generation from medium scale biomass in the National Park to 2031.

Table 3.1 Potential generation from medium-scale biomass

Type of site	Nos/kW capacity	Annual GWh output per unit	Potential numbers and annual heat generation by 2020	Potential numbers and annual heat generation by 2031
Strategic sites	2 x 200kWe	0.35GWh	-	(2) 0.7GWh
Schools (new)	2 x 200kWe	0.35GWh	-	(2) 0.7Gwh
Schools (Existing)	5 x 200kWe	0.35GWh	-	(5) 1.75GWh
Leisure Complex	9 x 300kWe	0.52GWh	-	(9) 4.68GWh
Total			-	**7.83GWh**

Landscape capacity and policy update

3.21 Finally, there are no changes to biomass technologies since the 2008 study that would require a reassessment of the landscape capacity of the National Park to accommodate them. This revised potential generation is considered to be deliverable under the current Local Development Plan policy context.

4. Anaerobic Digestion

Resource Reassessment

4.1 Nationally, the past five years have seen the installed capacity of anaerobic digestion plant increase to 456 MW from 396 plants; this is 6 times greater than in 2010. The growth in the sector has been reflected within the National Park. This is primarily due to changing economics, and principally the introduction in April 2010 of the Feed in Tariff for anaerobic digestion plants below 5MW.

4.2 The 2008 report predicted (in the absence of subsidies) that in the Park smaller scale 10kW units on farms would be most viable with an overall potential contribution from the sector of 0.35GWh of electricity generated by 2021.

Current Situation

4.3 In September this year, the Pembrokeshire Coast National Park Authority approved its first application for a 500kW anaerobic digestion combined heat and power plant. If the recently permitted anaerobic digestion plant becomes operational it could generate about 4GWh in both electricity and heat in its first year alone.

4.4 The key factors that have facilitated this surge of interest for anaerobic digestion from livestock and dairy farmers in the Park are understood to be:

- Vulnerability of the farming sector to global market price fluctuations requiring greater diversification of income;
- Income from Feed In Tariff for electricity generation, and from the Renewable Heat Incentive if heat output is appropriately metered;
- New regulations on the horizon by August 2018 requiring farmers to comply with conditions on the use of slurry waste, as Natural Resources Wales has declared the Milford Haven Catchment at amber risk of becoming a Nitrate Vulnerable Zone (March 2015);
- Pressure from Government and supply chains, coupled with support from co-operative organisations (such as First Milk) and large supermarket chains for farms to be more sustainable;
- Medium to long term concern about increasing electricity prices having a negative impact on business viability;
- Increasing numbers of relevant and local case studies;
- An optimistic forecast over the next 5 years of a 20% increase in milk production, particularly from 200+ herds, and in particular, younger farmers operating housed systems with over 200+ cows. (Source: Welsh Dairy Farmer Survey 2014)

Technology Improvements

4.5 Technical development of anaerobic digestion plant has resulted in processes that reduce the nitrogen and phosphorous content of digestate. In the UK PAS 110[6] was published in 2010 as the market for anaerobic digestion grew and the need to ensure the quality of increasing digestate became more important.

Opportunities and constraints

4.6 A recent review of anaerobic digestion plants on UK farms[7] carried out for the Royal Agricultural Society of England (2015) highlights both opportunities and constraints for anaerobic digestion on farms across the UK in the future.

[6] British Standards Institute Publicly Available Specifications (PAS) 110 - Specification for Digestate

[7] A Review of Anaerobic Digestion plants on UK farms – Barriers, Benefits and Case Studies by Angela Bywater on behalf of the Royal Agricultural Society of England

Opportunities

- Firstly, UK and Welsh Governments and the agriculture industry view on-farm anaerobic digestion as a means of making a significant step towards more sustainable farming, and an ideal way to treat slurry. The NFU for example would like to see 1,000 on-farm digesters by 2020.
- The Royal Agricultural Society of England review indicates that for the greatest impact, low cost and simplified anaerobic digestion plant should be targeted at dairy farms, starting from about 100 cows and upwards. The use of biogas from the anaerobic digestion slurry treatment system for use in a boiler is considered to be the simplest and most cost effective solution.
- The Welsh Government 'Sustainable Production Grant' is available for investments in renewable energy production including the associated infrastructure but with the proviso that the energy produced is for self-consumption. It provides 40% funding and is likely to be prioritised for areas designated as nitrate vulnerable zones.
- Plants which are only processing material sourced from on the farm and are less than 465m^2 in size are eligible for permitted development and do not need to apply for full planning permission.
- Provided digesters are integrated into the existing farm complex, or building groups, and natural screening is provided where appropriate, small digesters can be incorporated into the wider landscape and should not conflict with the National Park Management Plan objectives.
- Small-scale anaerobic digesters, which produce less than 400kW of power output, are exempt from the Environmental Permitting Regulations 2010.
- Permitted development rights apply to buildings on agricultural or forestry land to house microgeneration equipment, and in particular to anaerobic digestion systems that generate up to 50kW of electrical and 45kW of heat capacity.
- In the future, there may be scope for larger units to sell electricity and heat to new homes and businesses as part of a distributed energy network where opportunities from proximity can be planned and integrated into new development.

Constraints

- The current uncertainty regarding the Government's review of Feed In Tariff & Renewable Heat Incentive subsidy for anaerobic digestion is concerning farmers who are considering the technology. This, coupled with the restrictions of the Sustainable Production Grant, may result in larger dairy farms finding the additional cost of combining anaerobic digestion with combined heat and power uneconomic.
- Medium scale anaerobic digestion plants are likely to fall outside permitted development regulations and require planning permission. They will also need to comply with Environmental Permitting Regulations. In the National Park, medium scale anaerobic digestion development will need to ensure that it does not conflict with the National Park Management Plan objectives, the Policies of the Local Development Plan, in particular Policy 33, and guidance in the Renewable Energy Supplementary Planning Guidance document[8].

<u>Potential Contribution by 2031</u>

4.7 The National Park obtained permission from the Animal and Plant Health Agency to obtain data for Pembrokeshire showing the number of cattle on farms registered as holdings. As the figures supplied are from an unknown date of registration and not annually updated these figures may now be significantly out of date. Notwithstanding this, it is the best proxy

[8] Pembrokeshire Coast National Park Authority Renewable Energy Supplementary Planning Guidance to the Local Development Plan for the Pembrokeshire Coast National Park – Technical Update April 2014

available. To obtain the figures for the National Park area, the data for the Pembrokeshire County Council area was filtered out using GIS.

4.8 Dairy herds are recognised nationally as providing greatest scope for anaerobic digestion, as highlighted by the most recent modelling and analysis[9].

4.9 Based on this analysis, dairy farms within the National Park and their registered herd sizes were grouped into five size ranges in terms of likely potential anaerobic digestion energy output. It was assumed that 50% of these farms were likely to implement an anaerobic digestion system, providing conditions in the future are favourable (see Table 4.1 below).

Table 4.1 Potential generation from small/medium scale Anaerobic Digestion

kW capacity	Number of dairy cattle	Potential number of AD dairy farms in the National Park	Potential numbers & annual electricity generation by 2020	Potential numbers & annual electricity generation by 2031
20 kWe	100 - 134	4		(4) 0.6
25 kWe	135 - 270	7		(7) 1.37
35 kWe	270 - 380	4		(4) 1.1
50 kWe	380 - 900	4		(4) 1.56
500 kWe	900+	2	(2) 7.8	(2) 7.8
Totals		**21**	**7.8 GWh**	**12.43 GWh**

[9] A Review of Anaerobic Digestion plants on UK farms – Barriers, Benefits and Case Studies by Angela Bywater on behalf of the Royal Agricultural society of England

Landscape capacity and policy update

4.10 Finally, there are no significant changes to anaerobic digestion technology since the 2008 study that would require a reassessment of the landscape capacity of the National Park to accommodate them. This revised potential generation is considered to be deliverable under the current Local Development Plan policy context.

5. Micro Hydro

Resource Reassessment

5.1 The 2008 study used constraints mapping to assess opportunities for small/micro hydro sites. The current Toolkit recommends this methodology and information from local sources where available. The 2008 study concluded that the potential location for micro hydro was in the Preseli area, and in areas where there is potential to re-activate old mill sites.

5.2 It was assumed a potential contribution from micro hydro sites in the Preseli area would be: 2 x 10kW schemes during the period 2011 – 2021 producing a total of 0.04GWh per annum.

Current situation

5.3 There are two operational schemes within the National Park, a micro hydro (5kW) installation at Cerrig, near Dinas Cross mentioned in the 2008 study, and a small hydro 90kW scheme at Pontfaen built in 2013. Both are located within the Preseli hills area.

5.4 The Pontfaen scheme has an installed capacity of 90kW, with an estimated total output of 0.197GWh per annum. This single new scheme has increased output by four times that forecast.

Permitted Development

5.5 Permitted development rights apply to buildings on agricultural or forestry land to house microgeneration equipment, and in particular to house hydro-turbines. Consequently, where permitted development guidelines are followed, microgeneration installations of less than 50kW will fall outside the scope and regulation of the National Park Planning Authority providing the conditions are followed. Schemes above 50kW, or those that fall outside the Permitted Development guidelines will require planning permission.

Additional resource assessment studies

5.6 In 2010, two potential hydropower opportunity assessment studies were published, the first by the British Hydropower Association and the second by the Environment Agency (now Natural Resources Wales).

5.7 The British Hydropower Association study[10] did not identify any potential small sites within the Pembrokeshire Coast National Park area.

5.8 The Environment Agency Study[11] identified a number of areas within the National Park in terms of their theoretical maximum power potential. The majority ranging between 0 – 50kW, with one area within the Preseli Hills identified as having potential between 100-500kW.

5.9 These areas were then assessed in terms of sensitivity of migrating and mobile fish species within the river area and the hydro power potential. It revealed scope for some low output, (0-10kW & 10-20kW) potential sites with low sensitivity around the north coast of the National Park. However, it concluded that the sites were unlikely to be attractive to developers as the potential income would be low whilst the costs of designing, installing and maintaining a scheme would be high.

Technology Improvements

5.10 Micro hydro technology has not benefited from the cost reductions that increased manufacturing capacity in say, the PV market. The main innovation since 2008 appears to be in installation of Archimedes screw style turbines; however the underlying necessity for a suitable site for installation still limits the uptake of micro hydro.

[10] England and Wales Hydropower Resource Assessment (2010)
[11] "Opportunity and environmental sensitivity mapping for hydropower in England and Wales"

Potential generation from small hydro by 2031

5.11 As outlined in the 2008 study, collectively, hydro schemes are unlikely to make a significant contribution to meeting the National Park's energy demand over the Plan period.

5.12 The reduction to the Feed-in-Tariff, coupled with current grid capacity limitations in the Park area are unlikely to result in further applications in the short term. Nevertheless, the Welsh Government policy, outlined in 'Green Growth Wales', is seeking to speed up abstraction licences for hydro power projects which are considered low risk schemes. This will reduce the amount of evidence needed during licensing and therefore reduce cost. Furthermore, the Sustainable Production Grant available to farmers may encourage the development of small/micro-hydro sites, but the numbers are expected to be very low.

5.13 The contribution from small/micro hydro is outined in Table 5.1 below.

Table 5.1 Potential generation from small/micro -hydro

Nos/kW capacity	Annual GWh output per unit	Potential numbers and annual electricity generation by 2020	Potential numbers and annual electricity generation by 2031
2 x 10kWe	0.03GWh	-	(2) 0.06GWh
1 x 50kWe	0.16GWh	-	(1) 0.16GWh
Total		-	**0.22GWh**

Landscape capacity and policy update

5.14 Finally, there are no significant changes to small/micro hydro technologies since the 2008 study that would require a reassessment of the landscape capacity of the National Park to accommodate them. This revised potential generation is considered to be deliverable under the current Local Development Plan policy context.

6. Heat pumps

6.1 The 2008 study identified a potential contribution of some 2.5GWh from heat pumps. Since 2008 the UK market for ground source heat pumps has grown in absolute numbers but shrunk as a percentage of total heat pump sales due to the far more rapid uptake of cheaper air source heat pumps. In 2015 around 4,850 ground source heat pumps were installed in the UK, around 10% of the total heat pump market[12].

6.2 The main policy change since 2008 is the introduction of Renewable Heat Incentive, with initially ground and then air source heat pumps becoming eligible. The subsidy is to be reformed by Government in 2016. A reduction in tariffs is likely to impact heat pump sales in the short term.

6.3 Permitted development rights for heat pumps have also encouraged more installations in recent years. Ground and water source heat pumps below 45kW are now permitted development for domestic and non-domestic properties within prescribed guidelines. Consequently their installation falls outside the scope and regulation of the Planning Authority.

6.4 Air source heat pumps under 45kW are permitted development for domestic properties; however, planning permission is required for non-domestic properties. Since 2008 the National Park Authority has permitted three applications for non-domestic air source heat pumps

Technology Improvements

6.5 Ground source heat pump technology remains fundamentally unchanged since 2008 however there has been technical innovation in the configuration of systems. Ground source heat pump systems are now available in which a number of small heat pumps, each serving a flat in a block share a communal ground loop or borehole array. This makes the application of heat pump technology more applicable to this type of dwelling.

6.6 The same variants in air source heat pump technology exist today as in 2008; however their relative popularity has varied over the last 7 years, as the market has developed considerably. There has been a trend towards split systems at the expense of mono-block units which were initially popular as they did not require handling refrigerant gasses. Whilst exhaust air heat pumps were initially popular, their performance when inappropriately installed was understandably compromised (Retrofit for the future) and as they are only suitable in homes having excellent fabric performance they remain a very small part of the market.

6.7 Performance of air source heat pumps has not always lived up to expectation, with phase one of the Energy Saving Trust (EST) heat pump trial finding the performance figures of the technology substantially less than manufacturer's headline claims. This finding was further investigated in the second phase of the work where issues surrounding design quality, installation quality and poor commissioning were found to reduce operational performance. Following remedial work on some of the systems studied a more respectable average system performance factor of 2.45 was determined for air source heat pumps, giving a significant reduction in running costs and CO_2 emissions over direct electric heated properties off the gas grid.

Potential generation by 2031

6.8 The study has assumed the likelihood that 45 community/commercial properties could use air source heat pump technology, either as part of new development or retrofit. The systems are assumed to be rated at 25kW, with an annual output of 0.04GWh creating a potential annual heat generation of approximately 2GWh by 2031. A reassessment of the landscape capacity of the National Park to accommodate them is not required. This revised potential generation is considered to be deliverable under the current Local Development Plan policy context.

[12] Source: Building Services Research & Information Association – Heat Pump Markets – UK in Europe IEA Heat Pump Workshop Nov 2012.

7. Solar technologies

Photovoltaics

Resource Reassessment

7.1 Pembrokeshire is well placed for solar resource however, falling into the south west region of the UK having higher irradiance than much of the rest of the county.

7.2 The 2008 study assumed that the cost of PV would be prohibitive compared to other technologies and only likely to occur in the context of domestic and small scale commercial buildings. The development of field scale PV systems was considered to be inappropriate given the national status of the Park landscape, so there was no contribution estimated from PV.

7.3 The current Toolkit methodology relates to the assessment of the potential for field scale solar installations. As there is currently no standard agreed approach to constraints mapping the potential for field scale solar, the Toolkit suggests a potential approach using GIS constraints mapping but highlights that the land may prove to be technically and or financially unviable for other reasons.

7.4 As an alternative, the Toolkit suggests that Local Authorities may wish to commission work to understand the landscape and cumulative impacts of field scale solar if it is likely to present persistent issues.

7.5 The Pembrokeshire Coast National Park Authority took this approach in March 2011, commissioning an assessment of the landscape sensitivity to field-scale solar PV using the Landscape Character Assessment of Pembrokeshire Coast National Park. The sensitivity of each Landscape Character Area is described with guidance provided within Park's Renewable Energy Supplementary Planning Guidance on where and how PV developments can be accommodated.

7.6 Four sizes of field-scale solar PV developments were assessed in terms of their potential to be located within National Park (classified to reflect its landscape sensitivities). These are shown in Table 7.1.

Table 7.1 Pembrokeshire Coast National Park – Landscape sensitivity to field scale PV

Size	Area	Estimated installed capacity[13]
Large	>5 ha	2MW
Medium	3 ha – 4.9	1 – 2 MW
Small	1 ha – 2.9	0.5 – 1 MW
Very Small	< 1ha	< 0.5 MW

Source: Pembrokeshire Coast National Park Authority Renewable Energy Supplementary Planning Guidance 2014

7.7 The Department for Energy and Climate Change guidance[14] recommends that a cut off equivalent to 0.5MWh (i.e. 3 acres, 1.2ha or 0.012km^2) is applied, as any sites smaller than this are less likely to be viable (commercially speaking) for development.

7.8 Whilst the landscape sensitivity analysis reveals a high level of landscape sensitivity to medium and large field solar developments, the Park's Supplementary Planning Guidance does indicate limited potential for small and very small scale field solar development within landscape areas identified to have moderate or low to moderate sensitivity to this form of PV technology.

[13] Source: DECC - UK Solar PV Strategy Part 1: Roadmap to a Brighter Future – October 2013 www.gov.uk/government/uploads/system/uploads/attachment_data/file/249277/UK_Solar_PV_Strategy_Part_1_Roadmap_to_a_Brighter_Future_08.10.pdf

[14] (as above)

Current situation

7.9 Changes to Permitted development rights and the introduction of the Feed in Tariff (Feed In Tariff) have resulted in a surge in PV panel installations both domestic and non-domestic within the National Park since 2010. An assessment of the Department for Energy and Climate Change[15] Feed In Tariff Installation Report (September 2015), looking at the Pembrokeshire postcode areas covered by the National Park estimates there to have been over 2,000 PV installations since 2010 totalling about 10,000 kW (6GWh). To put this in context in terms of electricity generation, this figure is just over 1GWh more than the potential contribution identified in the 2008 study from all technologies in the Park to 2021 (ie. 4.91GWh).

Planning permissions for PV in the Park (domestic and non-domestic)

7.10 Where a standalone solar installation is larger than 9m^2, the development falls outside the scope of 'permitted development', under the Town and Country Planning (General Permitted Development) (Amendment) (Wales) Order 2012, and is likely to require planning permission from the Pembrokeshire Coast National Park Authority.

7.11 These types of developments are likely to be small scale ground mounted arrays, for example a 50kW peak (204 panel) array at MOD Merrion Camp permitted in 2012; or large rooftop arrays, for example 19.5kW peak, 25m^2 panel array on the roof of the Dale Fort Field centre in Dale permitted in 2015. No applications have been submitted to date for field scale PV.

7.12 Table 7.2 shows PV schemes since 2008 that have received planning permission from the National Park Authority and been installed.

Table 7.2 Permitted & installed PV since 2008

Rated Power	Numbers	Output GWh	Locations
<5kW	10	0.03GWh	Saundersfoot (2), St Ishmaels, Dinas Cross, Porthgain, Stackpole, St Davids, Clunderwen, St Brides, Jameston, Pen y cwm
<20kW	3	0.03GWh	Dale, St Brides, Newport
>20kW	1	0.01GWh	Merrion Camp
	Total = 14	0.07GWh	

Technology Improvements

7.13 The greatest change in the PV sector has been the reduction in the cost of PV panels by 80% since 2008 with the International Renewable Energy Agency reporting a 65-70% reduction between 2009 and 2013. This means in some markets with greater levels of solar radiation, grid parity has been achieved. In the UK, rooftop solar generated electricity in both the domestic and commercial sectors has now reached parity with retail electicity prices, so is a cost effective investment even with the reduced Feed in tariif rates due to be imposed in 2016. PV technology has continued to develop over the last 7 years with enhancements in conversion efficiency enabling higher rated outputs for an array of any given size. Polycrystalline cells achieve efficiencies of 11-15%, Monocrystalline cells 13-17% and Hybrid cells just over 17-22%. The most cost effective solution may be lower efficiency panels where space is available for a slightly larger array. Alternative materials and manufacturing processes alongside a massive increase in manufacturing capacity, mainly in China, have all helped to reduce costs.

[15] Department of Energy and Climate Change

7.14 Inverter technology has evolved with the introduction of micro inverter systems where by each panel in a PV array is equipped with its own roof mounted inverter. This can improve overall array performance by avoiding problems associated with shading strings of panels, and limits the need for DC wiring which potentially improved safety, however most system still use centralised inverters.

Changes to PV subsidies

7.15 The Renewables Obligation Closure (Amendment) Order 2015 which came into force on 24 March 2015 closed the Renewables Obligation (RO) to new large-scale solar PV, i.e. installations over five megawatts (MW).

7.16 In July the UK Government consulted on proposals for the early closure of the Renewables Obligation RO across Great Britain to small and medium scale solar PV projects with a capacity of 5MW or below from 1 April 2016. The intention is that this will apply to both new stations and additional capacity being added to existing stations.

7.17 In August 2015, the Government subsequently consulted on changes to the Feed-in-Tariff with reductions across all technologies including PV. On 17 December, the Government published[16] its response to the consultation setting out revised tariffs for PV resulting in slightly higher rates than included in the initial consultation proposals.

7.18 Domestic installations below 1MW will now receive 4.39p/kWh – down from 12p/kWh currently. For small commercial projects, the new Feed-in Tariff rate will be 4.59p/kWh. Rooftop and ground-mount projects above 1MW will receive just 0.87p/kWh. The changes will come into force from February 8 2016 and the deadline for projects to receive the current higher tariffs is now January 15 2016. Early responses from trade associations suggest that the new tariff rates, albeit an improvement, will still be 'challenging' for commercial sector investment.

7.19 The decision also saw Pre-Accreditation re-introduced for solar (PV) with a declared net capacity greater than 50kW up to and including 5MW, this will give investors more certainty when investing in this technology. Validity periods of pre-accreditation for PV will be six months. The Government will also reintroduce the additional six month period for community energy projects on top of the relevant period per technology.

7.20 In the short term, sales of roof top solar for both domestic and non-domestic properties are expected to drop-off significantly. However, PV is a cost effective renewable energy technology and combined with growing opportunities for cheaper energy storage technology, future increases in the retail price of electricity and the emergence of cheaper modules, it should recover reasonably quickly.

7.21 Field solar conversely, will take much longer to recover. The electricity generated is supplying direct to the grid which realises lower low energy prices. There will be a spike in activity as advanced proposals are installed during the Renewables Obligation grace period to March 2016, after which field solar installations are expected to cease.

7.22 In the longer, 10 year term, field scale solar is only likely to establish an economic footing when wholesale energy prices rise and module costs reduce. The study has assumed growth in small scale ground mounted panels where these can be more easily sited within landscapes where the impact is expected to be low to moderate.

Potential Contribution by 2031

7.23 Table 7.3 below outlines the potential generation from field scale solar within the National Park. The methodology used for calculating this potential is outlined in Appendix 2.

[16] Review of the Feed- in Tariffs Scheme – DECC 17 Dec 2015

Table 7.3 Potential generation from field scale solar

Nos/kW capacity	Annual GWh output per unit	Potential numbers and annual electricity generation by 2020	Potential numbers and annual electricity generation by 2031
74 x 250kWe	0.22GWh	-	(74) 16GWh
8 x 1MW	0.875GWh	-	(8) 7GWh
Total		-	**23GWh**

Landscape capacity and policy update

7.24 As a recent landscape sensitivity analysis for field scale PV has been carried out within the National Park (para 7.5), there is no requirement for a landscape capacity assessment. This revised potential generation is considered to be deliverable under the current Local Development Plan policy context.

Solar Thermal

7.25 The 2008 report highlighted very significant potential for solar hot water development within the Park as an affordable technology that could be used universally throughout the Park, principally within the built environment. The technology can now be installed as Permitted Development within the Park providing guidelines are met.

Since 2008, one application for solar thermal on a non-domestic building has been made to the National Park Authority, with permission granted in 2009.

Technology Improvements

7.26 Solar thermal technology is well established and thus since 2007 the market has seen a continuation of the familiar types of system being installed; a combination of flat plate and evacuated tubes systems, direct circulation, drain down and heat pipe style systems. Installed UK capacity more than doubled between 2008 and 2012, the applicability to Pembrokeshire has not changed. Government capital funding schemes have ended but the renewable heat incentive is applicable to solar thermal. Different rates apply to domestic and commercial systems.

Potential Contribution

7.27 The 2008 study assessed the likely number of solar thermal units that could be installed at a domestic and commercial level and identified a potential generation of 1.2GWh of heat by 2021. As solar thermal technology fall within with Permitted Development rights, providing the guidelines are followed, their installation would fall outside the scope and control of the Planning Authority. Consequently, it would not be appropriate to set a target in the Local Plan that cannot be monitored and influenced by the Planning Authority.

8. Wind

Resource Reassessment

8.1 The 2008 study used resource and constraints mapping methodology as recommended by the current Toolkit. It also looked at more appropriate sized turbines (medium/ small) for national Park whereas the toolkit only concentrates on large turbines. The study estimated the following potential contributions:

Large turbines = 2 x 330kW turbines by 2021 generating 1.72GWh of electrical energy (Area adjacent to Milford Haven)

Medium turbines = 1 x 80kW + 1 x 250kW by 2021 generating 0.8GWh (Area adjacent to Milford Haven)

Small turbines = 15 x 50kW (5 by 2010 and 10 by 2016 generating 2GWh of electrical energy (most areas of park)

Current situation

8.2 Table 8.1 below shows the numbers, location and sizes of wind turbines permitted and installed in the National Park since 2008.

Table 8.1 Permitted & installed wind turbines since 2008

Rated Power	Numbers	Output GWh	Locations
5kW	7	0.091	Manorbier(4); Newport (1); Broad Haven (1) St Brides (1); Dinas Cross (1)
10kW	3	0.079	St Davids (1); St Dogmaels (1); Roch (1)
15kW	1	0.039	Marloes (allowed on appeal)
20kW	3	0.156	St Ishmaels (1); Jameston (1); St Brides (1)
	Total = 14	0.365GWh	

The size of turbines installed have been much smaller than forecast, the majority being turbines for farms of 20kW or less.

8.3 Applications for two larger scale turbines (225kW and 100kW) and three small scale turbines (10-15kW turbines) were refused planning permission and subsequently dismissed on appeal primarily on the basis of unacceptable impact upon the character and appearance of the National Park.

Permitted Development

8.4 Permitted development rights for wind turbines only apply to domestic properties where the turbine is under 50kW and is restricted to less than 11.1 metres in height (including blades). Domestic turbines that do not conform to the permitted development guidelines, and all non-domestic wind turbines require planning permission.

Technology Improvements

8.5 The wind resource in the National Park is a function of climate, location and landscape and thus will not have changed since our 2008 report. However, the present UK Government is ideologically opposed to the expansion of onshore wind and has sought to 'call in' planning applications in recent years. It has will also reduce the subsidies for future onshore wind during 2016. The Welsh Government has recently responded[17] to these plans stating:

"These developments….will have far reaching consequences in terms of immediate investment and employment by onshore wind developers and their supply chain in Wales, especially in the rural areas where projects are typically situated. This will also have huge reputational damage in terms of the UK's credentials on green growth and our ability to decarbonise".

[17] Welsh Government Written Statement – Onshore Wind Statement – 21/9/2015

Potential Contribution

8.6 There have been changes in the wind turbine market in recent years. The Vertical Axis turbine market continues a downward trend which has been in place since 2009.

8.7 The Renewable UK – Small and Medium Wind UK Market Report (March 2015) highlights in relation to sub-100kW wind turbines a trend of an annual deployment increase every year from 2008 to 2012. However, after the lowering of Feed-in-Tariff in December 2012 for all turbines under 100kW, coupled with a capacity-driven degression mechanism, this has had a negative impact on the small wind industry resulting in a 55% decrease in capacity deployment in the sub-100kW market. This downward trend has continued throughout 2014 and 2015 and is likely to continue with the reduction to the Feed-in Tariff for wind. The net effect could see prices increase for a few years as volume diminishes from reduced sales and reduced numbers of installers.

8.8 Demand for building mounted turbines in the UK has dramatically declined from 1,000 installed in 2007 to only 30 in 2014, with little indication of growth in the near future. Until siting and performance challenges are addressed, it is unlikely that this application will play a significant part in the UK small wind market and within the National Park area.

8.9 The short term difficulty of mains grid connection and the reduction in the Feed-in Tariff may result in more off-grid applications using battery storage. The on-going development of storage mechanisms may provide a viable option for larger-scale off-grid applications in the future.

8.10 The availability of the Welsh Government Sustainable Production Grant providing 40% towards the cost of renewables may help to keep standalone micro and small scale turbines an affordable option for agricultural businesses (see Funding Section, para 11.15).

8.11 Conversely the removal of tax relief for shareholders in community wind projects will impact on the take up of small and medium turbine schemes.

Potential Contribution by 2031

8.12 In view of the changing opportunities and constraints outlined, we have estimated the following contribution from wind technology shown in Table 8.2 below. The medium sized turbines (up to 330kW) are likely to be in the Milford area.

Table 8.2 Potential generation from wind

Nos/kW capacity	Annual GWh output per unit	Potential numbers and annual electricity generation by 2020	Potential numbers and annual electricity generation by 2031
20 x 5 – 20 kWe	Average 0.023 GWh	-	(20) 0.46 GWh
5 x 50kWe	0.12GWh	-	(5) 0.6 GWh
4 x 80 – 330kW	0.18 – 1.56 GWh	-	(4) 2.3 GWh
Total		-	**3.36 GWh**

Landscape capacity and policy update

8.13 Finally, there are no significant changes to small/medium wind turbine technologies since the 2008 study that would require a reassessment of the landscape capacity of the National Park to accommodate them. This revised potential generation is considered to be deliverable under the current Local Development Plan policy context.

9. District Heating and linked developments

District Heating

9.1 There have been no further district heating developments since the 2008 study, and the key opportunities identified for district heating remain the same. These are in summary, small-scale district heating schemes associated with new development within the main settlements of the National Park either for the development alone, or if locationally feasible, linked to an existing facility within the settlement that has a large heat energy requirement. Alternatively they can be developed for a group of nearby facilities requiring heat such as those associated with the tourism industry.

Technology Improvements

9.2 There have been no significant changes to district heating technology that would alter the suitability of its application in the National Park.

Microgeneration

9.3 All of the technologies considered in the study now offer different forms of microgeneration and can be installed in certain circumstances under Permitted Development Rights. The availability of the Government energy generation subsidies (Feed-in-Tariff and Renewable Heat Incentive) across the full spectrum of technologies has enhanced their attractiveness as additional sources of income at the domestic and commercial scale, and has boosted the numbers of technologies installed in recent years. This experience has been mirrored in the National Park.

9.4 As outlined in each technology section, the expansion of Permitted Development Rights across the full range of renewable technologies has meant that where the guidelines are followed, installation falls outside the scope and regulation of the National Park Planning Authority. Consequently, it is no longer appropriate to set a target in the Local Plan for microgeneration that cannot be monitored and influenced by the Planning Authority.

Grid Connection

9.5 Western Power Distribution is the electricity grid provider for Pembrokeshire and the Pembrokeshire Coast National Park. Recently the company has experienced unprecedented demand for the connection of renewable and conventional generation technologies within the Pembrokeshire area which has restricted capacity and created the need for upstream reinforcement works. It is aware though that this demand for generation connections has created constraints, with the key constraints to connection to the grid being cost and time taken to provide a connection, particularly where a project is small in scale and some distance from the existing grid network i.e. rural in location, or the connection requires upstream reinforcement works.

9.6 In the short term (3-5 years) substantial reinforcement work is planned on the 33 kilovolt (kV) and 132 kV distribution networks which will create sufficient capacity to allow all accepted generation offers to connect. In addition National Grid has identified the need for reinforcement works on the transmission network serving the Pembrokeshire area, the planning and design of required transmission works is at a very early stage. It is difficult to quantify the capacity these works will release back into the network as Western Power Distribution does not undertake speculative reinforcement but rather the general methodology is to address upstream reinforcement on a case by case basis as connection applications are received. However, as a general rule Western Power Distribution does not foresee grid constraint issues precluding the development of medium to small-scale renewable electricity generating technologies subject to reinforcement having been carried out.

9.7 In areas where there are multiple complex constraints affecting a number of customers over a long time period, full active network management systems will be implemented. Due to the level of generation projects within Pembrokeshire, Western Power Distribution has declared the network as an Active Network Management area.

9.8 Distributed control systems continually monitor all the limits on the network and then allocate the maximum amount of capacity to customers in that area based on the date their connection was accepted. This Last In, First Out hierarchy prioritises the oldest connections when issuing capacity, but is scalable so that new entrants will get access to the capacity when it becomes available. If generators wish to connect to the grid without reinforcement they will need to apply for an Active Network Management connection offer.

Marine Renewable Developments

9.9 Marine technologies have not been considered in this update as the marine environment lies beyond the jurisdiction of the National Park Authority (other than at the point where the energy comes ashore). However, since the 2008 study, Pembrokeshire has continued to develop as an important location for marine technology research and development.

9.10 An injection of funding from the Welsh Government created the Haven Waterway Enterprise Zone in March 2014 which provides support for businesses within the marine energy sector. The enterprise zone is in turn supported by Marine Energy Pembrokeshire (MEP), a not-for-profit partnership between technology developers, the supply chain, academia and the public sector working together to establish Pembrokeshire as a 'centre of excellence' for sustainable marine energy generation.

Tidal Energy

9.11 The development of a deep-sea tidal energy farm at Ramsey Sound, west of the St David's coastline was anticipated to be operational by 2010, but experienced considerable delays. The demonstrator array called the DeltaStream[18] is a tidal stream energy device featuring three generators that sit on a triangular frame with a combined generation capacity of up to 1.2MW of electricity. It was successfully installed on the sea bed before in December 2015. The device will be connected to the distribution network on the coast at St Justinian's (within the National Park) for a trial period of 12 months. Planning approval was granted by Pembrokeshire Coast National Park Authority for the onshore works in 2011, and these have now been completed. At the end of the trial DeltaStream and its supporting infrastructure will be removed.

9.12 A larger 10MW demonstration tidal stream project also off St David's Head has also been proposed. The project is to comprise of up to 9 generator units, each with a nominal installed capacity of 1.2MW. The project is termed a "demonstration array" however the lifespan of the project will be for up to 25 years.

9.13 The development will also include the provision of inter array cabling, sub-sea electrical infrastructure and sub-sea export cable(s) offshore, as well as an onshore package control room/substation and associated electrical infrastructure works to allow connection to the local distribution network. The installing company anticipate using, wherever possible existing onshore infrastructure to reduce any potential environmental impacts associated with the onshore works and will consider Pembrokeshire Coast National Park Authority planning policies when finalising the design and location of the compound.

[18] http://www.tidalenergyltd.com; Tidal Stream Energy Demonstration Array St David's Head, Pembrokeshire – Environmental Scoping Report – ECO2 and Tidal Energy - Aug 2012

Wave energy

9.14 The Wave Dragon[19] project has moved on from its pre-commercial demonstrator phase in 2008 to a fully developed wave energy converter. The unit, which is yet to be installed, will be a 7 MW device located two to three miles northwest of the National Park area of St Ann's Head. Due to these practical limitations, the demonstration site is located within the Pembrokeshire Marine SAC (Special Area of Conservation), and a full Environmental Impact Assessment (EIA) has been conducted. However, Wave Dragon are only applying for permission to use this site as a test area and the Wave Dragon will only remain in place here for three to five years, covering an area of approximately 0.25 km^2, before being removed. It is hoped that it will join ten other units further (ten to twelve miles) out to sea.

9.15 Marine Energy Ltd is in the process of making applications for a project to deploy a 10MW pre-commercial wave energy power park on a site off the Pembrokeshire coast in Wales. Marine Energy Ltd will carry out required environmental impact assessments, apply for and obtain all required licenses, permits, seabed leases and to own and operate the wave energy power parks. The expected electricity generation is 50,000 MWh per year. The power output will be exported via a 33kV sea cable to the on-shore power distribution grid owned and managed by Western Power Distribution Ltd.

9.16 The company will deploy "Seabased Wave Energy Converters". The Wave Energy Converters form part of an integrated wave energy power generation system capable of delivering Grid compliant power to the on-shore grid. The system will be assembled by Seabased Industries AB in Sweden.

[19] http://www.marineenergypembrokeshire.co.uk/projects/wave-dragon/ http://www.wavedragon.net/index.php?option=com_content&task=view&id=42&Itemid=65

10. Summary of Potential Contributions

Biomass

10.1 The reform of the Renewable Heat Incentive in 2016 is expected to limit the viability of biomass boilers in the Park area to medium sized systems of 350-400kW and above. Exceptions to this rule may occur where smaller systems are required in locations off the gas grid, or those with constant heat requirements like large hotels, or combined users i.e. a school and adjacent leisure centre. Other opportunities could include heat generation as part of district heating schemes for developments identified in the Local Plan. The district heating or combined heat and power plant may initially be gas-driven but provides the potential for conversion to biomass at a later stage when economically feasible.

10.2 Table 10.1 below outlines the potential generation from medium scale biomass in the National Park to 2031.

Table 10.1 Potential generation from small/medium-scale biomass

Type of site	Nos/kW capacity	Annual GWh output per unit	Potential numbers and annual heat generation by 2020	Potential numbers and annual heat generation by 2031
Strategic sites	2 x 200kWe	0.35Wh	-	(2) 0.7GWh
Schools (new)	2 x 200kWe	0.35GWh	-	(2) 0.7Gwh
Schools (Existing)	5 x 200kWe	0.35GWh	-	(5) 1.75GWh
Leisure Complex	9 x 300kWe	0.52GWh	-	(9) 4.68GWh
Total			-	**7.83GWh**

10.3 These targets are aspirational, dependent upon a range of factors in the future such as governmental changes in policy, funding opportunities/constraints, as well as other external factors.

The potential generation of 7.83GWh is equivalent to 0.00783 TWh. This theoretical contribution of heat energy generation in the National Park from small/medium biomass systems offers 0.26% towards the Welsh target for renewable heat of 3TWh per year by 2025.

Anaerobic Digestion

10.4 Dairy herds are recognised as providing the greatest scope for anaerobic digestion on farms. There are many dairy farms within the National Park, and a significant proportion of them have herds of 100+, the largest over 1,000.

10.5 The future for growth in small to medium scale anaerobic digestion on dairy farms is reasonably optimistic. Subsidies from the Feed in Tariff and Renewable Heat Incentive are unlikely to suffer the same level of cuts as other renewable technologies; the Welsh Government's Sustainable Production Grant offers a significant contribution towards capital costs, and the control of animal slurry from polluting water catchments is likely to become a regulatory duty in the area in 2018.

10.6 There are many benefits to the dairy farmer from installing an anaerobic digestion system, contributing towards reducing greenhouse gas emissions as well as offsetting the farm's requirement for energy and fertiliser. Case studies across the UK have shown that small to medium scale anaerobic digestion can be viable and future Government and business incentives towards greater farm sustainability will only enhance this.

Table 10.2 below outlines the potential generation from anaerobic digestion in the National Park to 2031.

Table 10.2 Potential generation from Small/medium scale Anaerobic Digestion

kW capacity	Number of dairy cattle	Potential number of AD dairy farms in the National Park	Potential numbers & annual electricity generation by 2020	Potential numbers & annual electricity generation by 2031
20 kWe	100 - 134	4		(4) 0.6
25 kWe	135 - 270	7		(7) 1.3
35 kWe	270 - 380	4		(4) 1.1
50 kWe	380 - 900	4		(4) 1.5
500 kWe	900+	2	(2) 7.8	(2) 7.8
Totals		**21**	**7.8 GWh**	**12.3 GWh**

The Potential electrical generation of 12.3 GWh is equivalent to 0.0123 TWh. This theoretical contribution of electrical energy generation in the National Park from AD offers 0.037% towards the Welsh target for renewable electricity of 33TWh per year by 2025.

Hydro

10.5 As outlined in the 2008 study, collectively, hydro schemes are unlikely to make a significant contribution to meeting the National Park's energy demand over the Plan period, although some proposed legislative changes, and grant opportunities for the farming community may encourage the development of small/micro-hydro sites, but the numbers are expected to be very low. The contribution from small/micro hydro is outined in Table 10.3.

Table 10.3 Potential generation from small/micro -hydro

Nos/kW capacity	Annual GWh output per unit	Potential numbers and annual electricity generation by 2020	Potential numbers and annual electricity generation by 2031
2 x 10kWe	0.03GWh	-	(2) 0.06GWh
1 x 50kWe	0.16GWh	-	(1) 0.16GWh
Total		-	**0.22GWh**

The potential generation of 0.22GWh is equivalent to 0.00022TWh. This theoretical contribution of electrical energy generation in the National Park from small/micro hydro offers 0.00066% towards the Welsh target for renewable electricity of 33TWh per year by 2025.

Heat Pumps

10.6 The study has assumed the likelihood that 45 community/commercial properties could use air source heat pump technology, either as part of new development or retrofit. The systems are assumed to be rated at 25kW, with an annual output of 0.04GWh creating a potential annual heat generation of approximately 2GWh by 2031.

The potential generation of 2GWh is equivalent to 0.002TWh. This theoretical contribution of heat energy generation in the National Park from air source heat pumps offers 0.06% towards the Welsh target for renewable heat of 3TWh per year by 2025.

Solar Technologies: Field scale PV

10.7 The study has assumed growth in small and very small scale ground mounted panels where these can be more easily sited within landscapes where the impact is expected to be low to moderate.

Table 10.4 Potential generation from field scale solar

Nos/kW capacity	Annual GWh output per unit	Potential numbers and annual electricity generation by 2020	Potential numbers and annual electricity generation by 2031
42 x 250kWe	0.22GWh	-	(74) 16GWh
8 x 1MW	0.875GWh	-	(8) 7GWh
Total		-	**23GWh**

The potential generation of 23GWh is equivalent to 0.023TWh. This theoretical contribution of electrical energy generation in the National Park from small and very small field scale photovoltaic offers 0.069% towards the Welsh target for renewable electricity of 33TWh per year

Solar Technologies: Solar thermal

10.8 The 2008 study assessed the likely number of solar thermal units that could be installed at a domestic and commercial level and identified a potential generation of 1.2GWh of heat by 2021. As solar thermal technology fall within with Permitted Development rights, providing the guidelines are followed, their installation would fall outside the scope and control of the Planning Authority. Consequently, it would not be appropriate to set a target in the Local Plan that cannot be monitored and influenced by the Planning Authority.

Wind Turbines

10.7 The study has assumed growth in standalone micro/small and medium wind turbines with contribution summarised in Table 10.5:

Table 10.5 Potential generation from wind

Nos/kW capacity	Annual GWh output per unit	Potential numbers and annual electricity generation by 2020	Potential numbers and annual electricity generation by 2031
20 x 5 – 20 kWe	Average 0.023 GWh	-	(20) 0.46 GWh
5 x 50kWe	0.12GWh	-	(5) 0.6 GWh
4 x 80 – 330kW	0.18 – 1.56 GWh	-	2.3 GWh
Total		-	**3.36 GWh**

The potential generation of 3.36GWh is equivalent to 0.00336TWh. This theoretical contribution of electrical energy generation in the National Park from small and medium wind turbines offers just 0.01% towards the renewable electricity target of 33TWh per year by 2025.

Overall Estimates

Based on the above calculations of renewable energy contributions, Table 10.6 highlights that the potential future development of appropriately located renewable energy technologies regulated by the Local Planning Authority would make a very small contribution towards Welsh targets. This is primarily because the size of renewables acceptable within the landscape of the Park are small, and many of the technologies, either small or micro scale, now fall under permitted development rights.

Table 10.6 Potential contribution from renewable technologies within the Pembrokeshire Coast National Park to 2031

Renewable Electricity		Renewable Heat	
Technology Type	**Potential generated (GWh) by 2031**	**Technology type**	**Potential generated (GWh) by 2031**
Biomass(*)			7.8 GWh
Anaerobic Digestion	12.3 GWh		
Hydro	0.2 GWh		
Heat Pumps			2.0 GWh
Field-scale solar	23.0 GWh		
Wind	3.4 GWh		
Total	38.9 GWh	**Total**	9.8 GWh
Welsh target 2025	33 TWh	**Welsh target 2025**	3 TWh
% Contribution	1.18%	**% Contribution**	0.33%

(*)This target is aspirational, dependent upon a range of factors in the future such as governmental changes in policy, funding opportunities/constraints, as well as other external factors.

11. Funding Opportunities

11.1 This section provides a summary of the main funding sources available to renewable and low carbon technologies identified in this report.

UK Funding:

Feed in Tariff

11.2 Feed-in Tariffs were introduced on 1 April 2010 and replaced UK government grants as the main financial incentive to encourage uptake of renewable electricity-generating technologies. Most microgeneration scale domestic and non-domestic technologies qualify for the scheme, including:

- solar electricity (PV) (roof mounted or stand-alone)
- wind turbines (building mounted or free standing)
- hydroelectricity
- anaerobic digesters
- micro combined heat and power (combined heat and power)

11.3 The UK Government's Department for Energy and Climate Change makes the key decisions on Feed In Tariffs in terms of government policy. The energy regulator Ofgem administers the scheme.

11.4 In August 2015, the Government consulted on considerable reductions to the Feed In Tariff raising concerns that renewable technology deployment would decline with resultant job losses within the renewables sector.

11.5 On 17 December, the Government published[20] its response setting out revised tariffs for PV, wind and hydro resulting in slightly higher rates than consulted on. The overall spending cap for all technologies (wind, solar, hydro and anaerobic digestion) is to stay, as proposed by Government, at £100m until 2018 – approximately £35 million per year.

11.6 For PV, domestic installations below 1MW will now receive 4.39p/kWh – down from 12p/kWh currently. The changes will come into force from February 8 and the deadline for projects to receive the current higher tariffs is now January 15. For small commercial projects, the new Feed-in Tariff rate will be 4.59p/kWh. Rooftop and ground-mount projects above 1MW will receive just 0.87p/kWh. Early responses from trade associations suggest that the new tariff rates, albeit an improvement, will still be 'challenging' for commercial sector investment.

11.7 The decision also saw Pre-Accreditation re-introduced for solar (PV) and for wind installations with a declared net capacity greater than 50kW up to and including 5MW, and all anaerobic digestion and hydro installations up to and including 5MW. This will give investors more certainty when investing in these technologies. Validity periods of pre-accreditation will be six months for PV; one year for wind; and two years for hydro and anaerobic digestion. Government will also reintroduce the additional six month period for community energy projects on top of the relevant period per technology.

11.8 In early 2016 Department for Energy and Climate Change intends to launch a separate consultation proposals relating to tariffs and degression for anaerobic digestion and micro-combined heat and power (micro-combined heat and power) technologies. It is also intends to revisit the topic of sustainability criteria for anaerobic digestion plant, to ensure anaerobic digestion feedstock is sustainable, so as not to cause damage to the local environment or divert agricultural land from food crops.

[20] Review of the Feed- in Tariffs Scheme – DECC 17 Dec 2015

11.9 Government does not intend to implement a decision at this stage on the long-term future of the Feed In Tariffs scheme. Government's view is that keeping generation tariffs available, within a system of caps where declining tariff trajectories provide a path for certain technologies to become less reliant on subsidies, offers an opportunity for only the export tariff to be available for new generators once the cap has been used up.

Renewable Heat Incentive

11.10 The Renewable Heat Incentive is a UK Government scheme set up to encourage uptake of renewable heat technologies amongst householders, communities and businesses through financial incentives.

11.11 The non-domestic Renewable Heat Incentive was launched in 2011 to provide financial assistance to non-domestic generators of renewable heat, and producers of renewable biogas and biomethane in England, Scotland and Wales. The domestic Renewable Heat Incentive was launched on 9th April 2014 covering England, Wales and Scotland and is targeted at - but not limited to - off-gas households.

11.12 The Renewable Heat Incentive provides financial support to the owner of the renewable heating system for seven years.

11.13 The Government's Autumn Statement on 25th November 2015 announced reform of the Renewable Heat Incentive to improve value for money, reduce costs and improve budget management. The funding will now be extended to 2020/2021 but with a smaller budget. Small biomass under 200kW will see further 10% drop in the tariff effective from January 2016, whereas for medium sized biomass (200kW – 1MW) there are no changes to the tariffs for the forthcoming quarter. The Government is due to consult on the detail of the reform in early 2016.

Awards for All

11.14 This grant provides voluntary and community groups with a quick and easy way to get small National Lottery grants of between £500 and £5,000 for projects which aim to help improve local communities and the lives of people most in need. The programme encourages a wide range of community, health, educational and environmental projects.

https://www.biglotteryfund.org.uk/global-content/programmes/wales/awards-for-all-wales

Welsh Government Funding:

1) Sustainable Production Grant Scheme

11.15 Support for investments to improve performance and sustainability of agricultural holdings. Capital investments by agricultural businesses: including arable, beef, dairy, goats, horticulture (including hydroponics and aquaponics), pigs, poultry, sheep and apiculture.

11.16 Investments in Renewable Energy Production including associated infrastructure is eligible for support, providing that the energy produced is for self-consumption. Investments in on-farm renewable energy plants where the production capacity exceeds the annual self-consumption will not be eligible under this scheme. Forestry is NOT eligible under this scheme.

11.17 The maximum grant threshold per enterprise for any individual investment project is £400,000. Only one grant award per enterprise will be made in the period to 31 December 2020. The minimum grant threshold per enterprise for any individual investment project is £16,000. The maximum grant rate for any individual investment project is 40% of the total investment cost regardless of the size of the enterprise and location.

2) Project funding for community groups

(**Small scale** £1,000 - £15,000)

11.18 Projects must:

- support the goals set out in the Well-being Future Generations (Wales) Act 2015
- demonstrate wider multiple benefits for the local community, their environment and their local economy

Large scale >£15,000

11.19 Guidance is expected to be issued later on this year. Open to broad range of organisations. The scheme is looking for innovative approaches and integrated actions delivering multiple benefits, and delivering against Ministerial priorities and environmental goals.

Ynni'r Fro

11.20 The Welsh Government's Ynni'r Fro programme is aimed at helping social enterprises across Wales to develop their own community-scale renewable energy schemes. The support available through Ynni'r Fro includes:

- Grant aid
- Loans
- Free, independent, practical advice and information

Preparatory stage grants

➢ To help projects get off the ground, up to £30,000 is available to fund early stage activities such as:

- Environmental surveys
- Feasibility studies
- Community engagement activity

Capital grants and loans

➢ Grants and loans are available towards the cost of constructing a renewable energy project.

Technical Development Officers

➢ A network of locally-based Technical Development Officers operates across Wales to help groups develop their projects and access Ynni'r Fro funding.

Pembrokeshire, Carmarthenshire Contact - Ben Ferguson-Walker - 07740 519397- ben@severnwye.org.uk

http://www.energysavingtrust.org.uk/organisations/ynnir-fro-community-programme

The Welsh Government Rural Communities – Rural Development Programme 2014-2020

11.21 This is a 7 year European Agricultural Fund for Rural Development (EAFRD) programme funded by the European Union and Welsh Government. This funds:

Glastir Woodland Grants

11.22 Glastir is the sustainable land management scheme for Wales funded through the latest Rural Development Plan (2014-20). Through the scheme Welsh Government offers financial support to farmers and land managers. The Glastir Woodland Management and Glastir Woodland Creation schemes, replace the Better Woodlands for Wales (BWW) scheme. Under Glastir Woodland Creation there are three grants available. Two are associated with establishing new

woodland and erecting new fencing to protect newly planted trees from livestock. The third is for holders of existing Glastir Woodland Creation contracts. Further details: http://goo.gl/PAeUsQ. Glastir Woodland Management offers grants to manage existing woodlands that are 0.5ha or more in a single block. Further details: http://goo.gl/ytI2r9

Glastir Woodland Restoration funding

11.23 This is aimed at achieving continued sustainable forest management, and increased resilience in woodland affected by ramorum disease of larch. Only one grant award per enterprise will be made in the period to 31 December 2020. The minimum grant threshold per enterprise for any individual investment project is £16,000. The maximum grant rate for any individual investment project is 40% of the total investment cost regardless of the size of the enterprise and location.

Local Funding:

Pembrokeshire Coast National Park Authority – Sustainable Development Fund

11.24 The **Sustainable Development Fund** grant supports projects that provide social, environmental, economic and cultural benefits, to improve the quality of life for communities in the National Park. The National Park Authority receives money from the Welsh Government to provide financial and practical support to projects within the Pembrokeshire Coast National Park. £100,000 was available in the 2015-16 financial year.

Appendix 1: Calculations of energy contributions

For the purposes of providing an estimate of the contribution the Pembrokeshire Coast National Park could make towards the Welsh renewable energy generation targets, the following assumptions and calculations have been used.

To calculate the annual electricity or heat generation in GWh, for each technology, the installed capacity (size of the unit i.e. 50kW) is multiplied by the number of hours in a year, and multiplied again by the 'capacity factor'. The capacity factor is the ratio of the actual output of the power unit over a period of time and its output if it had operated at full capacity over that time (e.g. Wind turbines will not always be operating at full capacity as wind speeds vary.

The renewable electricity and renewable heat generation capacity factors have been taken from the Welsh Government's Toolkit for Planners[21], Tables 54 & 55.

Calculation:

Installed Capacity (GW) X Number of hours per year X Capacity Factor (to convert from kW to GW 24 x 365 = 8760 e.g. 30% or 0.3 multiply by 0.000001) = Electricity (or heat) generated per year

Capacity Factors

Onshore wind: 0.27
Solar farm: 0.1
Micro hydro: 0.37
Building Integrated Renewables (heat – biomass boilers, heat pumps): 0.2
Anaerobic digestion: 0.9

[21] Practice Guidance – Planning for Renewable and Low Carbon Energy – A Toolkit for Planners (September 2015)

Appendix 2: Methodology for estimating potential generation from field scale solar

Methodology

For the purposes of the study update it was assumed that 0.14% of each Landscape Character Area, identified as having low to moderate or moderate sensitivity to field scale solar, could accommodate appropriately sized/located field scale solar. The figure of 0.14% is considered to be an appropriate estimate of potential area and is based on a report by the NFU which states that the UK could generate 10GW of power from 25,000 ha, about 0.14% of UK agricultural land.

The Welsh Government's Toolkit for Planners (page 57) – refers to the Department for Energy and Climate Change UK Solar PV Strategy as a means for estimating the capacity of field scale PV by area (summarised below):

> 1MW of fixed tilt array solar panels requires approximately 2.43ha of land.

Using this methodology, each Landscape Character Area (ha) was converted to acres with the MW output equivalent calculated on the basis of 1MW per 6 acres. The total MW output figure was then converted to GWh.

Very Small sites: The study assumed that a 250kW array would be an appropriate scale for the 'Very Small' category (ie <1ha). The total MW equivalent of all the Landscape Character Areas that could accommodate Very Small arrays was then divided by 250kW to give the number of very small sites that could be accommodated.

Small Sites: The study assumed small sites to be 1MW capacity per site as per guidance in the National Park's Renewables Supplementary Planning Guidance.

The table below highlights the area and capacity calculations for each Landscape Character Area with either 'low to moderate' and 'moderate' sensitivity for small and very small scale field solar arrays.

Landscape Character Areas (LCA) with 'Low-Moderate[22]' and 'Moderate' sensitivity for small and very small scale field solar arrays.

LCA Code	LCA Name	Area (ha)	0.14% = ha	MW equiv	Very small sites (250kW) Typical nos.	Very small sites GWh	Small sites Typical nos.	Small Sites MW	Small Sites GWh
LCA 1	Saundersfoot settled coast	1801.33	2.52ha	1.04	4	0.911			
LCA 6	Castlemartin/Merrion Ranges	3658.78	5.12	2.11	8	1.848			
LCA 7	Angle Peninsula	1365.86	1.91	0.79	2	0.692			
LCA 9	Marloes	5166.57	7.23	2.98	12	2.610	3	2.98	2.610
LCA 11	Herbrandston Refinery Fringe	703.99	0.98	0.40	2	0.350			
LCA 13	Brandy Brook	895.31	1.25	0.51	2	0.446	1	0.51	0.446
LCA 14	Solva Valley	302.04	0.42	0.17	1	0.148			
LCA 15	Dowrog & Tretio Commons	1309.49	1.83	0.75	3	0.657			
LCA 18	St Davids Headland	2186.46	3.06	1.26	5	1.103			
LCA 20	Trefin	2687.19	3.76	1.55	6	1.357	1	1.55	1.357
LCA 25	Cemaes Head	5239.31	7.33	3.02	12	2.645	3	3.02	2.645
LCA 28	Daugleddau	7175.78	10.04	4.14	17	3.626			
	Totals	**61683.26**	**45.45**	**18.72**	**74**	**16.393**	**8**	**8.06**	**7.058**

[22] The only Landscape Character Area to be designated low-moderate sensitivity in respect to very small field solar is Herbrandston. All the other Landscape Character Areas have moderate sensitivity to either small or very small field solar.