

Ceredigion

**Local Development Plan
2007 - 2022**

Draft Supplementary Planning Guidance Renewable Energy

Consultation Draft July 2014

This Supplementary Planning Guidance (SPG) is one of a series of guidance notes which support the policies of the Ceredigion Local Development Plan (LDP). Although decisions on planning applications will be based on the LDP's policies (as indicated in part 38(6) of the Planning and Compulsory Purchase Act 2004), the content of the SPG is a material planning consideration.

The Guidance does not set out policy independently of the LDP but only provides supplementary guidance. Therefore, in line with the Environmental Assessment of Plans and Programmes (Wales) Regulations 2004, it has not been considered necessary to subject it to separate Strategic Environmental Assessment (SEA). The results of the Sustainability Appraisal/ Strategic Environmental Assessment (SA/SEA) of the policies relevant to this SPG, Policy LU25: Renewable Energy Generation may be viewed in Appendix 3 of the Ceredigion Local Development Plan Final Sustainability Appraisal Report (April 2013).

Contents

1. Introduction	1
2. The Need for Renewable Energy	2
3. Planning Policy	4
4. Technology Comparison	5
5. Wind in Wales	6
6. What is a Wind Turbine?	6
7. Planning Permission and Wind Turbines	8
7.1. Micro Generation	8
7.2. Sub Local Authority and Local Authority-wide Schemes	9
Table 1: Matters and Issues to Consider when Submitting a Planning Application Relating to Wind Turbines	10
8. Submitting a Planning Application	42
9. Useful Contacts	42
10. Appendix 1: Visual Impact of Wind Turbines	43
11. Landscape Quality and Character	44
12. Solar in the UK	52
13. Types of Technology	53
14. Solar Thermal	53
15. Photovoltaic	53
16. Planning permission and solar scheme size.	54
17. Micro Generation	55
18. Sub Local Authority, Local Authority-wide and Strategic Size Schemes	56
19. Site Selection - Sub Local Authority, Local Authority-wide and Strategic level	57
Table 2: Matters and Issues to consider when submitting a planning application related to solar thermal and photovoltaic	58
20. Submitting a Planning Application	76
21. Useful Contacts	77
22. Hydro in the Ceredigion	78
23. How Hydro Works	78
23.1. Types of Hydro Schemes	79
23.2. Head and Flow Rate	80

23.3. Inside a Hydropower Plant	80
24. How much energy can it produce?	82
25. Site Selection	83
26. Planning Permission	84
27. Issues to consider	85
Table 3: Matters and Issues to consider when submitting a planning application relating to hydro power	86
28. Submitting a Planning Application	95
29. Useful Contacts	95

1. Introduction

The main purpose of this SPG is to assist in the interpretation and application of national and local policies concerned with the installation of renewable energy technologies. Policy LU25: Renewable Energy Generation supports the development and implementation of renewable energy throughout Ceredigion. LU26: Large and Medium Size Wind Farms specifically focuses on the implementation of wind technology.

This SPG therefore forms a material consideration in the determination of all planning applications which involve the implementation of renewable energy technologies. It will provide detailed guidance to members of the public, developers, planning officers and the Council's planning committee on planning issues relating to renewable energy. The Guidance:

- Introduces the relevant planning policy context in relation to the installation of renewable energy technologies;
- Provides an overview of the various elements that need to be considered when installing renewable energy technologies;
and
- Provides clear guidance for developers, Members and planning officers relating to renewable energy technologies.

This guidance covers renewable energy technologies in relation to:

- Hydropower
- Solar
- Wind

2. The Need for Renewable Energy

The EU Renewable Energy Directive sets a UK target of 15% of energy from renewable by 2020.

This commitment supports the UK target which requires the reduction of emissions by at least 80% in 2050 from 1990 level by 2050 as part of the Climate Change Act. The 80% target includes Green House Gas (GHG) emissions from the devolved administrations, which currently accounts for around 20% of the UK's total emissions. The Welsh Government (WG) is committed to achieving at least a 40% reduction in all greenhouse gas emissions in Wales by 2020 against the 1990 baseline.

Whilst there is not a specific target for Ceredigion, the County Council recognises the importance of climate change and the long-term impact that it will have both on communities and the environment. The Council is therefore committed to reducing its' carbon footprint, and encourages the wider public and community to do the same.

In terms of who makes the decision on renewable energy technologies this is dependent on the size of the scheme. For electricity installations (e.g. wind, solar, biomass etc.) it is as follows:

Installation Size	Current Consent Body
Less than 50 Mega Watts onshore	Local Authorities and Welsh Ministers
More than 50 Mega Watts onshore	Secretary of State for Energy and Climate Change National Infrastructure Planning Appropriate Secretary of State

Planning Policy Wales (PPW), the national planning policy document produced by Welsh Government, defines the size scales of renewable energy as follows:

Scale of Development	Threshold (electricity and heat)
Strategic	Over 25MW for onshore wind and over 50 MW for all other technologies
Local Authority-wide	Between 5 MW and 25MW for onshore wind and between 5MW and 50MW for all other technologies
Sub Local Authority	Between 50kW and 5MW
Micro	Below 50kW

Current permitted development rights for generating power from renewable sources on domestic properties is defined as follows:

Type	Capacity
Technologies that generate electricity	50 kilowatts (kW)
Technologies that generate heat	45 kilowatts (kW)

You will need to check if your building is:

- Within a **Conservation Area**: you can see if your property is within a Conservation Area via the Council's interactive mapping available via this link <http://www.ceredigion.gov.uk/index.cfm?articleid=15100>
- A **Listed Building**: contact the Planning Services on 01545 572135 or email planning@ceredigion.gov.uk
- Subject to **Permitted Development Rights having been Removed**: contact the Planning Service on 01545 572135 or email planning@ceredigion.gov.uk

In these cases special provisions apply and you should seek further advice from the Planning Service.

3. Planning Policy

Policies within the Ceredigion Local Development Plan (LDP) support the installation of renewable energy.

Policy LU25:

Renewable Energy Generation

Subject to Policy LU26, renewable energy projects will be permitted which facilitate the development of additional renewable energy generating capacity and associated reduction in carbon emissions, where:

1. resource delivery has been assessed as an effective and viable option;
2. adverse impacts of the particular technology can be mitigated;
 - i. In line with natural heritage objectives; and
 - ii. To minimize the potential detrimental effects on local communities; and
3. a suitable scheme is provided for decommissioning at the end of the operational design life of the infrastructure, where appropriate

4. Technology Comparison

To adhere to policy LU25 as part of your planning application a comparison of other renewable energy technologies considered should be supplied. A help sheet has been developed which will provide you with guidance on how to do this. This can be accessed via the Councils website www.ceredigion.gov.uk

5. Wind in Wales

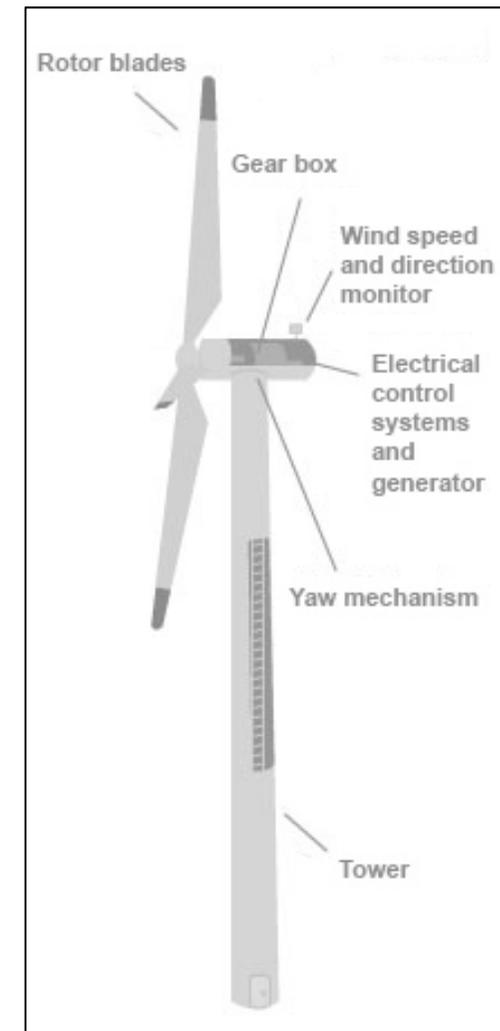
Planning Policy Wales (PPW) identifies the energy potential within Wales of onshore wind is 2 gigawatts. Wales' wind resource capacity is further explored within Technical Advice Note (TAN) 8: Planning for Renewable Energy. The TAN advises that large (over 25 megawatts) onshore wind farms should be concentrated into particular areas, these are defined as Strategic Search Areas (SSAs). SSA D: Nant Y Moch lies mostly within Ceredigion and partly in Powys. No other SSAs are currently identified in Ceredigion.

6. What is a Wind Turbine?

A wind turbine is made up of four main components:

- a tower – the upright structure on which the blades and nacelle are located;
- a nacelle – is mounted on the tower and houses the generator and gear box;
- a hub – allows the blades to spin (rotor); and
- blades – (attached to the hub) these react to wind, so that they rotate and impart energy to the rotor.

Figure 1 opposite illustrates the components of a wind turbine



There are two main types of wind turbine:

- Horizontal axis turbines – the rotor is located at the top of the tower and the turbine must be pointed into the wind. The nacelle and blades move to where the wind is blowing from.
- Vertical axis turbines – rotor is arranged vertically, the turbine doesn't have to be pointing into the wind.

Turbines come in various sizes, the table below may help you visualise the size of a turbine against other structures.

Landscape Element	Turbine Height in Meters
Single storey house	5 meters
1.5 to 2 storey house	6 – 10 meters
Telegraph pole	10 meters
Blaenplwyf Mast	160 meters

Generally the bigger the turbine the more power it can generate, though this isn't always the case. Sometimes you might need a taller tower in order to take advantage of the best wind speeds. Depending on the type of turbine the power output will be expressed either in Kilowatts (kW) or in Megawatts (MW).

$$1\text{kW} = 0.001\text{MW}$$

The following conversion table of power outputs is provided for ease of reference:

Kilowatt (kW)	Megawatt (MW)
10kW	0.01MW
50kW	0.05MW
100kW	0.1MW
750kW	0.75MW
1000kw	1MW
2000kW	2MW

7. Planning Permission and Wind Turbines

7.1. Micro Generation

Micro generation is categorised as a scheme that is **below 50kW**. Permitted Development Rights set out in the ‘Town and Country Planning (General Permitted Development) (Amendment) (Wales) Order 2012’ allow a wind turbine to be installed without the need for planning permission provided certain elements are met.

To see if a turbine needs planning permission you should refer to Planning Portal: <https://www.planningportal.gov.uk/permission/> to check and also refer to the Welsh Government advice on generating your own energy: <http://new.wales.gov.uk/topics/planning/policy/guidanceandleaflets/generaterenewable/?lang=en>

7.2. Sub Local Authority and Local Authority-wide Schemes

Sub Local Authority schemes are categorised as those with a generating potential between 50kW and 5MW. Local Authority-wide schemes are those generating 25MW to 50MW. **For a scheme generating energy between 50kW and 50MW planning permission will always be required.**

The following table will help you address the issues that will need to be considered as part of any planning application. The table can be read as a very detailed checklist on what needs to be done as part of your planning application submission.

The first column of the table sets out the Matter/Issue that needs to be addressed, the second column sets out how the matter/issue can be addressed and the final column gives links to further documents, where appropriate, that will need to be considered when addressing the issue/matter.

Prior to submitting any planning application you should ensure that following:

- Adequate wind resource
- Ministry of Defence – if site is within a safeguarding zone that the Ministry of Defence do not object to the development
- Grid connection – that there is capacity within the grid to take a further connection, what upgrades are required
- Statutory Designations – is the site covered by any

Whilst this table covers matters and issues that may need to be considered as part of you planning application it does not cover the technical aspect of what maps, drawings etc. you will need to include. For technical advice you should refer to the Submission

Guidance Note available here: www.ceredigion.gov.uk .However when submitting your application it is essential that the red line needs to include:

- siting of turbine
- access
- cabling etc.

These elements all need to be considered in relation to ecology and highways.

Table 1: Matters and Issues to Consider when Submitting a Planning Application Relating to Wind Turbines

Row Number	Matter/Issue	What Needs to be Addressed	Guidance
Location			
1	Ensure the turbine is in the right location	<p>Turbines often work best in an exposed location and work best at a height where there are no obstructions from buildings, trees or other features that would cause turbulence. There may however, be landscape implications (see landscape section below).</p> <p>The Met Office provides a ‘Virtual Met Mast’ wind data service for wind turbine developers/applicants this can be used to identify windy spots.</p> <p>Smaller turbines which require less (5MW and under) can often be</p>	<p>Virtual Met Mast: http://www.metoffice.gov.uk/renewables/vmm</p>

Row Number	Matter/Issue	What Needs to be Addressed	Guidance
		located near to existing built features e.g. houses, industrial parks, trees etc. but typically they are less successful because winds tend to be turbulent, weak, and erratic due to buildings, trees and other obstructions. There may also be an impact on landscape, ecology etc. from these locations.	
2	Where can I put a 5MW or higher wind scheme?	<p>Wind schemes that generate 5MW to 50MW will only be permitted within Strategic Search Area D (SSA D) in Ceredigion.</p> <p>Therefore it is essential that any scheme with a generation output of 5MW – 50MW is within SSA D, subject to the stipulations in LDP Policy LU26.</p>	<p>TAN 8: http://new.wales.gov.uk/topics/planning/policy/tans/tan8/?lang=en</p> <p>LDP Policy LU26: Arup Report: Ceredigion County Council/Powys County Council TAN 8 Annex D study of SSA D: Nant-y-Moch:</p>
Landscape			

Row Number	Matter/Issue	What Needs to be Addressed	Guidance
3	Wind turbine is visible from numerous points and can sometimes be seen from very far away.	<p>Proposed development must carefully consider its potential effects on the landscape in which it sits. It should be noted that different landscapes possess different characteristics and what is considered acceptable in one place may not be acceptable in another. Appendix 1 of this document gives further details on important landscapes and landscape types.</p> <p>Careful consideration of the design and positioning of a wind turbines is therefore essential as it can greatly influence any potential effects on landscape character and visual amenity.</p> <p>Wind turbine design should carefully consider the potential visual impact on the landscape.</p> <p>Key landscape and visual characteristics of an area e.g. landform, elevations, presence/absence of woodland etc., should be identified. It is important that that the heights of wind turbine do not overwhelm the scale of hills, ridges, and historic monuments.</p> <p>The application should consider the Natural Heritage Objectives as detailed within TAN 8: Annex D paragraph 8.3 and 8.4. Refer to section 3 within this SPG document which discusses this matter</p>	<p>TAN 8: Annex D http://new.wales.gov.uk/topics/planning/policy/tans/tan8/?lang=en</p> <p>Renewable UK: Planning Guidance: Small Wind – A good practice guide: http://www.renewableuk.com/en/publications/guides.cfm/Smallwindplanningguidance</p>

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		<p>further.</p> <p>The TAN clearly states that in areas outside the SSAs, the implicit objective is to maintain the landscape character i.e. no significant change in landscape character from wind turbine development.</p>	
4	<p>The turbine is sited close to existing features e.g. farm, houses, settlements, industrial parks, hedges, woods</p>	<p>Whilst larger wind schemes are often located in exposed locations where scale is often difficult to perceive, smaller turbines (5MW and under) can often be located near to existing built features e.g. houses, industrial parks and vegetation features e.g. hedges, copses. These existing features provide scale indicators within the landscape. It is therefore important to ensure that the turbines relate to the scale of the adjacent landscape features.</p> <p>The different sizes of wind turbines can cause confusion within a landscape. For example large turbines when viewed against smaller turbines can often appear closer to you than smaller ones even if the smaller turbines are actually closer.</p> <p>Smaller turbines (5MW and less) have more potential to use landform to restrict their visual impact than medium and larger (5MW to 50MW) schemes. It should be explored how the land form</p>	

Row Number	Matter/Issue	What Needs to be Addressed	Guidance
		may help screen the turbine, without affecting its performance.	
5	Turbine is within, adjacent to or can be seen from a Special Landscape Area(s) (SLA).	<p>There are 13 Special Landscape Areas (SLAs) within Ceredigion, which cover a range of landscape types including coastal, valley and upland. Specific reference to wind turbine impact as a key management issue has been highlighted in relation to the following specific SLAs:</p> <ul style="list-style-type: none"> • SLA 2: Ceredigion Coast – Aberystwyth to Borth • SLA 3: Ceredigion Coast – Llanrhystud to Aberystwyth • SLA 4: Ceredigion Coast – New Quay to Llanrhystud • SLA 5: Ceredigion Coast – Aberporth to New Quay • SLA 6: Ceredigion Coast – Gwbert to Aberporth • SLA7: Teifi Valley • SLA 9: Wyre Valley • SLA 10: Ystywth Valley • SLA 11: Rhediol Valley • SLA 12: Northern Uplands • SLA 13: Southern Uplands <p>As part of the assessment the scale and nature of the development</p>	SPG Link:

Row Number	Matter/Issue	What Needs to be Addressed	Guidance
		<p>and its ability to be accommodated without significant damage to, and where possible enhancement of, the valued characteristics of the SLA, should be considered.</p> <p>Applications will need to demonstrate how any issues in terms of effect and possible mitigation are to be addressed.</p>	
6	Wind turbine falls within a coastal seascape.	<p>The quality of seascapes is particularly relevant given the length of the Ceredigion coastline, some 96km in extent from the Dyfi estuary in the north to the Teifi estuary in the south near Cardigan and that it includes a Heritage Coast Designation.</p> <p>Ceredigion lies within the Cardigan Bay national seascape unit and includes the following regional units:</p> <ul style="list-style-type: none"> • 24: Pen Bwch Point to Upper Borth • 25: Dyfi Estuary • 26: Upper Borth to New Quay • 27: New Quay to Cardigan Island • 28: Teifi Estuary <p>If the turbine falls within a seascape, reference should be made to</p>	<p>Seascape Units website: http://www.ccgc.gov.uk/landscape--wildlife/protecting-our-landscape/seascapes/seascape-assessment-of-wales.aspx</p>

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		the Countryside Council for Wales' (now part of Natural Resources Wales) "Seascapes" report (2009). As part of the planning application it should be explained how the turbine will not have a detrimental effect on the particular seascape or what mitigation methods are proposed to limit impact.	
7	The turbine is located within an historic environment.	<p>Within the County there are:</p> <ul style="list-style-type: none"> • 13 Conservation Areas: <ul style="list-style-type: none"> ○ Aberaeron ○ Aberystwyth ○ Adpar ○ Cardigan ○ Cenarth ○ Lampeter ○ Llanbadarn Fawr ○ Llanddewi Brefi ○ Llandysul ○ Llanrhystud ○ Llansantffraed ○ New Quay 	Ceredigion LDP Constraints interactive mapping: http://www.ceredigion.gov.uk

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		<ul style="list-style-type: none"> ○ Tregaron • 1888 (approximately) listed buildings • Llanerchaeron National Trust property • 4 Landscapes of Special Historic Interest • 12 Historic Gardens of National Importance. <p>Whilst these designations do not preclude development proposals that potentially affect skylines with important cultural or historic landmark features should be avoided. For example, it's important to ensure that the siting of a turbine does not prevent the understanding and appreciation of, historic landmarks features such as hilltop monuments etc. It is also important that the position of a turbine does not affect views which are integral to the character of a Conservation Area.</p>	
8	The siting of numerous individual turbines has a cumulative effect on the	When deciding upon the location for your turbine it is important to assess the surrounding landscape. The cumulative effects of individual turbines within a landscape may result in the landscape being dominated by turbines.	Landscape Institute: http://www.landscapeinstitute.co.uk/ Scottish Natural Heritage:

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	landscape.	<p>Two types of cumulative landscape effects can occur:</p> <ol style="list-style-type: none"> 1. The direct effects on the physical fabric of the landscape i.e. where a number of different turbine developments remove or damage a series of landscape components such as trees, hedgerows or hedgebanks; and 2. . New features are introduced into the landscape and this may then change the landscape character. <p>The cumulative impact of wind development on landscape and visual amenity is a product of:</p> <ul style="list-style-type: none"> • the distance between individual wind farms/turbines; • the distance over which they are visible; • the overall character of the landscape and its sensitivity to windfarms/turbines; • the siting and design of the wind farms/turbines themselves; and • the way in which the landscape is experienced. <p>Cumulative effects on visual amenity can be caused by ‘combined visibility’ and/or ‘sequential effects’:</p>	<p>Assessing the Cumulative Impact of Onshore Wind Energy Developments: http://www.snh.gov.uk/docs/A675503.pdf</p> <p>Pembrokeshire County Council, National Park and Carmarthen County Council: Cumulative Impact of Wind Turbines on Landscape and Visual Amenity: http://www.pembrokeshirecoast.org.uk/files/files/Dev%20Plans/Cumulative%20Impact%20SPG%20Final%20Jan2014.pdf</p>

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		<ul style="list-style-type: none"> • Combined: where the observer is able to see two or more developments from one viewpoint. An assessment should consider the combined effect of all turbines which are (or would be) visible from relevant viewpoints; • Sequential: where the observer has to move to another viewpoint to see the same or different developments. Sequential effects may range from frequently sequential (the features appear regularly and with short time lapses between) to occasionally sequential (long time lapses between appearances) depending on speed of travel and distance between the viewpoints. <p>Cumulative effects can be static or ongoing:</p> <ul style="list-style-type: none"> • Static Receptors: <ul style="list-style-type: none"> ○ Hilltops or headlands or scenic viewpoints accessible by car, parks and gardens or listed buildings; ○ Sensitive areas such as the Heritage Coast and open access land; and ○ Residents in dwellings whether on the edge of a settlement or located in open countryside. 	

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		<ul style="list-style-type: none"> • Ongoing Receptors: <ul style="list-style-type: none"> ○ Users of footpaths including the Wales Coast Path and Cambrian Way; ○ Users of bridleways; ○ Users of the National Cycle route ○ Users of scenic routes or roads used by tourists e.g. the Coast Road; and ○ Recreational sea users such as leisure sailors. <p>When undertaking your cumulative effect study it is important that you define your study area. You can do this either by:</p> <ul style="list-style-type: none"> • Basing it on Landscape Character Types/Areas e.g. those as defined by LANDMAP; • Basing it on the Zone of Theoretical Visibility; or • A combination of both. <p>The cumulative effect study should:</p> <ul style="list-style-type: none"> • Identify whether other turbines can be seen from the chosen site. This includes turbines that have received permission but are not yet erected. You should refer to this survey and 	

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		<p>its results in your planning application; you should include a map showing the location of those existing turbines;</p> <ul style="list-style-type: none"> • Explain the value attached to the views that a person may experience from this location; and • Explain the physical size and scale of the cumulative visual effects identified. <p>For guidance on how to undertaken an assessment you should refer to the Landscape Institute Guidelines for Landscape and Visual Impact Assessment.</p> <p>You can also refer to guidance on assessing cumulative effects produced by Scottish Natural Heritage and Pembrokeshire County Council, National Park and Carmarthenshire County Council. Whilst this information relates to Scotland and Pembrokeshire/Carmarthenshire it may be useful to consider the advice as many of the issues will be similar in Ceredigion.</p>	
9	What does the Landscape and Visual Impact	<p>The amount of detail needed within a LVIA will relate to the size of the turbine.</p> <p>It is recommended that an appropriately qualified Landscape</p>	<p>The Landscape Institute: http://www.landscapeinstitute.co.uk/</p>

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	Assessment (LVIA) need to do	<p>Architect is appointed to undertake a LVIA. The LVIA should be undertaken in accordance with the Landscape Institute Guidelines.</p> <p>Many elements go into producing the LVIA, however it should be informed by the Zone of Theoretical Visibility (defined below). It is from this work that you should choose your receptor points.</p>	
10		<p>The Zone of Theoretical Visibility (ZTV) represents the area over which a development can theoretically be seen. A ZTV indicates areas from where a turbine may be seen within the study area, they cannot show how it will look, nor indicate the nature or magnitude of the visual impacts.</p> <p>The larger the turbine the bigger the ZTV will need to be. As a guide a:</p> <ul style="list-style-type: none"> • Turbine 20 meters in height or less should use a ZTV of 15km; • Turbine of 20 – 50+ meters should use a ZTV of 20km; <p>For a ZTV to be clear it should:</p> <ul style="list-style-type: none"> • Be superimposed on a clearly legible base map at a recognised scale e.g. Ordnance Survey (OS) 1:50,000; 	

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		<ul style="list-style-type: none"> • Wind turbine should be clearly marked; • Viewpoint locations should be numbered and shown on the ZTV – label these carefully to avoid obscuring vital ZTV information; • Have concentric rings to indicate the different distances from the proposed developments e.g. 10, 20, 30km. It is recommended that these rings not be coloured/shaded as this may imply a direct relationship between the distance and relative visibility or visual impact that would be misleading; • Multiple ZTVs should be provided e.g. tower height, blade tip etc – these should be provided as separate documents i.e. the results of each ZTV should not be overlaid. <p>Within your ZTV you should consider main receptors based on the following:</p> <ul style="list-style-type: none"> • Trunk roads i.e. A44, A487 • Principle roads i.e. A475, A485, A486, A484, A482, A4120, A4159; 	

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		<ul style="list-style-type: none"> • Settlements named within the Ceredigion and adjacent Counties Local Development Plan's; • Public Rights of Way; • Within/out of/into any designated areas (see section 3.1 in this SPG document). <p>As part of your ZTV you should supply information on:</p> <ul style="list-style-type: none"> • Software used; • Digital Terrain Model used; • Observer Eye level used (in metres); • Resolution of ZTV used (in metres); • Line of site check frequency used (in metres); and • Maximum distance considered used (in metres / kilometres). 	
11		<p>As part of your LVIA visualisations such as wire drawings and photomontages should be submitted.</p> <p>Whist these images are never 'true to life' they can help illustrate the landscape and how a turbine may or may not fit in within it.</p> <p>As it is not possible to include photographs of every part of every</p>	

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		<p>different landscape photographs and wire drawings should be selected to illustrate a representative range of the character of the landscape.</p> <p>The size of a photograph required to represent a view will vary for different projects and different views.</p> <p>It is recommended that a panorama is taken from each viewpoint that includes the entire width of open view. This may be a 360° for some viewpoints.</p> <p>Where there is a high vertical dimension to the view e.g. mountain, hilly area it is advisable to prepare a panorama comprising of vertical 'portrait' frames.</p> <p>When using photographs/photomontages you should provide information on:</p> <ul style="list-style-type: none"> • The camera used to take the photograph <ul style="list-style-type: none"> ○ SLR 35mm film or digital SLR; • The focal length: <ul style="list-style-type: none"> ○ camera should always be focussed on infinity both for 	

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		<p>consistency and to ensure that the focal length and principal distance area equal; and</p> <ul style="list-style-type: none"> ○ On auto-focus lenses, focussing should be set to manual or locked on infinity ○ 50mm or 100mm; ● Time of day; and ● Weather conditions. <p>For wire models you should provide information on:</p> <ul style="list-style-type: none"> ● Software used ● Digital Terrain Model used; ● Observer Eye level used (in metres); ● Resolution of ZTV used (in metres); and ● Line of site check frequency used (in metres). 	
12	How should the application reference LANDMAP	<p>As part of the LVIA applicants will need to make reference to the LANDMAP system of landscape evaluation. LANDMAP assesses the landscape against 5 layers:</p> <ul style="list-style-type: none"> ● Cultural Landscape; ● Geological Landscape; 	<p>LANDMAP: http://www.ccw.gov.uk/landmap LANDMAP Guidance Note 3: Guidance for Wales:</p>

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		<ul style="list-style-type: none"> • Historic Landscape; • Landscape Habitat; and • Visual and Sensory. <p>Within the LVIA it is important to explain how the proposed wind scheme will affect each of the landscape types.</p> <p>For guidance on using LANDMAP information applicants should consult NRW's LANDMAP Guidance Note 3: Guidance for Wales: Using LANDMAP for Landscape and Visual Impact Assessment of Onshore Wind Turbines.</p>	<p>Using LANDMAP for Landscape and Visual Impact Assessment of Onshore Wind Turbines: http://www.ccg.gov.uk/landscape--wildlife/protecting-our-landscape/idoc.ashx?docid=56930f34-e81a-45b8-84de-c4359b84c1f8&version=-1</p>
13	What colour should the turbine be?	<p>Larger commercial turbines are generally light grey in colour to reduce their contrast with the sky.</p> <p>Smaller turbines (lower than 5MW) however may be sited on a lower elevation with a non-sky background. In these situations there may be scope to relate the turbine more to the backdrop.</p> <p>In all cases the reflectivity of the turbine components should be minimised.</p>	

Row Number	Matter/Issue	What Needs to be Addressed	Guidance
		Ecology	
14	Need to identify relevant ecological issues'	<p>Turbines can have an impact on ecology through the physical construction of the mast foundations, buried cabling, track ways and widening of access and bends in the road. These works can result in loss of habitat, disturbance of species and killing/injuring of species through direct works or entrapment from diggings. The turbine blades can also impact birds and bats through collision and barotrauma and the presence of the turbine may have impacts of disturbance on breeding birds.</p> <p>Therefore, Preliminary Ecological Appraisal (PEA) and any other required ecological survey work (see Nature Conservation and Guidance note and Nature Conservation SPG) will be required to be submitted with all single or multiple wind turbine applications to determine the likelihood of any potential impacts on biodiversity. This must incorporate a desk study and field survey, carried out by a suitably qualified ecologist, and where appropriate, species surveys such as bats and birds and an assessment of the likely impacts. The scope must include the site of the turbine and any</p>	<p>Council Ecologist: ecology@ceredigion.gov.uk</p> <p>Guidance Note: Nature Conservation and Wind Turbines: www.ceredigion.gov.uk</p> <p>Nature Conservation SPG: www.ceredigion.gov.uk</p> <p>Natural Resources Wales: http://naturalresourceswales.gov.uk</p> <p>Natural England: TIN051: http://publications.naturalengland.org.uk/publication/35010</p> <p>Natural England: TIN059:</p>

Row Number	Matter/Issue	What Needs to be Addressed	Guidance
		works related to the development such as access, access improvements, cable laying, crane pads etc. and the surrounding land (including farm buildings). Mobile species may need to be considered at some distance away from the turbine. Potential cumulative impacts with other turbines and wind farms in the locality should also be incorporated in the assessment. For details on the requirements for the PEA and when more detailed surveys may be required, please see the guidance note 'Nature Conservation and Wind Turbines' and the Nature Conservation SPG available on the council website.	http://publications.naturalengland.org.uk/publication/33013 Scottish Natural Heritage: Wind farm impacts on bird guidance: http://www.snh.gov.uk/planning-and-development/renewable-energy/onshore-wind/windfarm-impacts-on-birds-guidance/ Scottish Natural Heritage Assessing the cumulative impact of onshore wind energy developments: http://www.snh.gov.uk/docs/A675503.pdf
15	The turbine is located near to a waterbody	During the construction and decommissioning of the wind turbines water bodies e.g. ponds, rivers etc. may be polluted. This in particular may have impacts with regards to protected sites such as Sites of Special Scientific Interest (SSSIs), Special Protection Areas (SPAs), Special Areas of Conservation (SACs) etc. A Test of	Environment Agency Pollution Prevention Guidelines: Work and Maintenance in or Near Water PPG:

Row Number	Matter/Issue	What Needs to be Addressed	Guidance
		<p>Likely Significant Effect therefore may be needed for the application (see Nature Conservation SPG for more information).</p> <p>Turbines should be sited away from these areas and a Pollution Prevention Statement (PPS) will be required for applications which may have impacts on a water body. This should include:</p> <ul style="list-style-type: none"> • A detailed plan showing the location of any water features in the vicinity. • Full details of how any watercourses will be crossed or confirmation that this is not applicable. • Storage facilities for any oils if applicable. • Details of surface water drainage arrangements to be installed to intercept and treat contaminated surface water run-off. • Details of measures to ensure no polluting discharge from disturbed areas. • Measures for dealing with any contaminated material (excavated waste). • Measures for dealing with any waste produced. 	<p>https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/290145/pmho1107bnkg-e-e.pdf</p> <p>Nature Conservation SPG: www.ceredigion.gov.uk</p>

Row Number	Matter/Issue	What Needs to be Addressed	Guidance
		<ul style="list-style-type: none"> • Measures for dealing with any invasive plants on the site. • Details of emergency contacts, for example Natural Resources Wales' Pollution hotline 0800 807 060. 	
16	Turbine requires an Environmental Impact Assessment	<p>Individual wind turbines and windfarms are listed under Schedule 2.3(i) of the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999.</p> <p>If the turbine is greater than 15 meters or more than 1 turbine is being erected, request a screening opinion from the Local Authority.</p>	<p>EIA: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/7676/155958.pdf</p>
Archaeology			
17	Location of the turbine needs to consider any archaeological assets.	<p>Information will need to be provided as part of the application that the turbine does not negatively affect an archaeological asset. You should contact Dyfed Archaeology to discuss any possible archaeological issues. Designated heritage assets include:</p> <ul style="list-style-type: none"> • Scheduled Ancient Monument (SAM); • Listed buildings. <p>No works (including archaeological investigation) are permitted</p>	<p>Dyfed Archaeology: http://www.dyfedarchaeology.org.uk</p>

Row Number	Matter/Issue	What Needs to be Addressed	Guidance
		<p>within a SAM without Scheduled Monument Consent (SMC) to be obtained from Cadw.</p> <p>If archaeological remains are thought to exist, field investigations to gather more information on the significance of these may be required.</p> <p>Such investigations may sometimes be required prior to the determination of a planning application, and can include geophysical survey and evaluation trial trenches. If there is thought to be a lesser potential for archaeological remains, mitigation measures such as an archaeological watching brief secured by condition may be appropriate.</p> <p>The siting of turbines on Listed Buildings (micro turbines) or within the associated curtilage of Listed Buildings would require Listed Building Consent from the Local Planning Authority. Siting of turbines within the general environs of a Listed Building would not require Listed Buildings Consent.</p>	

Row Number	Matter/Issue	What Needs to be Addressed	Guidance
Highways			
18	Turbines may affect the trunk and local highway networks.	<p>Turbines generally need to be set back from roadways. During the construction and for future servicing needs, a Traffic Management Plan may need to be prepared in order to avoid unnecessary local traffic disruption.</p> <p>For small wind proposals, the parts of the turbine(s) will not normally present issues regarding transport to the site using the existing road network and normal size loads.</p> <p>For the larger sized turbines route analysis may be required to accompany a planning application where access issues are anticipated due to the delivery route proposed. Where required, a route analysis can form technical supporting information to accompany the planning application.</p> <p>Speak with the Council's Highways Service to ascertain whether the size of the turbine would be an abnormal load delivery.</p>	<p>TAN 18: Transport: http://new.wales.gov.uk/topics/planning/policy/tans/tan18/?lang=en</p> <p>Council Highway Section: hpw@ceredigion.gov.uk 01545 572572</p>
Noise			
19	Noise can be heard from the turbine.	Noise impact will be a key consideration when determining an application. Noise emitted from turbines can be defined into two	ETSU-R-97 The assessment and rating of

Row Number	Matter/Issue	What Needs to be Addressed	Guidance
		<p>sources:</p> <ul style="list-style-type: none"> • Aerodynamic: the passage of air over the wind turbine blades • Mechanical sources: the components of the turbine <p>Turbines should not be located close to noise sensitive properties e.g. a domestic home etc.</p> <p>There is also some variance on how much noise is made by each turbine. Therefore investigation into turbines that are quieter, if a turbine is to be located near to residential properties, should be considered.</p> <p>The main guidance for assessing impact from wind turbines is 'ETSU-R-97 The assessment and rating of noise from wind farms' you should also refer to Institute of Acoustics: A Good Practice Guide.</p> <p>As part of your application you should establish a baseline of noise which is based on the specific site where the turbine is going. You should not provide just noise information on the wind turbine.</p>	<p>noise from wind farms: http://webarchive.nationalarchives.gov.uk/+http://www.berr.gov.uk/files/file20433.pdf http://www.ioa.org.uk/publications/good-practice-guide</p> <p>Institute of Acoustics: A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise:</p>

Row Number	Matter/Issue	What Needs to be Addressed	Guidance
Shadow Flicker			
20	Turbine is causing shadow flicker	<p>Due to blades moving if a turbine is viewed with the sun behind it, under specific conditions an effect known as ‘shadow flicker’ can occur.</p> <p>There are some measures that can be taken which should help reduce shadow flicker, these are:</p> <ul style="list-style-type: none"> • Where possible you should try and position the turbine to avoid shadow flicker. • Screen shadow flicker impacts using planting, provided it does not cause a disruption to air flow • Use matt or semi-matt finish on the turbine blades. 	<p>Department of Energy & Climate Change : Update of UK Shadow Flicker evidence base: https://www.gov.uk/government/news/update-of-uk-shadow-flicker-evidence-base</p>
Electromagnetic Transmissions (TV, radio signals)			
21	Location of the turbine will cause interference with signals.	<p>Effects on television reception can usually be resolved through careful siting of individual turbines. Experience has shown that when reception is compromised it is usually of a predictable nature and can be alleviated by the installation or modification of a local repeater station or cable connection.</p> <p>Ofcom offer a service to developers where the coordinates of a site</p>	<p>Ofcom: http://licensing.ofcom.org.uk/radiocommunication-licences/fixed-terrestrial-links/guidance-for-licensees/wind-farms/?a=0</p>

Row Number	Matter/Issue	What Needs to be Addressed	Guidance
		<p>can be sent to them for comment.</p> <p>The BBC also has an online tool available on their website which can provide an initial assessment of the likelihood of disruption.</p> <p>It is advised that you use these services and include any feedback as part of your planning application.</p> <p>If as part of survey disruption to signals is identified it is recommended that a baseline survey is carried out establishing the current level of service. This information can then be used to help mitigate against any disruption.</p>	
Aviation			
22	Turbine is within an Aerodrome Buffer Zone.	<p>Contact prior to an application being submitted the:</p> <ul style="list-style-type: none"> • Ministry of Defence (MoD); • National Air Traffic Services (NATS) <p>Within your planning application you should provide detail on whether MoD (QinetiQ) or NATS have objection to the proposed development, and if so can they be overcome? You will need to supply this information as part of your planning application.</p>	<p>LDP Constraints interactive mapping: http://www.ceredigion.gov.uk Civil Aviation Authority: Policy and Guidelines on Wind Turbines: http://www.caa.co.uk/applica</p>

Row Number	Matter/Issue	What Needs to be Addressed	Guidance
		<p>Implications to aviation are not limited to aircrafts but also apply to the equipment and radar. The Civil Authority has produced guidelines on wind turbines that you should refer to.</p> <p>Renewable UK has developed a proforma which will help you provide the correct details to the relevant bodies. It is recommended that you use this in your communication with the Aviation bodies.</p> <p>Within Ceredigion there is also West Wales Airport. You should contact them prior to submitting an application to see if they also have any objection to the proposed development.</p>	<p>tion.aspx?catid=33&pagetype=65&appid=11&mode=detail&id=5609</p> <p>Renewable UK Proforma: http://www.renewableuk.com/en/our-work/aviation-and-radar/</p> <p>Aviation Safeguarding Toolkit: https://restats.decc.gov.uk/cms/aviation-safeguarding-maps</p>
Community Benefit			
23	The scheme has raised concerns with the community.	<p>The larger a wind turbine scheme the greater the impact will be. When designing your scheme it is important to address any issues in regard to rights of way, impact on tourism etc.</p> <p>Explain how the scheme, if it does, benefits the wider community. For example is it going to provide power to a nearby school or</p>	<p>Ynni'r Fro programme: http://www.energysavingtrust.org.uk/wales/Communities/Finding-funding/Ynni-r-Fro-programme</p>

Row Number	Matter/Issue	What Needs to be Addressed	Guidance
		<p>housing estate?</p> <p>If the development is part of a community scheme you should provide details of this as part of your planning application. The Welsh Government currently provides funding for community schemes via the Ynni'r Fro programme.</p>	
24	The scheme may require a financial contribution	<p>Medium and large scale wind farms (5MW to 50MW) may need to make a financial contribution proportionate to the scale of the wind turbine(s) to an appropriate local community fund. TAN 8 Annex B gives advice on community benefits.</p> <p>If a contribution is required identify what community is to receive the contribution and how it is to be spent.</p> <p>Any financial contribution is agreed separate to the planning application process.</p>	<p>TAN 8: Annex B: http://new.wales.gov.uk/topics/planning/policy/tans/tan8/?lang=en</p>
Comparison Study			
25	What other renewable energy technologies have been considered.	<p>Produce a report which explains what other renewable energy technologies e.g. solar, have been considered.</p> <p>The Welsh Government have produced information on the types of renewable energy are available and their planning implications.</p>	<p>Welsh Government: http://wales.gov.uk/topics/planning/planningresearch/publishedresearch/planningim</p>

Row Number	Matter/Issue	What Needs to be Addressed	Guidance
		The Local Planning Authority has produced a help sheet that can be used as a basis for undertaking the review into other renewable energy technologies.	plications/?lang=en Renewable Energy Technology Comparison Help Sheet :
Decommissioning Statement			
26	What does the Decommissioning Statement need to cover	<p>This is a statement submitted along with the planning application which explains to the Local Authority how the wind turbine will be removed once it has reached the end of its life. It is considered that the statement should explain how:</p> <ul style="list-style-type: none"> • The turbine is to be removed, including the foundations, from the site; and • Any ground remediation works to be undertaken and when. 	
Grid Connection			
27	How close does the turbine need to be to a grid connection	You will need to speak with the relevant Power Distribution Network operator to assess what upgrades will be required to the electrical grid network for the purpose of the development. Within Ceredigion there are two Power operators, Western Power and Scottish Power.	<p>Western Power Distribution: http://www.westernpower.co.uk</p> <p>Scottish Power: http://www.scottishpower.co</p>

Row Number	Matter/Issue	What Needs to be Addressed	Guidance
		<p>As part of your application you should provide a broad indication of the route of connectivity to the electrical grid.</p> <p>This will obviously not be an issue in circumstances where it is not proposed to connect the wind turbine to the electricity grid, for example where the electricity generated would be used directly, or where the electricity generated would be stored using batteries.</p>	uk
Public Rights of Way and Tourism			
28	<p>Turbine is located by or near a Public Right of Way (PROW)</p> <p>Public rights of way include footpaths, bridleways and byways open to all traffic.</p>	<p>There is currently over 2506km of public rights of way in Ceredigion. You should contact the Council's Coast and Countryside Service for information on PROWs</p> <p>It is an offence to obstruct a pavement (footway) and the fact that planning permission has been granted, or is not required, does not entitle a developer to obstruct, interfere or move a Public Right of Way.</p> <p>Any proposal for a wind turbine should carefully consider the impact of such development on the users of any adjacent public right of way, including footpaths and bridleways. Such development should not have a significant detrimental impact on the amenity of</p>	<p>Coast and Countryside:</p> <p>www.ceredigion.gov.uk</p>

Row Number	Matter/Issue	What Needs to be Addressed	Guidance
		<p>people using the footpath or bridleway and the health and safety of such users should be carefully considered, both during the construction, operation and maintenance of the facility.</p>	
29	Turbine is located in a tourism area	<p>Ceredigion tourism depends heavily on the country's landscape. The Wales Visitor Survey 2013 showed that 67% of visitors came to Ceredigion to enjoy the landscape / countryside / beach.</p> <p>Main resort settlements are identified as:</p> <ul style="list-style-type: none"> • Aberystwyth; • Aberaeron; • New Quay; and • Cardigan. <p>If the wind scheme is of a small to medium scale (5–25MW) consider implementing interpretation boards so people can understand what they are seeing.</p> <p>If a wind scheme is of a large scale (25MW +) consider developing an information centre. This type of facility can help people understand the development, raise awareness and also help increase tourism visits.</p>	<p>Ceredigion County Council: Tourism and Visitor Economy Strategy for Ceredigion 2011-2020: http://www.ceredigion.gov.uk/public-it/tourism/stats/certwg/CEREDIGION%20TOURISM%20STRATEGY%202011-2020.pdf</p>

8. Submitting a Planning Application

For full guidance on what needs to be submitted as part of a planning application e.g. location plans etc, refer to the Submission Guidance Note available here: www.ceredigion.gov.uk As part of your application for a wind turbine scheme, specific information is required within your planning application, these are:

- Comparison Energy Study (row 25)
- Decommissioning Report (row 26)
- Energy Output Statement
- Landscaping and Visual Impact Assessment (row 3-13)
- Ministry of Defence Report (if it is within the protected zone) (row 22)
- Model details and colour - this should include the overall height of the turbine from the base of the tower to the blade tip. This can then be broken down into individual components e.g. the tower is 30 meters high, blade tip is 20 meters etc.
- Preliminary Ecological Appraisal and any other surveys (row 14-16)
- Renewable Energy Technology Comparison Report (row 25)
- Shadow Flicker Assessment. (row 20)
- Traffic Management Plan for abnormal load deliveries (row 18)
- TV reception data/mitigation (row 21)

9. Useful Contacts

Aviation Safeguarding Toolkit: <https://restats.decc.gov.uk/cms/aviation-safeguarding-maps>

Dyfed Archeology: <http://www.dyfedarchaeology.org.uk>

Energy Savings Trust: <http://www.energysavingtrust.org.uk/>

Landscape Institute: <http://www.landscapeinstitute.co.uk/>

Microgeneration Certification Scheme (MCS): www.microgenerationcertification.org

Natural Resources Wales: <http://naturalresourceswales.gov.uk/>

Planning Portal: www.planningportal.gov.uk

Renewable UK: <http://www.renewableuk.com/en/our-work/aviation-and-radar>

Scottish Natural Heritage: <http://www.snh.gov.uk/docs/A675503.pdf>

Seascape Project: <http://www.ccg.gov.uk/landscape--wildlife/protecting-our-landscape/seascapes/seascape-assessment-of-wales.aspx>

Virtual Met Mast: <http://www.metoffice.gov.uk/renewables/vmm>

10. Appendix 1: Visual Impact of Wind Turbines

For wind turbines to be effective they need to be in exposed locations in order to catch the wind. This means that they can often be seen from various locations.

TAN 8, Annex D sets out the need to consider Natural Heritage Objectives when judging the acceptability of landscape impact.

Paragraph 8.4 of the Annex clearly states:

“In the rest of Wales outside the SSAs, the implicit objective is to maintain the landscape character i.e. no significant change in landscape character from wind turbine development.”¹

¹ Technical Advice Note 8: Renewable Energy, Annex D, Welsh Assembly Government (1996)

11. Landscape Quality and Character

Landscape is the physical manifestation of space, the tangible elements that give shape and diversity to our surroundings. Landscape is important, not just as scenery but because it links culture with nature, and the past with the present. Well-looked after and highly valued landscapes are essential to social well-being and an economically healthy society. Landscapes are valued because of their inherent interest, their contribution to both national identity and local distinctiveness. The protection of high quality and highly valued landscapes therefore is important both for its own sake and for the health, social and economic wellbeing of individuals and communities.

The quality of a specific landscape is most readily expressed by designation, the special qualities of which are a material consideration. Ceredigion currently has the following designated areas:

- Dyfi Biosphere
- Scheduled Ancient Monuments (approximately 257)
- Special Historic Interest Landscape:
 - Upland Ceredigion
 - Lower Teifi Valley
 - Drefach-Felindre
 - Tywi Valley
- Historic Gardens of National Importance:
 - Hafod (Grade I)
 - Nanteos, Nanteos Mansion
 - Plas Penglais

- Aberystwyth and Llanbadarn Campuses
- National Library of Wales (Grade II*)
- Alltrodyn
- Coedmore Garden, Cilgerran
- Derry Ormond Garden, Betws Bledrws
- Llanerchaeron
- Llanllyr Gardens, Talsarn
- Lodge Park Gardens, Tre'r Ddol
- Pigeonsford Walled Garden, Llangrannog
- Trawsgoed Gardens, Trawsgoed
- Cardigan Castle (Grade II)
- Heritage Coast:
 - Borth - Clarach
 - Monks Cave - Llanrhystud
 - New Quay - Tresaith
 - Pen-peles - Gwbert
 - Marine Heritage Coast: New Quay and Tresaith one nautical mile seaward.
- 13 Special Landscape Areas (SLA):
 - SLA 1: Dyfi Estuary and Valley
 - SLA 2: Ceredigion Coast – Aberystwyth to Borth
 - SLA 3: Ceredigion Coast – Llanrhystud to Aberystwyth
 - SLA 4: Ceredigion Coast – New Quay to Llanrhystud

- SLA 5: Ceredigion Coast – Aberporth to New Quay
- SLA 6: Ceredigion Coast – Gwbert to Aberporth
- SLA 7: Teifi Valley
- SLA 8: Aeron Valley
- SLA 9: Wyre Valley
- SLA 10: Ystywth Valley
- SLA 11: Rhediol Valley
- SLA 12: Northern Uplands
- SLA 13: Southern Uplands

Ceredigion also has the following National Trust sites identified for their landscape properties:

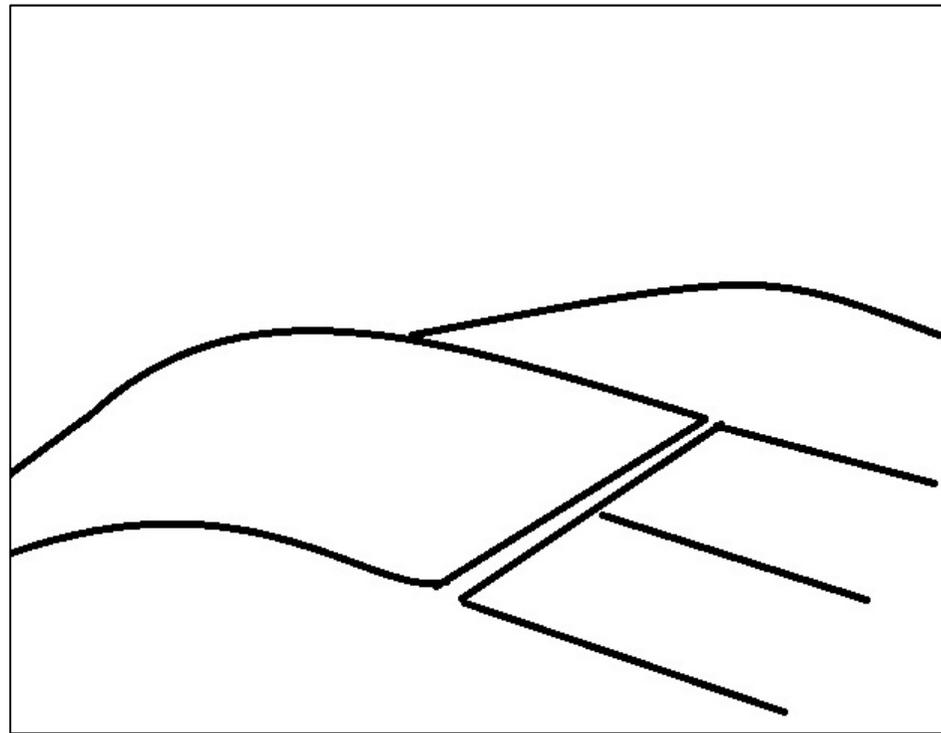
- Mwnt
- Penbryn
- Newquay - Cwm Tydu
- Bryn Bras
- Ynys Lochtyn
- Henllan
- Mynachd'yr Graig

It's important to note that where a specific landscape is identified by NRW's LANDMAP system as being of particular value but is not included within a designation, the LANDMAP information will itself be a material consideration in the determination of planning applications, as required under LDP Policy DM17.

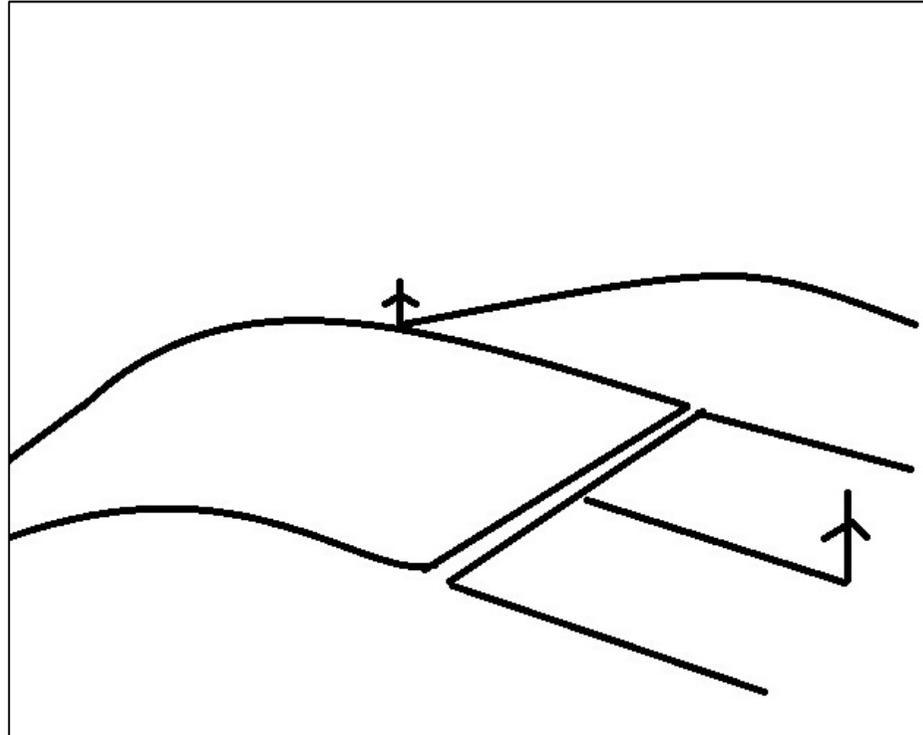
Turbine proposals will be assessed in relation to their scale and nature and their ability to be accommodated without significant damage to the special visual, historic, geological, ecological and cultural qualities of these landscapes. Where designations exist, effects on the special qualities that underlie the basis for the designation will require detailed consideration and will be taken as the basis for the assessment of the significance of impact.

The character of a landscape in the context of impacts of wind energy development can be articulated as:

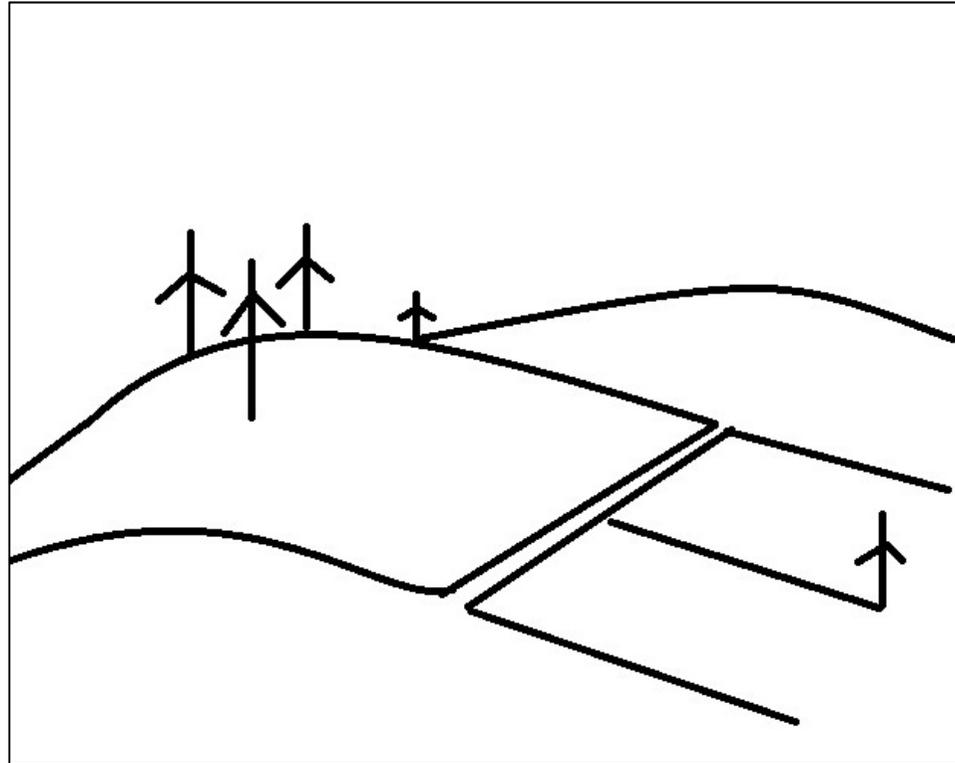
1. A wind turbine free landscape



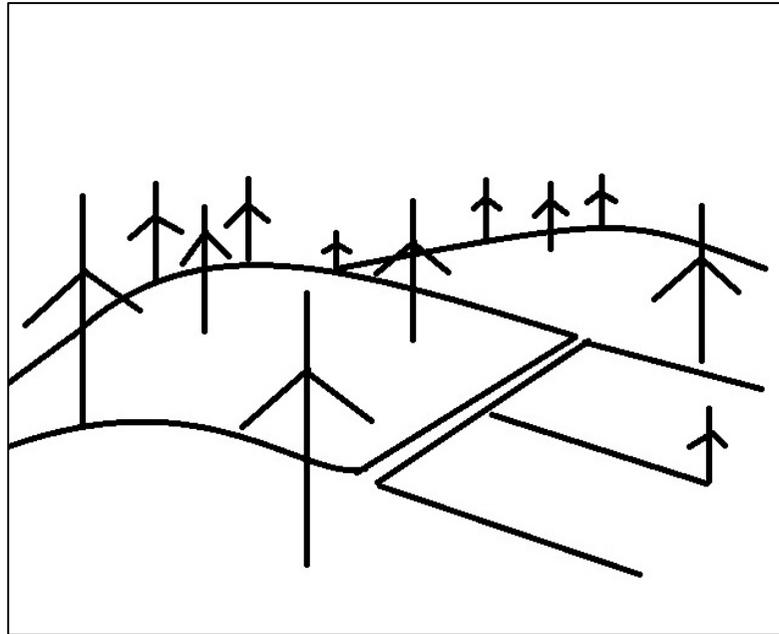
A landscape with occasional wind turbines



2. A wind turbine landscape



3. A windfarm landscape



These descriptions are useful in terms of attributing 'significance' to change in landscape character. Although the judgement as to whether a significant change has occurred or not is very dependent upon the scale of the development and where it is to occur, it is possible to determine a 'default' benchmark of significance in relation to designated sites and non-designated sites. Subsequent/final decisions relating to whether the impacts of a specific development are acceptable can then be considered on the basis of number (absolute or cumulative) of turbines, scale and design and whether the impacts can be mitigated for their context.

What may be deemed to constitute a 'significant change in landscape character' as well as the acceptability of the change, can take account of the fact that Ceredigion is a geographically large and diverse area, where individual or cumulative impacts may be limited in some areas though not in others.

12. Solar in the UK

Whilst you might not always think it the UK has a reasonable amount of solar radiation. Figure 2 shows total amount of solar irradiation i.e. sunlight that the UK had over the time period of 2001-2007. As can be seen the amount of sunlight received in the North of the UK is less than received in the south. In terms of Wales it received 950-1000 kilowatt hours (kWh) per meter².

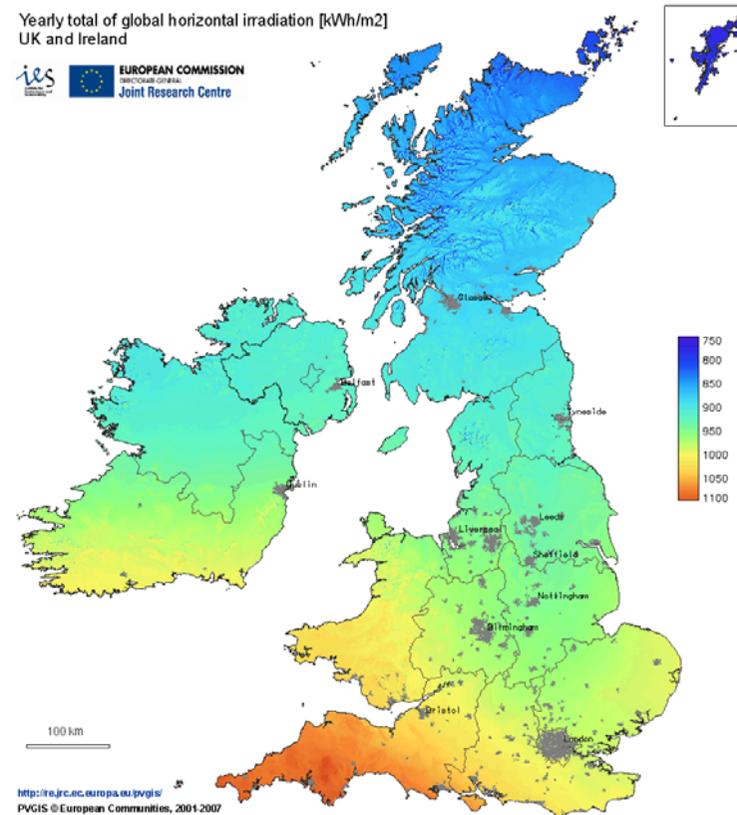


Figure 2: Yearly total of global horizontal irradiation in the UK and Ireland (2001-2007) (European Communities, 2007)

13. Types of Technology

Technologies for harnessing the sun's power fall into two main categories, solar thermal and photovoltaic.

14. Solar Thermal

A solar thermal system is a way of creating hot water from the sun. The technology is comprised of three main components:

- **Solar collectors** which collect the sun's rays so that when the light shines on the panel it heats up the water;
- **Hot water cylinder** to store the water that is heated up during the day and supplies it for use later; and
- **Plumbing system** piping to move the fluid around the system

There are two main types of solar thermal systems: Flat Plate or Vacuum Tube.

Flat Plate panels are a thin panel of metal that acts as an absorber positioned just below a sheet of glass. The metal panels absorb the sun's heat and this heat is then transferred to a liquid that is pumped through the system.

Vacuum Tubes are glass tubes where a vacuum is created within them except for thin strips of twisted metal which act as an absorber. The vacuum means conduction losses are reduced so heat transfer in evacuated tubes is very efficient.

Often photovoltaic and solar thermal technologies can be integrated into the building e.g. on the roof or standalone systems.

15. Photovoltaic

Put simply photovoltaic (PV) systems convert sunlight into electricity. These cells don't need direct sunlight to work; they can still generate some electricity on a cloudy day. These systems are comprised of two main components:

- **Solar collectors** collect the sun's rays so that when light shines on the cell it creates an electric field causing electricity to flow; and
- **Wiring:** This includes a converter to convert the direct current electricity from the panel to alternating current so it can be connected to the building's main electricity distribution board. An inverter is also required to convert DC to AC for connection via substation to the grid.

Most PV systems are made up of panels that fit on top of an existing roof, but you can also fit solar tiles. Free standing solar panels arranged in 'solar arrays' on agricultural or cleared brownfield sites would constitute a solar farm.

The advantage of a PV system is that it can fit on top of the roof you already have, whereas solar tiles are designed to be used in place of ordinary roof tiles.

A PV panel is likely to be cheaper than solar tiles as this is the technology that has been around the longest. However solar tiles are more aesthetically pleasing and you will save on the cost of normal roofing tiles.

16. Planning permission and solar scheme size.

Solar Thermal and Photovoltaic systems come in many sizes. This SPG applies the size designations used in Planning Policy Wales, Chapter 12 (produced by Welsh Government). These are broken down into the following categories:

- Micro generation;
- Sub Local Authority;
- Local Authority-wide; and
- Strategic.

17. Micro Generation

Micro generation is categorised as a scheme that is below 50kW. PV arrays and Solar Thermal on a domestic property e.g., a house, is generally up to 4kW peak capacity. This is due to single phase connection limits and electrical regulations.

Permitted Development Rights set out in the 'Town and Country Planning (General Permitted Development) (Amendment) (Wales) Order 2012' allow solar thermal and photovoltaic to be installed without the need for planning permission provided certain elements are met.

To see if a solar scheme needs planning permission you should refer to Planning Portal: <https://www.planningportal.gov.uk/permission/> to check and also refer to the Welsh Government advice on generating your own energy:

<http://new.wales.gov.uk/topics/planning/policy/guidanceandleaflets/generaterenewable/?lang=en>

In many cases you will be able to install PV and Solar Thermal without the need to gain planning consent. However different rules do apply if your building is within a **Conservation Area**, is a **Listed Building** or has **Permitted Development Rights** removed. If you wish to install PV or Solar Thermal on a building within the conservation area you will need to apply for planning permission. If you wish to install PV or solar thermal on a Listed Building you will need to apply to the Local Planning Authority for Listed Building Consent even if planning permission is not required. Cadw have published the document 'Renewable energy and your historic building: Installing Micro-Generation Systems: A Guide to Best Practice' this is available from the Cadw website: <http://cadw.wales.gov.uk> If your property has had its permitted development rights removed you will need to apply for planning permission to install solar thermal or PV.

18. Sub Local Authority, Local Authority-wide and Strategic Size Schemes

As a general guidance each MW of photovoltaic requires 2.5 to 3.0 hectares of land. Therefore anything from 50kw is unlikely to be suitable as an integrated system or as a standalone unit within a domestic curtilage.

Due to rising energy costs medium and large scale installations of PV arrays and solar thermal categorised as Sub Local Authority and Local Authority-wide, are becoming more common.

Scheme name	Generating Potential
Sub Local Authority	50kW and 5MW
Local Authority-wide	5MW to 50M
Strategic	50MW +

Sub-local and Local Authority Wide schemes will be decided by the Local Planning Authority i.e. Ceredigion County Council. However, a solar thermal or PV array that generates over 50MW is considered to be a Strategic scale renewable energy project. Permission for a project of this scale would be consented by the UK Government, advised by the National Infrastructure Directorate within the Planning Inspectorate.

19. Site Selection - Sub Local Authority, Local Authority-wide and Strategic level

When considering installing a scheme that is of Sub Local Authority, Local Authority-wide level and strategic size, a range of issues have to be considered. **For a scheme generating energy between 50kW and 50MW planning permission will always be required.**

The table below will help you address the issues that will need to be considered as part of any planning application. Whilst this table covers matters and issues that may need to be considered as part of your planning application it does not cover the technical aspect of what maps, drawings etc you will need to include. For technical advice you should refer to the Submission Guidance Note available here: www.ceredigion.gov.uk. However when submitting your application it is essential that the red line needs to include:

- siting of array
- access
- cabling etc.

These elements all need to be considered in relation to ecology and highways.

Table 2: Matters and Issues to consider when submitting a planning application related to solar thermal and photovoltaic
(this table lists the matters/issues alphabetically)

Row Number	Matter/Issue	What needs to be addressed	Guidance
Agricultural Use			
1	The PV array is proposed for an agricultural field	<p>The array should be designed so the field can still be used for agricultural purposes e.g. having sheep etc. in the field without harm to the livestock. This will also help keep the site from becoming overgrown.</p> <p>The British Research Establishment (BRE) have produced guidance on large scale PV arrays. Whilst this is based on English legislation much of the advice can be applied to Wales. Please note that it is important to make sure you check any relevant Welsh legislation to ensure there is not a difference.</p>	<p>BRE: Planning guidance for the development of large scale ground mounted solar PV systems: https://www.bre.co.uk/filelibrary/pdf/other_pdfs/KN5524_Planning_Guidance_reduced.pdf</p>
Comparison Study			
2	What other renewable energy technologies have been considered.	<p>Produce a report which explains what other renewable energy technologies e.g. wind, have been considered.</p> <p>The Welsh Government have produced information on the types of renewable energy are available and their planning implications.</p> <p>The Local Planning Authority has produced a help sheet that can be used</p>	<p>Welsh Government: http://wales.gov.uk/topics/planning/planningresearch/publishedresearch/planningimplications/?lang=en</p>

Row Number	Matter/Issue	What needs to be addressed	Guidance
		as a basis for undertaking the review into other renewable energy technologies.	Renewable Energy Technology Comparison Help Sheet : www.ceredigion.gov.uk
Decommissioning Statement			
3	What does the Decommissioning Statement need to cover	<p>This is a statement submitted along with the planning application which explains to the Local Authority how the PV array will be removed once it has reached the end of its life.</p> <p>It is considered that the decommissioning of a PV array should be straightforward, the statement should explain how:</p> <ul style="list-style-type: none"> • PV system is to be removed, including any foundations; • Security fencing/lighting is to be removed; and • Any ground remediation works to be undertaken and when. 	
Ecology			
4	Need to identify relevant ecological issues'	Field solar PV arrays can have an impact on ecology through the physical construction of the buried cabling, track ways, widening of access and road bends and associated structures. These works can result in loss of habitat, disturbance of species and killing/injuring of species through	Council Ecologist: ecology@ceredigion.gov.uk Guidance Note: Nature Conservation and Solar PV

Row Number	Matter/Issue	What needs to be addressed	Guidance
		<p>direct works or entrapment from diggings. The panels themselves can cause shading and therefore habitat may deteriorate over time and have been known to have impacts near water from species thinking they are water. The presence of panels may also reduce the ability of some species to use more richer habitats for foraging/breeding etc. Security fencing can also restrict use of the site and reduce habitat connectivity and lighting or night working may cause disturbance to species such as otters and bats.</p> <p>Integrated solar PV arrays (on buildings) potentially may impact roosting bats and breeding birds from blockages to or destruction of roosts or disturbance.</p> <p>Therefore, Preliminary Ecological Appraisal (PEA) and any other required ecological survey work (see Nature Conservation and Guidance note and Nature Conservation SPG) will be required to be submitted with all field solar PV array applications to determine the likelihood of any potential impacts on biodiversity. This must incorporate a desk study and field survey, carried out by a suitably qualified ecologist, and where appropriate, species surveys such as reptiles, badgers, bats, invertebrates and birds and an assessment of the likely impacts. The</p>	<p>Arrays:</p> <p>Natural England: Solar parks: maximising environmental benefits (TIN101):</p> <p>http://publications.naturalengland.org.uk/publication/32027</p>

Row Number	Matter/Issue	What needs to be addressed	Guidance
		<p>scope must include the site of the PV array and any works related to the development such as access, access improvements, cable laying etc. and the surrounding land (including watercourses). Potential cumulative impacts with other PV arrays in the locality should also be incorporated in the assessment. Applicants for integrated solar PV arrays should contact the LPA to determine whether a survey is required. For details on the requirements for the PEA, when more detailed surveys may be required and integrated solar PV, please see the help sheet 'Nature Conservation and Solar PV Arrays' available on the council website.</p>	
5	Array requires an Environmental Impact Assessment	<p>Depending on the size of the array and potential impacts you may also need to undertake an Environmental Impact Assessment (EIA).</p> <p>Solar PV arrays are not explicitly listed within Schedule 2 of the EIA Regulations 45 which require an EIA if the project is judged likely to give rise to significant environmental effects due to its size, nature and/or location. Whilst solar PV is not explicitly mentioned they may fall within sub-category (a) of 'Energy industry', i.e. 'industrial installations for the production of electricity, steam and hot water', for which Schedule 2 indicates that developments more than 0.5 ha in area may require EIA.</p>	<p>EIA: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/7676/155958.pdf</p>

Row Number	Matter/Issue	What needs to be addressed	Guidance
		<p>Given that proposals are likely to exceed this area threshold and that they are generally located in the open countryside it is recommended that proposers of solar PV arrays submit a request for a Screening Opinion to the Local Planning Authority under the EIA Regulations at an early stage.</p>	
Glare and Glint			
6	The PV array has the potential to cause glare/glint	<p>Whilst solar panels are designed to absorb light in some instances PV arrays can cause glare and glint.</p> <p>Glint is produced as a direct reflection of the sun on the surface of the PV solar panel. Glare is a continuous source of brightness not by reflecting the actual sun but the bright sky.</p> <p>However if glare is an issue it is possible to get PV systems designed with anti-glare properties. When assessing for glare/glint it is important to consider the combined reflective quality of not only the PV panels, but also the frames.</p> <p>Glare and glint can be an issue in regard to aviation. The Civil Aviation Authority CAA have produced interim guidance on PV, you should refer to this prior to submitting your application.</p> <p>It is recommended that measurements for and assessment related to</p>	<p>Civil Aviation Authority: Interim Guidance, Solar Photovoltaic: https://www.caa.co.uk/docs/697/srg_asd_solarphotovolt_aicsystguidance.pdf</p>

Row Number	Matter/Issue	What needs to be addressed	Guidance
		glare and glint is depicted in feet or flight levels (thousands of feet). It is also recommended that a straight line approach from the runway is not the only assessment method undertaken but also a circular/oblong assessment as this will reflect some of the circuits carried out by the aircrafts.	
Grid Connection			
7	How close does the PV array need to be to a grid connection.	<p>PV arrays need to be located close to a suitable grid connection. This means that proposals for such schemes are likely to cluster around grid connection points. You will need to speak with the appropriate Power Distribution Network operator to assess what upgrades will be required to the electrical grid network for the purpose of the array. Within Ceredigion there are two Power operators, Western Power and Scottish Power.</p> <p>As part of your application you should provide a broad indication of the route of connectivity to the electrical grid.</p> <p>Due to arrays needing to be near a grid connection point when siting a scheme it is important to consider not only the impact this development will have but also the potential cumulative effects with similar proposals and other forms of development.</p>	<p>Western Power Distribution: http://www.westernpower.co.uk</p> <p>Scottish Power: http://www.scottishpower.co.uk</p>

Row Number	Matter/Issue	What needs to be addressed	Guidance
Ground Anchoring			
8	Securing the array to the ground	The reversibility of the site back to its original use e.g., to an agricultural field from the PV array, should be ensured. The use of concrete filled foundations should therefore be avoided. Pile driven, screw foundations or concrete blocks (shoes) should be used where possible as these are capable of being more easily removed.	BRE: Planning guidance for the development of large scale ground mounted solar PV systems: https://www.bre.co.uk/filelibrary/pdf/other_pdfs/KN5524_Planning_Guidance_reduced.pdf
Landscape			
9	Solar array is visible from numerous points and can sometimes be seen from very far away.	Landscape is important, not just as scenery but because it links culture with nature, and the past with the present. Well-looked after and highly valued landscapes are essential to social well-being and economically healthy society. Landscapes are valued because of their inherent interest, their contribution to both national identity and local distinctiveness. The protection of high quality and highly valued landscapes, which Ceredigion is fortunate to possess, is therefore important both for its own sake and for the health and social and economic wellbeing of individuals	The Landscape Institute: http://www.landscapeinstitute.co.uk/ LANDMAP: http://www.ccw.gov.uk/landmap

Row Number	Matter/Issue	What needs to be addressed	Guidance
		<p>and communities. This means that proposed development must carefully consider its potential effects on the landscape in which it sits.</p> <p>Because solar arrays often need prominent locations to operate, they have the potential to be visible from numerous points and can sometimes be seen from great distances. Indeed, the landscape impact of an array is likely to be one of the most significant issues applicants will need to deal with. It should be noted that different landscapes possess different characteristics and what is considered acceptable in one place may not be acceptable in another. While it is logical that developers will wish to place a solar array on the most southerly sloping site, as this is where solar gain will be the greatest, careful consideration will need to be given to its positioning as this can greatly influence any potential effects on landscape character and visual amenity.</p> <p>Development of the array will also need to be considered in terms of its design, the layout and future maintenance. Whilst it's important to ensure that the array is not shaded it is important that existing hedge lines and trees are not removed and if they must be these losses will need to be mitigated.</p>	

Row Number	Matter/Issue	What needs to be addressed	Guidance
		As part of your application a Landscape Visual Impact Assessment (LVIA) must be undertaken, reference to LANDMAP should form part of this work. The Landscape Institute have produced the document 'Guidelines for Landscape and Visual Impact Assessment' you should refer to this when undertaking the LVIA.	
10	Array is within, adjacent to or can be seen from a Special Landscape Areas	<p>There are 13 Special Landscape Areas (SLAs) within Ceredigion, which cover a range of landscape types including coastal, valley and upland. The SLAs are subject to LDP Policy DM18, which requires that development within the SLAs be assessed in relation to the scale and nature of the development and its ability to be accommodated without significant damage to, and where possible enhancement of, the valued characteristics of the SLA.</p> <p>Detail relating to these characteristics are contained within Supplementary Planning Guidance: Special Landscape Areas. Specific reference to energy developments as a key management issue has been highlighted in relation to the following specific SLAs:</p> <ul style="list-style-type: none"> • SLA 2: Ceredigion Coast – Aberystwyth to Borth • SLA 3: Ceredigion Coast – Llanrhystud to Aberystwyth • SLA 4: Ceredigion Coast – New Quay to Llanrhystud 	<p>SPG Link:</p> <p>LDP Policy Link:</p>

Row Number	Matter/Issue	What needs to be addressed	Guidance
		<ul style="list-style-type: none"> • SLA 5: Ceredigion Coast – Aberporth to New Quay • SLA 6: Ceredigion Coast – Gwbert to Aberporth • SLA7: Teifi Valley • SLA 9: Wyre Valley • SLA 10: Ystywth Valley • SLA 11: Rhediol Valley • SLA 12: Northern Uplands • SLA 13: Southern Uplands <p>It is essential that the SLA SPG be consulted upon as part of putting together the planning application in order to identify the character elements that are at risk of unacceptable impact of development. The proposal will need to address any issues in terms of effect and possible mitigation.</p>	
11	The array is within or adjacent to a seascapes	<p>The quality of seascapes is particularly relevant given the length of the Ceredigion coastline, some 96km in extent from the Dyfi estuary in the north to the Teifi estuary in the south near Cardigan and that it includes a Heritage Coast Designation.</p> <p>Ceredigion lies within the Cardigan Bay national seascape unit and</p>	<p>Seascape Units website: http://www.ccg.gov.uk/landscape--wildlife/protecting-our-landscape/seascapes/seasc</p>

Row Number	Matter/Issue	What needs to be addressed	Guidance
		<p>includes the following regional units:</p> <ul style="list-style-type: none"> • 24: Pen Bwch Point to Upper Borth • 25: Dyfi Estuary • 26: Upper Borth to New Quay • 27: New Quay to Cardigan Island • 28: Teifi Estuary <p>If the array falls within a seascape reference to the Countryside Council for Wales' (now part of Natural Resources Wales) "Seascapes" report (2009) should occur. As part of the planning application it should be explained how the solar array will not have a detrimental effect to the area and what mitigation methods are required.</p>	<p>ape-assessment-of-wales.aspx</p>
12	The array is located within an historic environment.	<p>Within the County there are:</p> <ul style="list-style-type: none"> • 13 Conservation Areas: <ul style="list-style-type: none"> ○ Aberaeron ○ Aberystwyth ○ Adpar ○ Cardigan ○ Cenarth 	<p>Ceredigion LDP Constraints interactive mapping: http://www.ceredigion.gov.uk</p>

Row Number	Matter/Issue	What needs to be addressed	Guidance
		<ul style="list-style-type: none"> ○ Lampeter ○ Llanbadarn Fawr ○ Llanddewi Brefi ○ Llandysul ○ Llanrhystud ○ Llansantffraed ○ New Quay ○ Tregaron <ul style="list-style-type: none"> ● 4 Landscapes of Special Historic Interest ● 12 Historic Gardens of National Importance. <p>If the array is within any of these areas information will need to be supplied as part of the planning application identifying any impact the scheme would have on a designated area and any proposed mitigation methods.</p>	
13	What does the Landscape and Visual Impact Assessment (LVIA)	<p>The amount of detail within a LVIA will relate to the size of the array.</p> <p>It is recommended that an appropriately qualified Landscape Architect is appointed to undertake a LVIA. The LVIA should be undertaken in accordance with the Landscape Institute Guidelines.</p>	<p>The Landscape Institute: http://www.landscapeinstitute.co.uk/</p>

Row Number	Matter/Issue	What needs to be addressed	Guidance
14	need to do	<p>The Zone of Theoretical Visibility (ZTV) represents the area over which a development can theoretically be seen. A ZTV indicates areas from where a solar array may be seen within the study area, they cannot show how it will look, nor indicate the nature or magnitude of the visual impacts. For a ZTV to be clear it should:</p> <ul style="list-style-type: none"> • Be superimposed on a clearly legible base map at a recognised scale e.g. Ordnance Survey (OS) 1:50,000; • Array position should be clearly marked • Viewpoint locations should be numbered and shown on the ZTV – label these carefully to avoid obscuring vital ZTV information. • Have concentric rings to indicate the different distances from the proposed developments e.g. 10, 20, 30km. It is recommended that these rings not be coloured/shaded as this may imply a direct relationship between the distance and relative visibility or visual impact that would be misleading. <p>As part of your ZTV you should supply information on:</p> <ul style="list-style-type: none"> • Software used; • Digital Terrain Model used; • Observer Eye level used (in metres); 	

Row Number	Matter/Issue	What needs to be addressed	Guidance
		<ul style="list-style-type: none"> • Resolution of ZTV used (in metres); and • Line of site check frequency used (in metres). <p>Maximum distance considered used (in metres / kilometres).</p> <p>Within your ZTV you should consider main receptors based on the following:</p> <ul style="list-style-type: none"> • Trunk roads i.e. A44, A487 • Principle roads i.e. A475, A485, A486, A484, A482, A4120, A4159; • Settlements named within the Ceredigion and adjacent Counties Local Development Plan's; • Public Rights of Way; • Within/out of/into any designated areas (see section 3.1 in this SPG document). 	
15		<p>As part of your LVIA visualisations such as wire drawings and photomontages should be submitted.</p> <p>Whist these images are never 'true to live' they can help illustrate the landscape and how a solar array may or may not fit in within it.</p> <p>As it is not possible to include photographs of every part of every different</p>	

Row Number	Matter/Issue	What needs to be addressed	Guidance
		<p>landscape photographs and wire drawings should be selected to illustrate a representative range of the character of the landscape.</p> <p>The size of a photograph required to represent a view will vary for different projects and different views.</p> <p>It is recommended that a panorama is taken from each viewpoint that includes the entire width of open view. This may be a 360° for some viewpoints.</p> <p>Where there is a high vertical dimension to the view e.g. mountain, hilly area it is advisable to prepare a panorama comprising of vertical 'portrait' frames.</p> <p>When using photographs/photomontages you should provide information on:</p> <ul style="list-style-type: none"> • The camera used to take the photograph; • The focal length; • Time of day; and • Weather conditions. <p>For wire models you should provide information:</p>	

Row Number	Matter/Issue	What needs to be addressed	Guidance
		<ul style="list-style-type: none"> • Software used; • Digital Terrain Model used; • Observer Eye level used (in metres); • Resolution of ZTV used (in metres); and • Line of site check frequency used (in metres). 	
16	How should the application reference LANDMAP	<p>As part of the LVIA applicants will need to make reference to the LANDMAP system of landscape evaluation. LANDMAP assesses the landscape against 5 layers:</p> <ul style="list-style-type: none"> • Cultural Landscape; • Geological Landscape; • Historic Landscape; • Landscape Habitat; and • Visual and Sensory. <p>Within the LVIA it is important to explain how the scheme will affect each of the landscape types. This will need to include the establishment of the landscape's value and an assessment of the sensitivity of the landscape and its susceptibility to change. Consideration should also be given to size, scale and geographical extent of the proposal.</p>	<p>LANDMAP: http://www.ccw.gov.uk/landmap</p>

Row Number	Matter/Issue	What needs to be addressed	Guidance
Land Levelling			
17	Can I put a PV array on a sloping site?	Ideally a site should be chosen that does not require any levelling. Any land levelling required should be discussed prior to an application being submitted.	BRE: Planning guidance for the development of large scale ground mounted solar PV systems: https://www.bre.co.uk/filelibrary/pdf/other_pdfs/KN5524_Planning_Guidance_reduced.pdf
Public Rights of Way			
18	The site is located by or near to a Public Right of Way (PROW)	<p>During construction and on-going maintenance, protection of PROWs should be considered.</p> <p>It is an offence to obstruct a pavement (footway) and the fact that planning permission has been granted, or is not required, does not entitle a developer to obstruct, interfere or move a Public Right of Way. You should contact the Council's Coast and Countryside Services for information on PROWs.</p> <p>If the array will be placed over the existing PROW the diversion of the</p>	Coast and Countryside: www.ceredigion.gov.uk

Row Number	Matter/Issue	What needs to be addressed	Guidance
		path will need to be part of the planning application. It may also be useful to include an interpretation board explaining the system.	
Security			
19	Security features are required	Security fencing/lighting may be required on certain sites, if so applicants should seek to: <ul style="list-style-type: none"> • minimise security lighting and where it has to be used utilise a passive infra-red technology which minimises glare and light pollution; • minimise the height of fencing; and • use natural features/vegetation where possible to make a barrier. 	
Shade			
20	Future shading will cause an issue.	The array should be protected from shade for life. Ensure that trees and vegetation will not in the future cause shading issues.	
Soil Stripping			
21	Soil needs to be removed as part of the development.	Soil stripping may be required in terms of temporary access roads, cable trenches etc. Where this occurs the topsoil and subsoil should be stripped, stored and then used for restoration.	

Row Number	Matter/Issue	What needs to be addressed	Guidance
Trackers			
22	How can the PV array maximise the amount of sun?	<p>Trackers are motors which move the array to follow the daily movement of the sun. These ‘trackers’ are expensive to install and require maintenance and therefore many arrays are static i.e. they don’t move.</p> <p>A happy medium is often employed where the array is moved on a seasonal basis (once every quarter) reflecting season changes in the height of the mid-day sun.</p> <p>The potential impacts of the installation in all phases of orientation should be addressed as part of the planning application.</p>	

20. Submitting a Planning Application

For full guidance on what needs to be submitted as part of a planning application e.g. location plans etc., refer to the Submission Guidance Note available here: www.ceredigion.gov.uk. As part of your application for a solar, specific information is required within your planning application, these are:

- Comparison Energy Study (row 2)
- Decommissioning Statement (row 3)
- Colour of the panel’s surrounding frames
- Energy Output Statement

- Gradient of the site and the surrounding landform
- Height and layout of the panels
- Landscape Visual Impact Assessments with reference to LANDMAP (row 9-16)
- Perimeter fencing
- Preliminary Ecological Appraisal and any other surveys (row 4-5)
- Treatment of the ground below and between the panels, for example to grow crops, graze livestock, or to lay down mulch to reduce maintenance

21. Useful Contacts

BRE: Planning guidance for the development of large scale ground mounted solar PV systems:

https://www.bre.co.uk/filelibrary/pdf/other_pdfs/KN5524_Planning_Guidance_reduced.pdf

Aviation Safeguarding Toolkit: <https://restats.decc.gov.uk/cms/aviation-safeguarding-maps>

Dyfed Archeology: <http://www.dyfedarchaeology.org.uk>

Energy Savings Trust: <http://www.energysavingtrust.org.uk/>

Landscape Institute: <http://www.landscapeinstitute.co.uk/>

Microgeneration Certification Scheme (MCS): www.microgenerationcertification.org

Natural Resources Wales: <http://naturalresourceswales.gov.uk/>

Planning Portal: www.planningportal.gov.uk

Renewable UK: <http://www.renewableuk.com/en/our-work/aviation-and-radar>

Scottish Natural Heritage: <http://www.snh.gov.uk/docs/A675503.pdf>

Seascape Project: <http://www.ccg.gov.uk/landscape--wildlife/protecting-our-landscape/seascapes/seascape-assessment-of-wales.aspx>

Virtual Met Mast: <http://www.metoffice.gov.uk/renewables/vmm>

22. Hydro in the Ceredigion

Hydroelectricity is power generated by running water, whether it is a small stream or a large river. Harnessing the power of water represents one of the oldest renewable energies in the history of mankind. Within Ceredigion, many farms traditionally operated with the aid of water power.

Ceredigion's Rheidol Power Station has been generating renewable energy since 1962. The hydropower annual energy production from this station is about 85 Giga Watt Hours (GWh) – enough to power approximately 12,350 homes (Statkraft, 2013).

Within Ceredigion the cumulative length of all watercourses is 4329.63 km. The Irish Sea also borders the County. Whilst there is a lot of water available in Ceredigion not all of it is viable for hydropower.

23. How Hydro Works

Simplistically hydroelectricity is the potential energy of water flowing downhill converted into kinetic energy in a turbine, which drives a generator to produce electricity. The greater the height and the more water flowing through the turbine, the more electricity can be generated.

23.1. Types of Hydro Schemes

Small scale hydro power, often called micro hydro, is a system that converts the energy of flowing water into electricity. Usually a system of this size would have an output of 100kW or less.

Micro hydro systems do differ from larger scale systems in that they utilise much lower quantities of flowing water during operation. This means that they produce less electricity as a consequence.

Pumped storage

This is a large system which requires two storage areas e.g. lakes, one higher than the other. The principle of this system is to produce electricity when there is a high demand by customers (this is called peak time). At night because many business are closed and people are sleeping there is less demand for electricity (off peak). At this time water will be pumped from the lower lake to the higher lake. This takes advantage of cheaper electricity.

During the day the water in the higher lake is released in a controlled method to turn turbines and thus generate electricity. An example of this system in operation can be seen at Dol Wen, Blaenau Ffestiniog, North Wales.

Storage

This is where water is stored in a reservoir or lake and is released to drive turbines when electricity is required.

Run of River

This scheme does not rely on water being stored but diverts some water from a stream/ river and directs it through a turbine and then back into the stream/river.

23.2. Head and Flow Rate

The head and flow rate of a stream/river defines the type of turbine required for a hydro scheme.

The **Head** is the vertical distance between the water flowing from a high point to a lower point via a turbine. **Flow** is how much water comes down the stream/river, this turns the turbine. Hydro turbines are defined as:

- Low Headed;
- Medium Headed; or
- High Headed

23.3. Inside a Hydropower Plant

Big and small hydropower plants all generally have the same components. These are:

- **Intake (Water):** often part of a weir the intake diverts the flow of water from a water course towards a forebay tank and penstock. The intake would usually contain some sort of fish/debris filter.
- **Forebay Tank:** this is an optional element which provides a small reservoir to buffer the flow through the turbine during extremes in stream flow rate. This is suited to larger hydro schemes.
- **Penstock:** what connects the water to the turbine. Transfers and delivers the water from the intake/forebay tank to the turbine unit located in the Power House.
- **Power House:** where the turbines, generator and any other equipment is housed.
- **Tailrace:** also called the outflow, the channel which returns the water back to the watercourse once it has given up its energy to the turbine and exited the power house.
- **Transmission Line/Grid Connection:** the connection, either overhead or underground, between the Power House (generator) and the electrical network (i.e. the National Grid).

Figure 3 below shows a diagram of a hydro scheme with the components marked on.

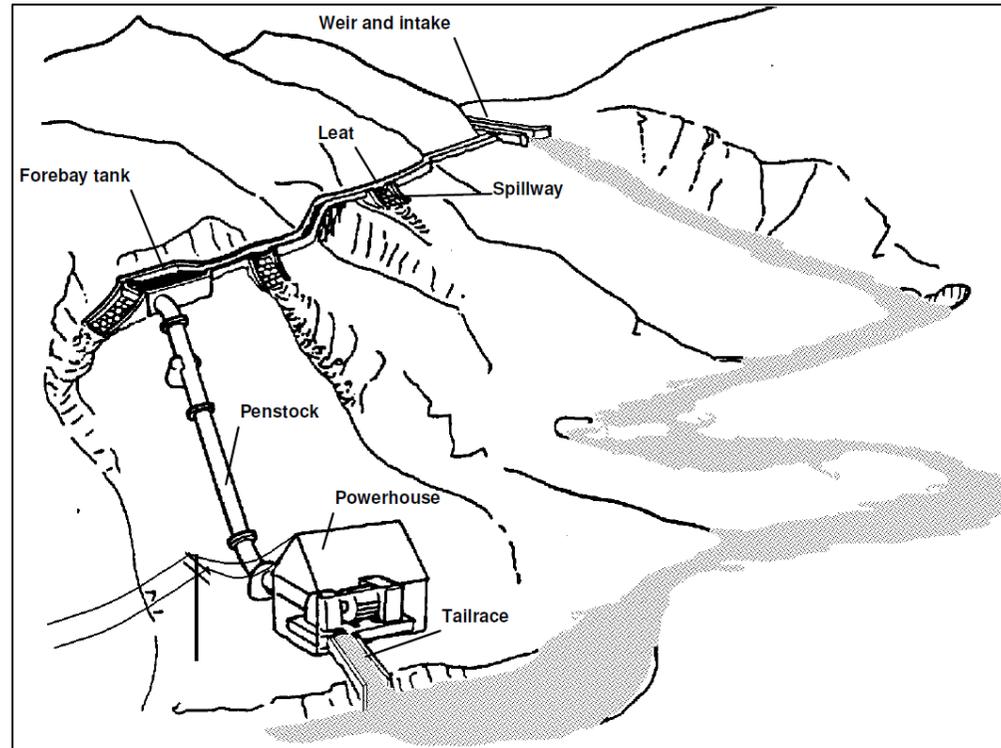


Figure 3: Hydro Components (British Hydropower Association, 2012)

24. How much energy can it produce?

The energy available in flowing water depends on the volume of water flowing per second and the height (head) that water falls.

The potential power to be obtained from flowing water can be calculated as follows:

$$P = H \times Q \times g \times e$$

- P = Power (kW)
- H = Head Height (meters)
- Q = flow rate (cubic meters per second)
- g = gravitational constant (9.81 meters per second)
- e = efficiency (0.5 – 0.85 i.e. 50% - 80%).

For example a hypothetical system with a flow rate of 50 litres per second with a head of 7 meters, passing through a hydro system with an overall efficiency of 50% would be worked out as follows:

$$P = 7 \times 50 \times 9.81 \times 0.5 = 1.717kW$$

The efficiency of an individual hydro scheme will depend on a combination of factors including, amongst other things:

- Type, size and quality of turbine – manufacturers should state the hydraulic efficiency of their turbine. For schemes smaller than 50kW this will probably be around 70-80%.
- Size and length of penstock (pipes leading to the turbine) – larger pipes exhibit lower frictional losses than narrow pipes.
- Efficiency of any other mechanical power transmission, e.g. shafts, bearings, gearing. Efficiencies of perhaps 90-95% will be achieved.

- Efficiency of any electrical power conversion and transmission, e.g. generator, power converters, control equipment, length and types of cables, etc. again, 90-95% can be achieved.

The British Hydropower Association have produced a guidance note on the installation of Hydropower, it can be downloaded via the following link: http://www.british-hydro.org/Useful%20Information/mini_hydro_guide

25. Site Selection

Hydropower is very site specific and it is likely that most homes will not have access to a suitable resource even if they have a watercourse running nearby.

If you do have a watercourse, assessing it for potential hydropower is a task that has to be undertaken by a professional. You can find details of hydropower companies via the British Hydropower Association (<http://www.british-hydro.org>).

In simplistic terms, to be suitable for electricity generation, a river needs to have a combination of:

- Flow: how much water is flowing down the river per second; and
- Head: the distance between the high point and the low point.

This means you could have either lots of flow and not much head (such as a river flowing over a weir) or lots of head and not much flow (such as a mountain stream).

You will also need to consider what happens to the watercourse during the summer as this is usually the deciding factor. If the watercourse often runs low then it is unlikely that hydropower will be suitable.

Also you may want to consider a hydropower scheme as a community energy project rather than as a system to supply just one home. This can help keep the costs down and may also enable you to draw down other funding.

More information on hydropower can be accessed via the Energy Savings Trust website available: <http://www.energysavingtrust.org.uk/Generating-energy/Choosing-a-renewable-technology/Hydroelectricity>.

26. Planning Permission

Planning permission is required for all hydro schemes. Any scheme that generates over 50MW is considered to be a Strategic scale renewable energy project. Permission for a project of this scale would be consented by the UK Government advised by the National Infrastructure Directorate within the Planning Inspectorate.

Any development within, over, under or adjacent to a watercourse requires consent to ensure works do not increase flood risk, damage flood defences, or harm the environment, fisheries, or wildlife.

Abstraction Licences will need to be obtained from NRW as a hydro scheme will be removing water. It is essential that you consult with NRW before submitting a planning application in order to ascertain whether an abstraction licence would be granted, what issues may need addressing e.g. fisher advice, water flows etc. You should clarify this information prior to submitting a planning application.

Any works proposed in, under, over or on a watercourse that are likely to affect the flow within a watercourse may require Ordinary Watercourse Consent and /or Land Drainage Consent from the LA (Head of Assets and Transportation Services – Flooding and Coastal) in accordance with the Land Drainage Act 1991.

Any proposal should be discussed with the LA before commencement in order to determine whether the proposal will require an Ordinary Watercourse Consent and/or Land Drainage Consent. This will also ensure that the proposed work is assessed to ensure that they do not exacerbate an existing flooding problem, and do not adversely affect the local environment, fisheries and wildlife.

The primary responsibility for keeping watercourses clear of any obstruction (either temporary or permanent), which would impede the normal flow of water, either on their land or downstream rests with the landowner. Any works should be carried out in a manner that will not cause pollution, diversion affecting the rights of others or which would prevent the free passage of fish.

27. Issues to consider

No matter what size the hydropower scheme is to be there are common elements that need to be considered. Table 1 below sets out matters and issues that will need to be considered as part of any planning application.

Whilst this table covers matters and issues that may need to be considered as part of you planning application it does not cover the technical aspect of what maps, drawings etc. you will need to include. For technical advice you should refer to the Submission Guidance Note available here: www.ceredigion.gov.uk .However when submitting your application it is essential that the red line needs to include:

- siting of hydro power technology
- access
- cabling etc.

These elements all need to be considered in relation to ecology and highways.

Table 3: Matters and Issues to consider when submitting a planning application relating to hydro power

(this table lists the matters/issues alphabetically)

Row Number	Matter/Issue	What Needs to be Addressed	Guidance
Comparison Study			
1	What other renewable energy technologies have been considered.	<p>Produce a report which explains what other renewable energy technologies e.g. solar, have been considered.</p> <p>The Welsh Government have produced information on the types of renewable energy are available and their planning implications.</p> <p>The Local Planning Authority has produced a help sheet that can be used as a basis for undertaking the review into other renewable energy technologies.</p>	<p>Welsh Government: http://wales.gov.uk/topics/planning/planningresearch/publishedresearch/planningimplications/?lang=en</p> <p>Renewable Energy Technology Comparison Help Sheet : www.ceredigion.gov.uk</p>
Decommissioning Statement			
2	What does the Decommissioning Statement need to cover	<p>This is a statement submitted along with the planning application which explains to the Local Authority how the wind turbine will be removed once it has reached the end of its life. It is considered that the statement should explain how:</p> <ul style="list-style-type: none"> • The turbines are to be removed from the watercourse 	

		<ul style="list-style-type: none"> • Any physical structures to be removed e.g. the power house • Any ground remediation works to be undertaken and when 	
Design			
3	Appearance of external buildings	<p>Where a hydro scheme is proposed in the open landscapes the build elements, e.g. Power House, should be kept to a minimum and should be of a high quality design.</p> <p>These buildings should be designed to blend into the landscape. If buildings exist on site already it may be possible to renovate and adapt these buildings to fulfil the new need. This is often possible on former mill sites etc. A way of helping a new building blend into the landscape is by having a green roof. There could also be merit if a hydro scheme is within an agricultural setting in making any associated buildings look agriculture-related.</p>	Ceredigion County Council's Built Environment SPG:
Ecology			
4	Need to identify relevant ecological issues	<p>Micro-hydro schemes can have an impact on ecology through the physical construction of the intake structure, pipework, tailrace, turbine house, buried cabling, track ways and widening of access and road bends. These works can result in loss of habitat, disturbance of species and killing/injuring of species through direct works or entrapment from diggings. The abstraction of water to generate the</p>	<p>NRW: Hydropower: http://naturalresourceswales.gov.uk/apply-buy-report/apply-buy-grid/water/abstractions-impoundment/hydropower-</p>

		<p>turbine may have an impact through reduced flow through a particular section resulting in impacts on fish species and other ecological aspects of the river/stream and may also affect the micro-climate of a site (impacting rare lichens etc.). The physical structure of the intake may result in entrapment of fish and may provide a barrier to migration. Any lighting or night working may cause disturbance to species such as otters and bats.</p> <p>Therefore, a Preliminary Ecological Appraisal (PEA) and any other required ecological survey work (see Nature Conservation and Guidance note and Nature Conservation SPG) will need to be submitted with all micro-hydro applications to determine the likelihood of any potential impacts on biodiversity. This must incorporate a desk study and field survey including an ecological assessment of the stream/river, carried out by a suitably qualified ecologist, and where appropriate, species surveys such as otters, reptiles, badgers, bats, invertebrates and birds and an assessment of the likely impacts. The scope must include the site of the hydro scheme location and any works related to the development such as access, access improvements, cable laying, turbine house, pipework, tailraces etc. and the surrounding land. Potential cumulative impacts with other hydro schemes in the locality should also be incorporated in the</p>	<p>scheme/?lang=en</p> <p>Nature Conservation SPG: Nature Conservation and Micro-hydro Helpsheet:</p>
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		assessment. For details on the requirements for the PEA and when more detailed surveys may be required, please see the help sheet 'Nature Conservation and Micro-hydro' available on the council website.	
5	Hydro scheme requires an Environmental Impact Assessment (EIA)	<p>Installations for hydroelectric energy production are listed under Schedule 2.3(h) of the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999.</p> <p>Local Planning Authorities are required to screen applications for the need for EIA where the development involves a generating capacity of over 500Kw (0.5MW). Development proposed within sensitive areas, as defined in Regulation 2(1), must all be screened as the thresholds do not apply.</p>	<p>EIA:</p> <p>https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/7676/155958.pdf</p>
Fishing Rights			
6	Hydro scheme will affect fishing rights.	<p>One of the main concerns raised regarding the proposed introduction of a hydropower facility relates to the potential impact on fisheries interests.</p> <p>Fishing in Wales is subject to national and regional byelaws in order to protect the future of our fish stocks and fisheries in Wales.</p> <p>You should check to see whether there are any fishing rights on the stream/river you wish to utilise for hydropower.</p>	<p>NRW, Fishing:</p> <p>http://naturalresourceswales.gov.uk/out-and-about/enjoy-the-outdoors-go-fishing/?lang=en</p>

Flooding			
7	Is flooding likely to be an issue?	<p>The hydrological impact of a hydropower scheme is predominantly a matter to be considered by Natural Resources Wales (NRW).</p> <p>Changing the flow of a stream/river has the potential to cause flooding, especially during extreme weather events.</p> <p>Information will need to be submitted as part of a planning application as to the likelihood of any flooding and any proposed mitigation methods.</p> <p>A flood Consequence Assessment (FCA) may need to be supplied as part of the planning application. An FCA will be required if the hydro scheme requires damming.</p>	<p>NRW: Hydropower: http://naturalresourceswales.gov.uk/apply-buy-report/apply-buy-grid/water/abstractions-impoundment/hydropower-scheme/?lang=en</p>
Landscape			
8	The impact on the character of the landscape and changes in the visual appearance of waterfalls.	<p>Small scale hydroelectric schemes which are carefully sited and designed can have a minimum visual impact on their surrounding landscape but this requires detailed consideration at the conceptual design stages. Key landscape and visual impacts that may occur include:</p> <ul style="list-style-type: none"> • Landscape impacts – for example the impact of dams, weirs, leats, turbine houses and associated power lines on the 	<p>Welsh Government: Generating your own energy; Hydropower: http://wales.gov.uk/docs/desh/publications/111121energy2den.pdf</p> <p>Ceredigion County</p>

		<p>character of the landscape.</p> <ul style="list-style-type: none"> • Visual impact – for example the visual appearance of dams, weirs, leats, turbine houses and associated power lines and changes in the visual appearance of waterfalls affected by water abstraction. <p>Ensure that the scheme incorporates screen planting and built elements to be as small as possible and in keeping with local landscape features.</p>	<p>Council’s Nature Conservation SPG:</p>
<p>9</p>	<p>Hydro scheme is within, adjacent to or can be seen from a Special Landscape Area</p>	<p>There are 13 Special Landscape Areas (SLAs) within Ceredigion, which cover a range of landscape types including coastal, valley and upland. The SLAs are subject to policy DM18, which requires that development within the SLAs be assessed in relation to the scale and nature of the development and its ability to be accommodated without significant damage to, and where possible enhancement of, the valued characteristics of the SLA. Detail relating to these characteristics are contained within Supplementary Planning Guidance: Special Landscape Areas.</p> <p>It is essential that the SLA SPG be consulted upon as part of the application process in order to identify the character elements that are at risk of unacceptable impact of development. The proposal will need to address any issues in terms of effect and possible mitigation.</p>	<p>Ceredigion County Council’s Special Landscape Areas SPG:</p>

10	The hydro scheme is within or adjacent to a seascape	<p>The quality of seascape is particularly relevant given the length of the Ceredigion coastline, some 96km in extent from the Dyfi estuary in the north to the Teifi estuary in the south near Cardigan and that it includes a Heritage Coast Designation.</p> <p>Ceredigion lies within the Cardigan Bay national seascape unit and includes the following regional units:</p> <ul style="list-style-type: none"> • 24: Pen Bwch Point to Upper Borth • 25: Dyfi Estuary • 26: Upper Borth to New Quay • 27: New Quay to Cardigan Island • 28: Teifi Estuary <p>If the array falls within a seascape, reference to the Countryside Council for Wales' (now part of Natural Resources Wales) "Seascapes" report (2009) should occur. As part of the planning application it should be explained how the hydro scheme will not have a detrimental effect on the area and what mitigation methods are required.</p>	<p>Seascape Units website: http://www.ccg.gov.uk/landscape--wildlife/protecting-our-landscape/seascapes/seascape-assessment-of-wales.aspx</p>
11	The hydro scheme is located within an historic environment.	<p>Within the County there are:</p> <ul style="list-style-type: none"> • 13 Conservation Areas: <ul style="list-style-type: none"> ○ Aberaeron 	

		<ul style="list-style-type: none"> ○ Aberystwyth ○ Adpar ○ Cardigan ○ Cenarth ○ Lampeter ○ Llanbadarn Fawr ○ Llanddewi Brefi ○ Llandysul ○ Llanrhystud ○ Llansantffraed ○ New Quay ○ Tregaron <ul style="list-style-type: none"> ● 4 Landscapes of Special Historic Interest ● 12 Historic Gardens of National Importance <p>If the hydro scheme is within any of these areas information will need to be supplied as part of the planning application identifying any impact the scheme would have on a designated area and any proposed mitigation methods.</p>	
12	How should the application reference	When considering landscape effects, applicants will need to make reference to the LANDMAP system of landscape evaluation.	LANDMAP: http://www.ccw.gov.uk/land

	<p>LANDMAP</p>	<p>LANDMAP assesses the landscape against 5 layers:</p> <ul style="list-style-type: none"> • Cultural Landscape • Geological Landscape • Historic Landscape • Landscape Habitat • Visual and Sensory <p>Within this work it is important to explain how the scheme will affect each of the landscape types. This will need to include the establishment of the landscape's value and an assessment of the sensitivity of the landscape and its susceptibility to change. Consideration should also be given to size, scale and geographical extent of the proposal.</p>	<p>map</p>
<p>Noise</p>			
<p>13</p>	<p>Will the turbine produce noise?</p>	<p>Generally the turbine associated with a hydropower facility will normally be accommodated within the power house. This housing should be designed to generally limit noise levels.</p>	

28. Submitting a Planning Application

For full guidance on what needs to be submitted as part of a planning application e.g. location plans etc, refer to the Submission Guidance Note available here: www.ceredigion.gov.uk. As part of your application for a wind turbine scheme, specific information is required within your planning application, these are:

- Comparison Energy Study
- Decommissioning Statement
- Energy Output Statement
- Landscape Visual Impact Assessments with reference to LANDMAP
- Licences/consents
- Preliminary Ecological Appraisal and any other surveys

29. Useful Contacts

British Hydropower Association: <http://www.british-hydro.org>

Energy Savings Trust: <http://www.energysavingtrust.org.uk/>

Natural Resources Wales: <http://naturalresourceswales.gov.uk>