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Designing for Renewable Energy in Wales

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Consultation Draft

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Foreword

The purpose of this document is to set out the key design objectives and considerations for the sensitive development of large-scale onshore wind and solar farms as well as ancillary development in Wales. This document updates and expands on the previous *Designing Wind Farms in Wales 2014* good practice guidance, published by the Design Commission for Wales.

The context for this guidance document includes the ambitious targets set by Welsh Government for increasing the amount of energy generated by renewable sources. In 2017 the Welsh Government set renewable energy targets reflecting its commitment to a more sustainable future for Wales, with even more ambitious targets being proposed¹.

In 2021 renewable sources in Wales generated the equivalent of 55% of electricity use against the target of 70% by 2030 and Wales has achieved almost 90% of its target of at least 1 GW of renewable energy capacity to be locally owned by 2030, representing an estimated 1.9 GWh of generation in 2021. While renewables-based electrical capacity is increasing year-on-year, the current rate of growth will not be sufficient to meet our demand, especially future electricity needs and targets are therefore subject to regular review.

The Welsh Government must also respond to statutory duties placed upon it to reduce greenhouse gas emissions. The Environment (Wales) Act 2016 <https://www.gov.wales/environment-wales-act-2016-factsheets> requires the Welsh Government to reduce emissions of greenhouse gases in Wales to net zero by the year 2050, and establishes a framework of interim emissions targets and carbon budgets. Decarbonising our energy system assists emissions reduction across a range of sectors and is fundamental to meeting net zero and achieving a secure, affordable energy supply, a considerable part of which must come from renewable sources from wind and solar.

The Welsh Government clearly sets out in *Future Wales: The National Plan 2040* that, where development proposals for renewable energy generation from wind or solar technologies and equipment come forward, they *must* respond well to their context and contribute to meeting Welsh Government ambitions for low carbon energy generation. This guidance expands on this requirement.

¹ [Review of Wales' renewable energy targets | GOV.WALES](#)

For the purposes of this guide, 'large-scale' is not defined precisely and scale can be contextual, however it is anticipated that the primary focus of this guide is wind and solar installations that are ground mounted and largely independent of other built development. This guide promotes a holistic consideration of power generation infrastructure (i.e. wind turbines and solar panels) *and* associated infrastructure to ensure schemes are considered in their entirety. The focus of the guidance is on the source of power generation rather than the associated grid transmission, distribution or, where applicable, storage infrastructure, associated with large-scale renewable generation. Nevertheless, renewable energy installations should be planned and designed positively and with conviction and many of the principles set out in this guide in respect of the requirement for well thought through and clearly articulated design vision, rationale and approach which responds to the site and wider area context, apply to broader aspects such as overhead lines and other transmission infrastructure.

This publication *is not* a policy document. The document provides guidance *relating to policy*, as set out in the Welsh Government's **Planning Policy Wales** [Planning policy Wales | GOV.WALES](#) and **Future Wales: the National Plan 2040** <https://gov.wales/future-wales-national-plan-2040>. The guide supports **Policies 17 and 18 of Future Wales** (pp 94-99), by providing guidance that:

- Welsh Ministers, Planning and Environment Decisions Wales (PEDW) and Local Authorities can use in their role reviewing, influencing and determining wind and solar development;
- developers (both private and community led) can use early in the process to identify and address potential issues;
- stakeholders, consultees and community enterprises can draw from; and
- those coming to the planning process for the first time can use to better understand the key issues major wind and solar proposals should consider, the consenting process and wider useful sources of information.

The Design Commission for Wales is the national advisory body for design quality in the built and natural environment – an independent expert body, established by the Welsh Government. As such, the Commission is mindful of key policy and other requirements relating to large-scale energy projects, including renewables and nuclear, and of the commitment to reducing carbon emissions and addressing the impacts of climate change. We are also keenly aware of the implications of associated development for such projects and the need for careful design consideration of proposals as a whole. This guidance

therefore addresses those considerations in the round and in the context of existing national policy and legislation.

1.0 Introduction

This document provides guidance for all those involved in planning for, designing, promoting, reviewing, assessing, commenting on and engaging with the development of large-scale wind and solar farms in Wales.

1.1 Current context

This guide updates and supersedes '*Designing Wind Farms in Wales, DCFW 2014*'. Since that earlier publication was produced, the policy and legislative context has changed in Wales, particularly with the introduction of the Well-being of Future Generations Act (WBFGA)², updates to Planning Policy Wales (PPW)³ and the introduction of Future Wales: The National Plan 2040⁴.

The WBFGA sets a requirement to follow the sustainable development principle, as well as introducing seven well-being goals and five ways of working (Fig 1). Both PPW and Future Wales have been shaped by, and developed in line with, the requirements and spirit of the WBFGA and, in turn, this guidance builds on that foundation.

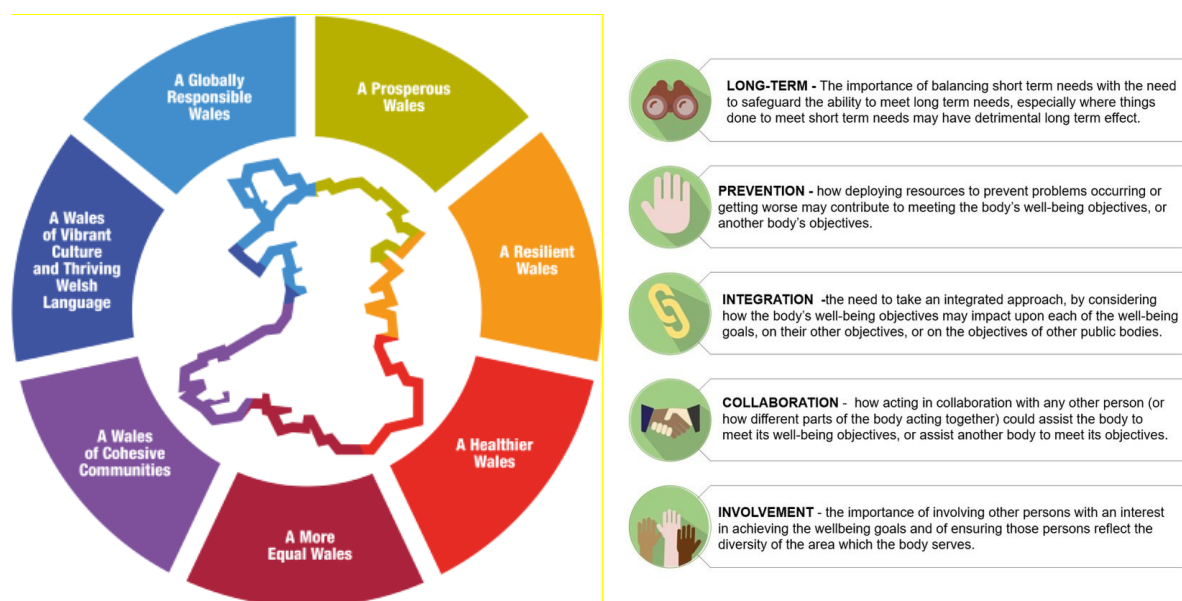


Figure 1: The Well-being of Future Generations Act Wales - Seven Goals and Five Ways of working

² <https://www.futuregenerations.wales/about-us/future-generations-act/>

³ https://www.gov.wales/sites/default/files/publications/2021-02/planning-policy-wales-edition-11_0.pdf

⁴ <https://www.gov.wales/future-wales-national-plan-2040-0>

Future Wales – the National Plan 2040 is the national development framework for Wales, setting the direction for development to 2040. It is a development plan with a strategy for addressing key national priorities through the planning system, including sustaining and developing a vibrant economy, achieving decarbonisation and climate-resilience, developing strong ecosystems, and improving the health and well-being of our communities. It contains two policies – 17 and 18 – which relate specifically to renewable energy and which this guidance applies. Policy 17 applies to all renewable and low carbon proposals, while Policy 18 relates to Developments of National Significance (DNS). This guidance applies to all large-scale proposals, but is particularly relevant to DNS applications (further information about DNS is provided in Section two below). Policies 17 and 18 state:

'Policy 17 – Renewable and Low Carbon Energy and Associated Infrastructure

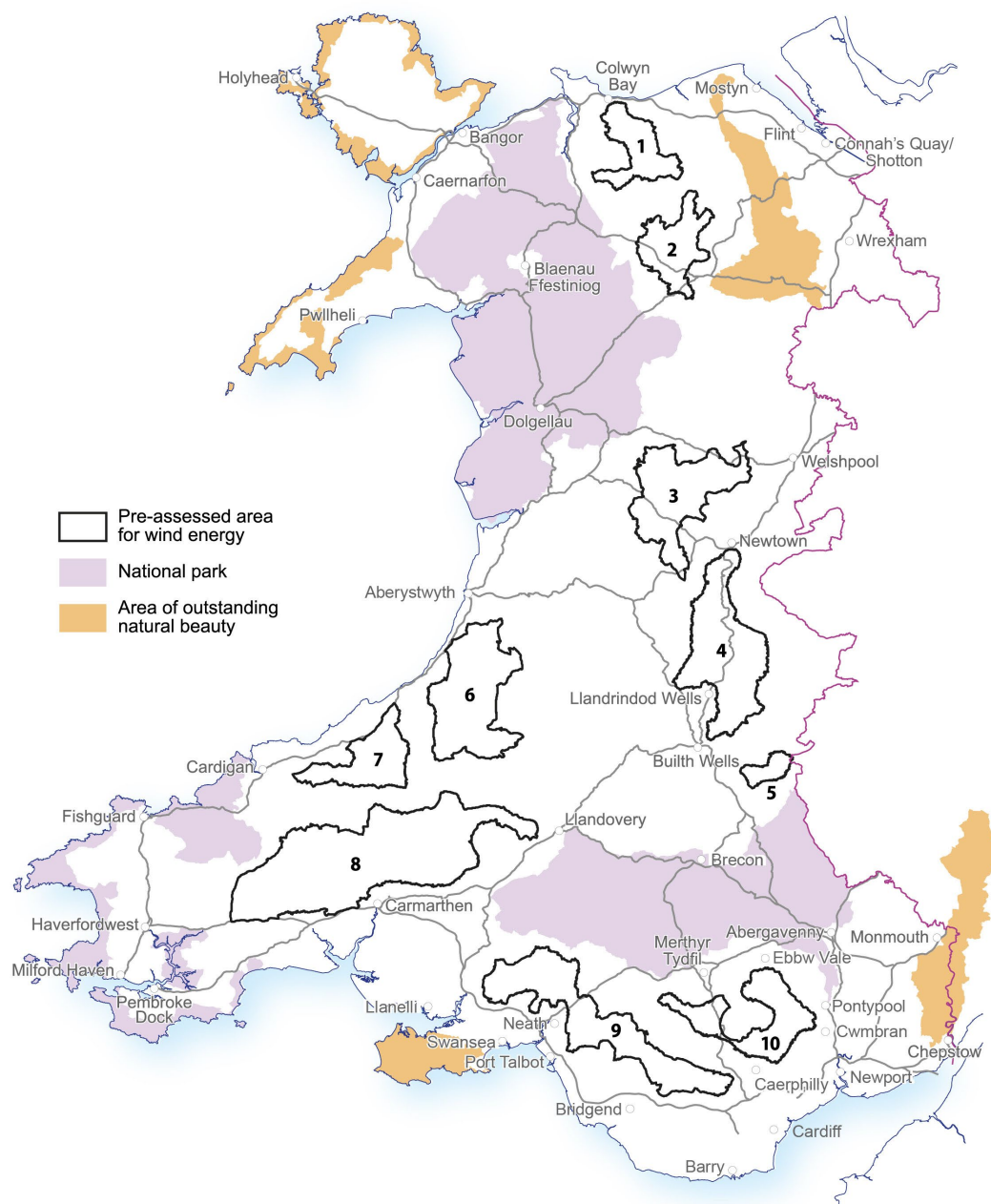
The Welsh Government strongly supports the principle of developing renewable and low carbon energy from all technologies and at all scales to meet our future energy needs. In determining planning applications for renewable and low carbon energy development, decision-makers must give significant weight to the need to meet Wales' international commitments and our target to generate 70% of consumed electricity by renewable means by 2030 in order to combat the climate emergency.

In Pre-Assessed Areas for Wind Energy the Welsh Government has already modelled the likely impact on the landscape and has found them to be capable of accommodating development in an acceptable way. There is a presumption in favour of large-scale wind energy development (including repowering) in these areas, subject to the criteria in policy 18.

Applications for large-scale wind and solar will not be permitted in National Parks and Areas of Outstanding Natural Beauty and all proposals should demonstrate that they will not have an unacceptable adverse impact on the environment. Proposals should describe the net benefits the scheme will bring in terms of social, economic, environmental and cultural improvements to local communities.

New strategic grid infrastructure for the transmission and distribution of energy should be designed to minimise visual impact on nearby communities. The Welsh Government will work with stakeholders, including National Grid and Distribution Network Operators, to transition to a multi-vector grid network and reduce the barriers to the implementation of new grid infrastructure.

Map – Pre-assessed Areas for Wind Energy⁵



⁵ [Policy 17 – Pre-assessed areas for wind energy | DataMapWales \(gov.wales\)](#)

Policy 18 – Renewable and Low Carbon Energy Developments of National Significance

Proposals for renewable and low carbon energy projects (including repowering) qualifying as Developments of National Significance will be permitted subject to policy 17 and the following criteria:

- 1. outside of the Pre-Assessed Areas for wind developments and everywhere for all other technologies, the proposal does not have an unacceptable adverse impact on the surrounding landscape (particularly on the setting of National Parks and Areas of Outstanding Natural Beauty);*
- 2. there are no unacceptable adverse visual impacts on nearby communities and individual dwellings;*
- 3. there are no adverse effects on the integrity of Internationally designated sites (including National Site Network sites and Ramsar sites) and the features for which they have been designated (unless there are no alternative solutions, Imperative Reasons of Overriding Public Interest (IROPI) and appropriate compensatory measures have been secured);*
- 4. there are no unacceptable adverse impacts on national statutory designated sites for nature conservation (and the features for which they have been designated), protected habitats and species;*
- 5. the proposal includes biodiversity enhancement measures to provide a net benefit for biodiversity;*
- 6. there are no unacceptable adverse impacts on statutorily protected built heritage assets;*
- 7. there are no unacceptable adverse impacts by way of shadow flicker, noise, reflected light, air quality or electromagnetic disturbance;*
- 8. there are no unacceptable impacts on the operations of defence facilities and operations (including aviation and radar) or the Mid Wales Low Flying Tactical Training Area (TTA-7T);*
- 9. there are no unacceptable adverse impacts on the transport network through the transportation of components or source fuels during its construction and/or ongoing operation;*
- 10. the proposal includes consideration of the materials needed or generated by the development to ensure the sustainable use and management of resources;*
- 11. there are acceptable provisions relating to the decommissioning of the development at the end of its lifetime, including the removal of infrastructure and effective restoration.*

The cumulative impacts of existing and consented renewable energy schemes should also be considered.'

The definition of 'unacceptable adverse' and 'adverse' in Future Wales Policy 18 above is for the appropriate determining planning authority to consider and is not defined in this guide or Future Wales. Every renewable energy proposal will have an individual set of circumstances and issues to consider and address, and all schemes are different in some way. The determination process provides the opportunity for a wide range of views to be heard, for evidence to be presented and tested, and for proposals to be considered against development plan policies and other material considerations.

This guide is specifically set out to encourage a greater consideration of design issues in the planning, design, assessment and determination of renewable energy developments. It particularly encourages an approach where key potential issues are considered from the earliest available opportunity, ensuring schemes are designed to avoid negative impacts.

1.2 Using this document

This publication aims to be useful for professionals and lay people alike. It clearly sets out design guidance for members of the public, developers and decision makers in relation to proposals for large-scale onshore wind and solar energy generation developments.

The guidance sits in the context of existing legislation and national planning policy in Wales, which are highlighted in Section two. The guide refers to the determination processes, which accompany decision making for such proposals in Wales, and signposts to further information regarding all aspects of the process.

Section four of the guidance introduces design considerations for both wind and solar proposals, while Sections five and six provide more specific guidance for wind farms and solar farms respectively. Therefore, reference should be made by all to Section four and then Section five or six depending on relevance. There are a wide range of issues which must be considered in the design of proposals of this nature, and a range of existing policy and guidance in relation to these issues. Where existing guidance is in place, this document will link to it to avoid duplication.

2.0 Legislative and policy context in Wales

In Wales, legislation for planning is enshrined in the Planning Act (Wales) 2015⁶ and is framed in the context of the Well-being of Future Generations (Wales) Act 2015. Work since 2015 and to date provides Wales with a current, integrated and comprehensive national planning vision and policy framework. Other relevant primary legislation includes:

- Town and Country Planning Act 1990 – the principle Act regulating the development and use of land in England and Wales.
- Planning and Compulsory Purchase Act 2004 – introduced the Local Development Plan system in Wales and made other reforms to development management provisions in the Town and Country Planning Act 1990.
- Planning Act 2008 – introduced further reforms to development management.

The Environment (Wales) Act 2016 is also relevant and should be referred to. Amongst other things, the legislation promotes sustainable management of natural resources and provides for targets for reducing emissions of greenhouse gases.

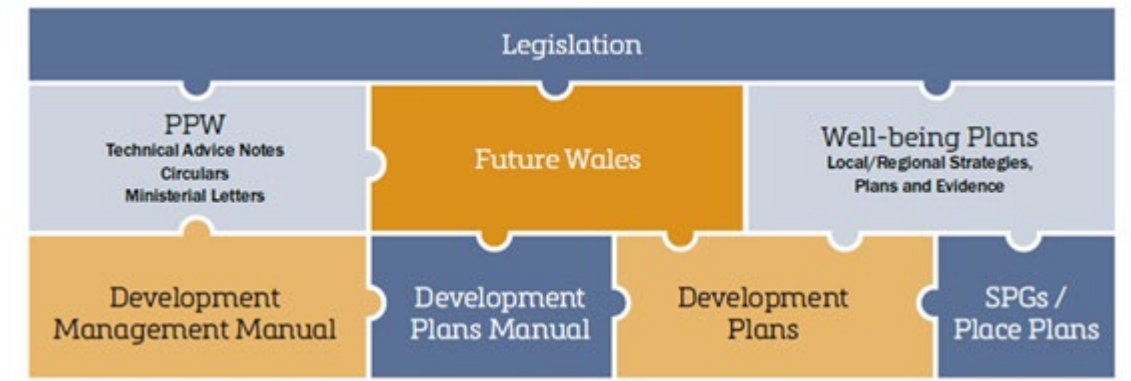
The following policy and guidance context provides a summary and, where applicable, a link to relevant documents.

- a) Planning Policy Wales 11, Feb 2021 is 'place-led' and reiterates the purpose of planning: *"The planning system manages the development and use of land in the public interest, prioritising long term collective benefit, contributing to improving the economic, social, environmental and cultural well-being of Wales. It must reconcile the needs of development and conservation, securing economy, efficiency and amenity in the use of land, ensuring the sustainable management of natural resources and protecting, promoting, conserving and enhancing the built and historic environment."*

In relation to renewable and low carbon energy, paragraph 5.9.21 of PPW 11 states that "prior to an application being submitted, developers for renewable and low carbon energy developments should, wherever possible, consider how to avoid, or otherwise minimise, adverse impacts through careful consideration of location, scale, design and other measures." This guidance document expands on these design considerations, which should begin at the earliest stages of site selection and planning.

⁶ <https://www.legislation.gov.uk/anaw/2015/4/contents/enacted>

PPW 11 integrates the commitments of the Well-being of Future Generations (Wales) Act, with a place-led approach emphasising well-being objectives, sound spatial strategies and sustainable placemaking. This integration is a key strength of national policy and unique to Wales. The diagram below, taken from PPW 11, illustrates the planning 'jigsaw' in Wales and reflects the role of PPW, Local Development Plans, Well-being Plans, Supplementary Planning Guidance and Place Plans.



The Planning Framework

- b) Future Wales: the National Plan 2040 sets the national vision and direction for development in Wales to 2040. It is a development plan and proposed development should, as appropriate, consider all its policies. In addition to Policies 17 and 18 extracted above, Policy 9 Resilient Ecological Networks and Green Infrastructure will be important in the planning for renewable energy infrastructure, in recognition of the *nature* as well as *climate* emergency and the need for a balanced approach.
- c) Technical Advice Note (TAN) 12: Design supports PPW 11 and sets out policy on good design <https://gov.wales/technical-advice-note-tan-12-design>
- d) TAN 5: Nature conservation and planning <https://www.gov.wales/technical-advice-note-tan-5-nature-conservation-and-planning>
- e) TAN 6: Planning for sustainable rural communities <https://www.gov.wales/technical-advice-note-tan-6-planning-sustainable-rural-communities>
- f) TAN 11: Noise – provides advice on how to use the planning system to reduce the adverse impact of noise. <https://www.gov.wales/technical-advice-note-tan-11-noise>

- g) TAN 15: Development and flood risk <https://www.gov.wales/technical-advice-note-tan-15-development-and-flood-risk-2004>
- h) TAN 24: The historic environment <https://www.gov.wales/technical-advice-note-tan-24-historic-environment>
- i) Strategic Development Plans (SDP): should be prepared on a regional basis and reflect functional areas, to address issues such as housing markets, travel to work patterns and economic opportunity areas. Future Wales Policy 19 provides the direction for establishing SDPs.
- j) Local Development Plans (LDP): set out a vision for how places are expected to change in land-use terms to accommodate development needs over the plan period. LDPs contain locally specific policies to explain or develop national policy further and to take forward local priorities for action. Their coverage and status are reflected in the following documents: <https://gov.wales/development-plans> and <https://gov.wales/sites/default/files/publications/2020-02/development-plan-coverage.pdf>.
- k) The Placemaking Wales Charter <https://gov.wales/new-charter-will-put-places-heart-planning> and the national Placemaking Guide <http://dcfw.org/wp-content/themes/dcfw-child/assets/PlacemakingGuideDigitalENG.pdf> support the place-led agenda. The charter sets out six principles for placemaking, which should help to guide early decision making and design for any development.
- l) Development of National Significance (DNS): Planning applications for on-shore generating projects in Wales, which have an installed generation capacity of between 10MW and 350MW (there is no upper limit for on-shore wind generating stations), are made directly to the Welsh Ministers under the DNS process and considered under policies in Future Wales. The application process for DNS and guidance on engaging in the process are set out in these documents <https://gov.wales/developments-national-significance-dns-guidance> and <https://gov.wales/developments-national-significance-dns-engaging-process>.
- m) Local Area Energy Plans (LAEPs): set out the change required to transition an area's energy system to Net Zero in a given timeframe. This is achieved by exploring potential pathways that consider a range of technologies and scenarios and, when combined with stakeholder engagement, leads to the identification of the most cost-

effective preferred pathway and a sequenced plan of proposed actions to achieving an area's Net Zero goal. Local authorities are the lead partners in the preparation of LAEPs. Guidance on LAEPs and their preparation is available here [Guidance on creating a Local Area Energy Plan - Energy Systems Catapult](#).

3.0 Supporting information and guidance

In addition to the national policy and guidance set out in Section two, the following documents provide further guidance that will be useful for consideration of attendant issues such as transport, connectivity and de-carbonisation.

- a) Routes to net zero <https://gov.wales/sites/default/files/publications/2021-07/a-route-map-for-decarbonisation-across-the-welsh-public-sector.pdf>
- b) Llwybr Newydd https://gov.wales/sites/default/files/publications/2021-03/llwybr-newydd-wales-transport-strategy-2021-full-strategy_0.pdf
- c) Infrastructure investment plan and pipeline <https://gov.wales/infrastructure-investment> and <https://gov.wales/sites/default/files/publications/2021-03/wales-infrastructure-investment-plan-project-pipeline-2021.pdf> and <https://gov.wales/wales-infrastructure-investment-plan-project-pipeline-2021>
- d) Practice Guidance: Planning Implications of Renewable and Low Carbon Energy LUC REPORT TEMPLATE (gov.wales)
- e) CIEEM Briefing on Approach to Net Benefits for Biodiversity and the DECCA Framework in the Terrestrial Planning System [Net-Benefits-briefing.pdf \(cieem.net\)](#)

Sustainability context

The requirement for sustainable development is enshrined in the Government of Wales Act 2006 and has been a key guiding principle and commitment of the Welsh Government, reflected in all its policy and legislation, since devolution and reinforced in the Well-being of Future Generations (Wales) Act.

This commitment includes addressing the impacts of climate change, ending reliance on fossil fuels and contributing to a reduction in global CO₂ emissions. National priorities include accelerating the transition away from reliance on fossil fuels and toward renewable energy to power Welsh industry, business and homes; to reduce wasteful energy consumption; and increase energy resilience and self-sufficiency.

Alongside this, there is a commitment to decarbonisation of the economy and the development of economic opportunities that are environmentally responsible, conserving precious, finite natural resources, high value land and landscapes, as well as nature and biodiversity. Within this, and explicit in *Future Wales*, is the weight given to the need to meet Wales' international commitment and develop renewable energy to meet our future energy needs.

As a result of these commitments, Wales, along with other climate responsible nations, is driving forward major and large-scale change after centuries of heavy industries, environmental exploitation and degradation. Vital to this change is conservation, energy saving and the use of technologies which help to reduce demand and influence individual and collective behaviour, accompanied by consideration and development of secure, alternative renewable energy sources, such as on and off-shore wind, solar, tidal, hydro, hydrogen and nuclear⁷. As part of this mix, wind and solar generation is the most advanced in terms of readiness and capacity for scale. In this context, this guidance provides direction for the design of important energy infrastructure that considers and cares for the landscape, nature, culture and communities of Wales.

⁷ [Welsh National Marine Plan | GOV.WALES](#)

4.0 Design for renewable energy

During the 18th and 19th Centuries, large areas of the Welsh landscape were transformed and, in many places, ecologically devastated by the economy and processes of the industrial revolution. The 20th Century saw the end, or relocation, of almost all such 'heavy industries' and the gradual 'healing' of the associated industrial landscapes. Now, the urgent challenge of the 21st Century is to rapidly transform the energy systems of the modern economy to be non-polluting and sustainable. Wind powered electricity generation and the direct conversion of solar power to electricity are two of the technologies that will contribute to this transformation. The Welsh Government is committed to the use of these technologies at scale, as part of the nation's energy strategy.

The opening sections of this document establish the context for developing on-shore wind and solar energy in Wales. The importance of landscape as an element of national cultural identity is also acknowledged, resulting in policy that ensures that the most highly valued landscapes and locations in Wales are protected.

The sections below outline the design process which can support good planning for wind and solar schemes.

4.1 The design process

The construction of large-scale wind and solar energy installations should result from a thorough, multidisciplinary design process, which starts with the development of a comprehensive design brief, to guide the developer, client and design team, prepared through a consultative process as discussed below.

The brief should be prepared with the involvement and engagement of stakeholders in the process, including local authorities, councils and the citizens they represent⁸. The brief should consider the key characteristics of the receiving landscape and the landscape objectives for the wind or solar farm in respect of these.

The scale and impact of wind turbine and solar array developments dictates that the engagement part of the process will require consideration to be given to communities dispersed over a wider geographical area and, at times, with more than a single approving authority.

⁸ [Planning-major-developments-guidance-on-pre-application-consultation.pdf \(gov.wales\)](https://gov.wales/planning-major-developments-guidance-on-pre-application-consultation.pdf)

4.2 Design objectives

The design objectives identified below must be recognised, and consistently applied, to ensure proposals clearly address the requirements of Policies 17 and 18 of Future Wales, as well as Policy 9 and other relevant policies in Future Wales, and reflect of the principles of good, contextual design. The following design objectives will apply to all large-scale wind and solar installations:

4.2.1 Avoid unacceptable environmental impacts on local communities through design processes

The scale of these types of development will require environmental changes, both locally and to the wider landscape. The design should seek to accommodate these changes in ways that take a broad view of the changes required. That is a view of acceptance of landscape change in parts of Wales and that the developments can be both positive and catalytic to wider changes in land use and ecological change. Impacts upon the setting of cultural, historic or archaeological landscape features should be particularly carefully considered.

4.2.2 Maximise benefits to local communities

Wind and solar farm designs should seek to maximise the benefits to local communities in terms of meaningful participation in the site selection and design process; access to employment in the creation and running of the facility; local landscape and infrastructure improvements; and access, learning and interpretation functions associated with the facility⁹.

4.2.3 Avoid negative environmental impacts on nature and wildlife

Impacts at all stages in the life cycle of the development should be considered in the design process, including during construction, operation, decommissioning and the after-care period. The approaches to avoiding and minimising impacts should be creative, robust, feasible and value adding. Effective restoration at the end of a scheme's life should be considered from the earliest stages. Avoid, and where necessary mitigate against, unacceptable environmental impacts on soils, nature and wildlife, and enhance ecological diversity.

Wind farms use a small proportion of the overall site area leaving other land available for nature and wildlife. Solar farm layouts *can* leave much of the land beneath the solar array panels available for other uses, but the installation and decommissioning process can be

⁹ [Guidance for developers, local communities and decision-makers. \(gov.wales\)](https://gov.wales/guidance-for-developers-local-communities-and-decision-makers)

destructive. Design should seek to enhance biodiversity of this land to provide a net benefit and secure ecosystem resilience. Understanding the ecological context of the site and the functional ecosystems will help achieve this.

4.2.4 Enhance the ecological diversity of the site to provide a net benefit

The requirement (Environment Wales Act, section 6 duty) to enhance nature conservation and biodiversity and to provide a net benefit within wind and solar farm sites should be integral to the design thinking, delivery and management approach, including consideration of the long-term land use when the turbines or solar installations are decommissioned.

4.2.5 Use of highest quality emerging new technology

Wind and solar turbine technology is constantly developing to improve efficiency performance and durability and to reduce undesirable environmental impacts. New developments should seek to make use of high quality, new and innovative technology to maximise the power generation potential and minimise negative environmental impacts.

4.2.6 Sustainable construction

Designs should take care to ensure that construction minimises the environmental impacts of wind and solar farm developments. Full consideration should be given to maximising resource efficiency, optimising potential material reuse and land restoration, and minimising the impact on the land for all stages in the life of the wind or solar farm, including initial construction; during regular repair and maintenance in use; the eventual decommissioning and disposal/recycling stages; and site restoration and aftercare.

4.2.7 Make meaningful changes to the landscape through design

The arrangement of turbines or solar arrays needs to be carefully considered as a landscape design challenge, which considers environmental, aesthetic and cultural factors in addition to the technical and engineering design constraints. The design proposal should follow from a careful analysis of the existing landscape history, form, ecology and scenic characteristics, and meaningfully add new elements that either harmonise or contrast with what already exists.

4.2.8 Site design and wider impacts

In addition to the large-scale site design considerations set out above, careful design consideration is needed in relation to other elements of wind and solar farm developments, including: access roads, storage and maintenance facilities, substations, battery storage facilities, and linkages to the local and national distributions grids. The design of these

elements should be informed by reference to the characteristic scale, form and dominant construction materials used in the architecture of the local area, as well as existing ecological connectivity.

4.3 The landscape design challenge

The development of large-scale wind and solar farms present challenging landscape design problems, so the consideration of the landscape should be the starting point for the design of either type of facility. Wind farms require careful consideration of the location and arrangement of groups of very large moving tower structures against the landscape and skyline backdrop. Solar arrays present a different type of landscape design problem. In flat landscapes, setting solar arrays may be effectively screened from view by perimeter planting and screening. Flat landscapes are, however, rare in hilly Wales. More frequently the solar array layouts result in bold regular geometric patterns seen set against the field and landscape pattern in the area. With both types of facility, the challenge is to devise a design that is a positive response to the landscape setting.

4.4 Coast

Wales has a great diversity of coastal landscapes, ranging from low-lying beaches with dunes, to craggy intricate cliffs and headlands. LANDMAP characterised the Welsh coast into 50 regional seascape units, detailing the character and qualities of each unit. Simple, open, flat coastal areas can probably better accommodate wind farms than complex coastal landscapes, such as those with inlets and islands. It is important that wind farms do not detract from existing landmarks, such as historical or navigational features, or coastal settlement and areas valued for recreation. Cumulative impacts may occur between on-shore and off-shore wind energy developments.

4.5 Woodland

Trees can act as a scale indicator if wind farms are sited immediately adjacent to, or within woodland areas. Trees can have a screening effect if they occur in the fore or midground of views looking towards turbines in the distance. This screening effect may change or be lost as via moving through the landscape. If a wind farm is located within a forest, the clearance of trees can create a pattern of spaces, lines and shapes, which could cause changes to distant views.

4.6 Agricultural land, soils and hydrology

The site selection process for wind and solar farms should consider how the land is currently used, its qualities and the role it and its features may play in local and wider systems.

Wind and solar farm development could create vulnerable changes to flood risk, ground water, surface water and drainage systems and peatland integrity. The layout and siting of energy developments can reduce the adverse impacts on hydrology.

Peat soils are extremely fragile and if compromised put at risk the resilience of the ecosystems they support. Peatland habitats cover only 3-4% of Wales, yet store in the region of 20-25% of all soil carbon. Where peat is identified within proposed developments, considerable weight should be given to its protection because of its special importance in underpinning and supporting national natural resources, such as soil carbon, biodiversity and flood management. The Welsh Government have made available the Peatlands of Wales map as a first step to assist in identifying peatland locations:

<https://datamap.gov.wales/maps/peatlands-of-wales-maps/>.

Planning Policy Wales recognises that agricultural land of grades 1, 2 and 3a of the Agricultural Land Classification system (ALC) is the best and most versatile, and should be conserved as a finite resource for the future. When considering site selection and the layout of schemes, considerable weight should be given to protecting the best agricultural land from development, because of its special importance¹⁰.

4.7 Ecology

Certain species in Britain are in need of special protection, for reasons of dramatic decline, loss of habitats and rarity or restricted distribution. The design, layout and siting of a wind farm and solar farm has to take into consideration the surrounding protected species and habitats. If the layout design has the potential to cause an adverse impact on biodiversity, the developer should work through the stages of the step wise policy set out in PPW – firstly looking to avoid impacts and later seeking to mitigate and compensate for impacts. Early consultation with Natural Resources Wales and local authority ecology teams will assist this iterative process.

Reference should be made to the Environment Wales Act, Section 7 lists of species and habitats of principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales [Biodiversity and resilience of ecosystems duty \(section 6\): guidance for public authorities | GOV.WALES](#). Further guidance is also available here [Wales Biodiversity Partnership - Environment \(Wales\) Act \(biodiversitywales.org.uk\)](#).

¹⁰ [Best and most versatile agricultural land and solar PV arrays | GOV.WALES](#)

4.8 Wind farm extensions and 'repowering'

Recent wind farm developments have included numerous extensions and upgrades (repowering) to existing wind farm developments. Layout and site design objectives and principles should echo those of the original wind farm. Scale, colour, form and rotation speed should be compatible with the existing wind turbines. If the upgrade of a wind farm involves a replacement of all existing turbines, with turbines of a different colour, scale and form, then it is imperative that throughout the design stage the design and layout principles are carried out.

4.9 Impact assessments

4.9.1 Environmental Impact Assessment

Where required, an Environmental Impact Assessment (EIA) accompanies a planning application and informs the local authority, developer, statutory and non-statutory consultees of the likely effects of a new development on the environment.

An EIA is only a statutory requirement for wind and solar energy proposals where the proposal is likely to have significant effects on the environment, under (currently) the Town and County Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999.

EIA is a key procedure, important for informing the Local Authorities and statutory and non-statutory consultees of the likely effects of a new development on the environment. An EIA considers all potential impacts of the development on the surrounding environment, including ecology, ornithology, noise, visual, communications, shadow flicker, archaeology, water, land, soil and biodiversity. The EIA also considers any environmental benefits such as the reductions in emissions, and improvements to biodiversity or habitats.

Not only does the EIA assess environmental impacts of the proposed development on the surrounding built and natural environment, but also the social and economic impacts.

Further information on EIA can be found in Appendix 3 of the following guidance [Examining Local Development Plans \(gov.wales\)](#).

4.9.2 Landscape and Visual Impact Assessment

The visual impacts of wind farms should inform the layout and siting of turbine installations.

Useful guidance may be found in [Guidelines for Landscape and Visual Impact Assessment Third Edition](#) published by Routledge for the Landscape Institute and Institute of Environmental Management & Assessment (IEMA) ISBN 978-0-415-68004-2. The

Landscape Institute considers that suitably qualified and experienced landscape professionals should carry out landscape and visual impact assessments (LVIAs).

Wind turbines are large structures that can be seen for great distances and the EIA process should be used to help consider and reduce the visual intrusion of wind turbines as part of the design process. The scale of modern turbines means that reducing their visual impact can be challenging and a more positive approach to their layout, placing the turbines with conviction and sensitivity, is more likely to be practical. There are various factors, such as landform, landscape scale, focal features, turbine colour, turbine size and turbine lighting, which could accentuate visual impacts of a wind farm and these are detailed elsewhere in this document.

4.9.3 Habitat Regulations Assessment

The following European sites are protected by the Habitats Regulations¹¹ and any proposals that could affect them will require an HRA:

- **Special Areas of Conservation** (SAC)
- **Special Protection Areas** (SPAs)

Any proposals affecting the following sites would also require an HRA, because these are protected by government policy:

- Proposed SACs
- Potential SPAs
- **Ramsar sites** - wetlands of international importance (both listed and proposed)
- areas secured as sites compensating for damage to a European site.

HRA assesses the likely impacts of the possible effects of a plan's policies on these sites, including cumulative impacts. If you are proposing wind or solar farm development that affects a European site, you must provide enough information to the competent authority to allow it to test if a project proposal could significantly harm the designated features of a European site. The competent authority must be certain that your proposal will have no adverse effects on a European site before it can give you permission.

Further guidance on HRA from NRW can be found here <https://naturalresources.wales/guidance-and-advice/business-sectors/planning-and-development/advice-for-developers/environmental-assessment/?lang=en>

¹¹ [Habitats regulations assessments: protecting a European site | GOV.WALES](https://gov.wales/guidance-and-advice/business-sectors/planning-and-development/advice-for-developers/environmental-assessment/?lang=en)

4.10 Social and economic considerations

Large-scale wind and solar developments can have a social impact on neighbouring communities. Effective and early consultation with key stakeholders and the public is an important part of the design process to understand and respond to these impacts. [Future Wales Policy 18](#) recognises these potential impacts and requires that they are considered through the DNS process.

The Welsh Government has statutory targets to reduce greenhouse gas emissions along a trajectory to net zero by 2050. The transformation to a smart, flexible system based on renewables will not only reduce emissions but will also support the decarbonisation of the wider economy. This provides an opportunity to retain social and economic benefit from future energy developments located in and around Wales, as the nation transitions to a more sustainable and abundant energy future. Local renewable energy developments offer significant potential for communities and small businesses to develop their own projects for local benefit.

[National planning policy](#) supports the principle of community benefits and local ownership, whilst recognising that planning decisions are based on an assessment of the impacts of a proposed development, irrespective of who the applicant is or the potential voluntary benefits offered. Voluntary benefits and those required to make a development acceptable are considered differently by the planning process.

The Welsh Government has set targets for locally owned renewable energy generation and has set out its [definitions](#) of local ownership, shared ownership and community ownership. The Welsh Government has published detailed guidance on achieving [local and shared ownership of energy projects in Wales](#), setting out the wider benefits that individual projects and the growth of the energy sector as a whole can provide. In addition to any contributions required through the planning process, wind and solar farm developers can provide funds to communities living closest to their project. Local authorities, where practical, should facilitate and encourage such proposals.

Construction, operation and maintenance activities of a wind and solar farm can create jobs for the local workforce, providing indirect and direct economic benefits. However, operational and maintenance employment for on-shore wind and solar farms is generally low. Local businesses may be economically affected, directly and indirectly, by wind and solar farms, for example, as a result of construction teams and workers using local accommodation or shopping locally. The tourism sector and the impact of wind and solar developments on the features and attractions that draw people to Wales should be considered at the design stages.

The [Welsh Government Energy Service](#) plays a key role in facilitating local ownership, providing bespoke advice, technical toolkits, and grant/capital loan financial support. Developers,

community organisations, Local Authorities, and landowners interested in exploring opportunities for local ownership should contact the Energy Service in the first instance.

4.11 Design and Access Statement

A Design and Access Statement (DAS) is a key document, which accompanies planning applications of many types. Renewable energy developers should aim to create wind or solar farms with a cohesive design, which relates to the surrounding landscape, and to demonstrate and communicate how this is achieved through a good DAS. A DAS should explain the analysis, design principles and concepts that have been applied to aspects of the proposal. The DAS should demonstrate how the local context has influenced the design of the development. A good DAS will also be a useful tool for clearly communicating to members of the community and decision makers alike, during the design and planning application process. Further guidance on DAS can be found here: [Design and Access Statements in Wales: Why, What and How - Design Commission for Wales \(dcfw.org\)](https://www.dcfw.org.uk/design-and-access-statements-in-wales-why-what-and-how/).

5.0 Designing wind farms

Future Wales makes clear that some parts of the country are Pre-Assessed Areas for wind energy development generation, which have already been modelled to test the likely impact on the landscape and have been found to be capable of accommodating such developments in an acceptable way.

The policy should not be interpreted as meaning that the landscapes in these areas are of no scenic or cultural value or contain no valuable natural resources. The policy does mean, however, that these locations have been assessed to be capable of accommodating the necessary landscape change, and it is the individual detail of proposals in these areas that will be subject to rigorous examination, rather than the principle of development itself.

The design of wind farms is a complex, many faceted challenge. The following are some of the principal issues that the designs will need to address and demonstrate an appropriate response to, in addition to the general points raised in Section four.

5.1 Location

On-shore wind turbine installations are, by necessity, located in exposed windy landscapes. These are most frequently found on high ground, or on exposed plains, where the turbine array forms a new skyline silhouette that is often visible across long distances. Accepting that these impacts are inevitable, the design approach must find a way to integrate the new elements into the existing landscape as discussed above. This may, for example, be organic or rigid in form; it may be bold, such as a grid located along ridgelines, or may take some other form. Whatever approach is adopted and tested, it should have a positive design intent that is clearly explained.

Amongst the main factors that influence the siting of wind farms are:

- exposed places that are open, high and relatively prominent;
- land ownership;
- access;
- grid connection;
- site topography;
- location in relation to other natural or cultural heritage interests and/or statutory designations;
- aviation constraints;
- proximity to settlement; and
- to avoid excessive turbulence.

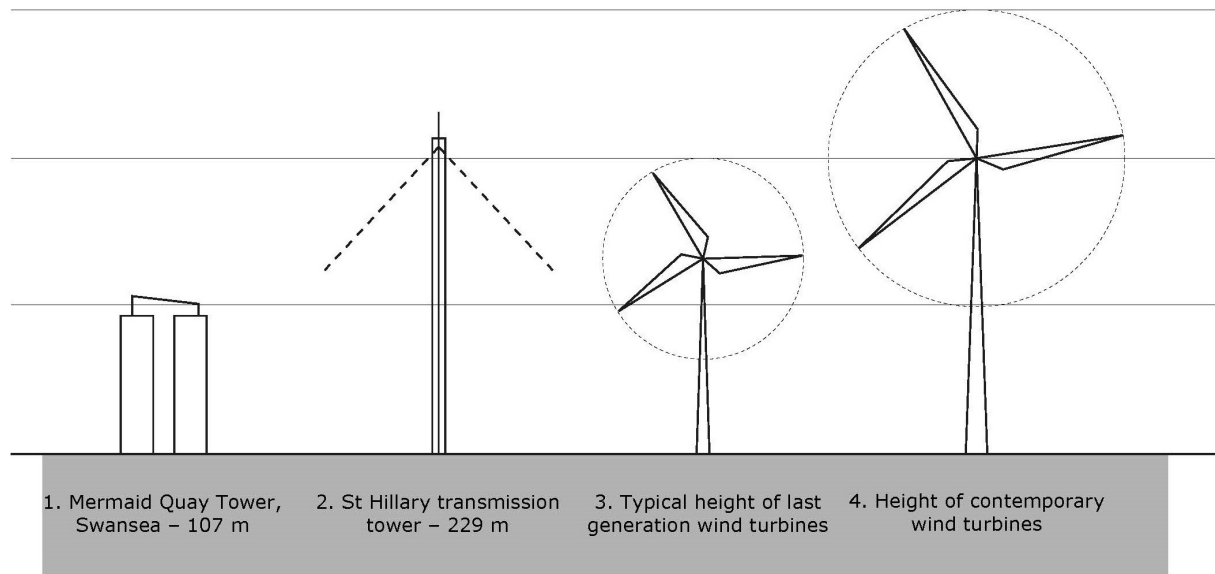


Wind farms are frequently visible over long distances



Particular care is needed in placing turbines close to residential communities

5.2 Scale



Wind turbine installations comprise groups of the tallest structures ever constructed in Wales and the drive to create turbines of greater generating capacity and efficiency is generally resulting in turbines of greater height. In the Pre-assessed Areas and other locations for wind turbine development, it is recognised that the scale of these interventions will change the appearance of the landscape. The design challenge associated with these large-scale turbine installations is to create landscapes which accommodate new renewable energy generation, and which contribute to decarbonisation, reduced climate impact, and energy security for Wales and the UK.

Structural and technological innovation over coming years will lead to the development of wind turbines of greater size and energy generating capacity. The impact of these much larger turbines on the landscapes will require exemplary design skill to create successful layouts. As size increases, there will need to a change of emphasis from turbines considered as features in a landscape to turbines much more defining the landscape character.



Wind turbines forming new skyline features in the landscape

The perception of scale will vary depending on the landscape context and proximity to other features, including individual buildings and settlements. It is necessary to note that

the relationship between visual impact and turbine size is not directionally proportional due to two reasons:

- a wind farm is viewed within a surrounding context which varies; and
- the actual size of a wind turbine is usually difficult to perceive.

5.3 Turbine layout

The layout of a wind farm should relate to the specific characteristics of the landscape and it is here that the design process can be used to influence installations so that they respond well to their context. Once the site(s) is chosen, aside from turbine height and blade lengths, the horizontal and vertical geometric alignment of turbines is perhaps the primary landscape and visual design consideration.

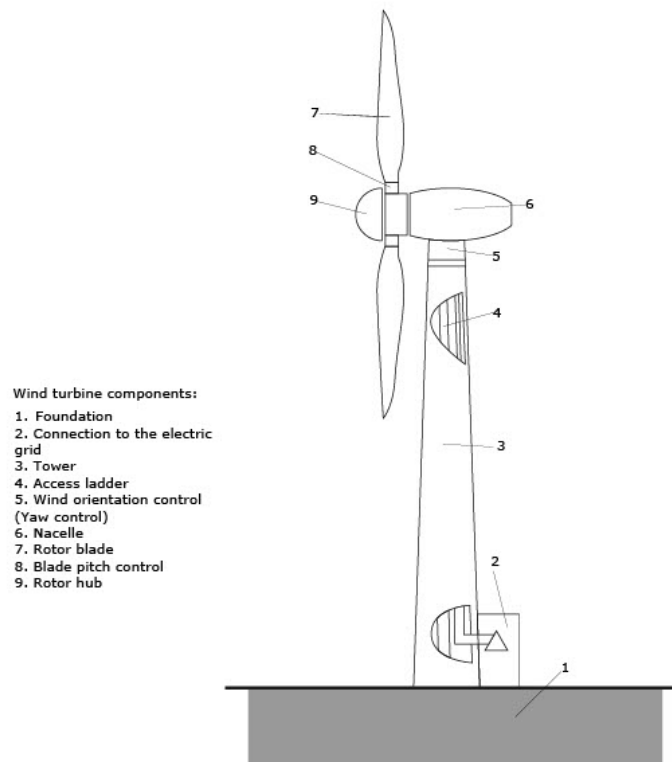
The layout of large-scale wind farms generally comprises a grid of wind turbines often taken as the starting point with the turbines spaced at minimum separation distances to avoid turbulence, often equating to 4-5 rotor diameters. Throughout the design process, layout should be tested and wind turbines may be moved or removed from the design due to a range of physical and environmental constraints and/or opportunities. Determining the appropriate turbine layout should be based on rigorous analysis, testing and response to the landscape setting.

It is worth acknowledging that as turbine size increases, the number of turbines needed in a given area to achieve the same or better energy yield decreases. Practically, this means wind farms are much more likely to comprise a smaller number of larger turbines. Layout designs should acknowledge and respond to this. Traditionally an odd number of turbines has been seen as more pleasing in the landscape, especially when grouped, but this is largely subjective and all layouts should arise from the design processes of analysis and testing noted above.

5.4 Colour and design

The landscape and visual impacts of wind turbines vary and some turbines of the same height may have subtle variations. However, modern turbines have generally evolved to broadly the same visual appearance with largely similar proportions, nacelle¹² shape, colour and foundation fixings.

¹² A wind turbine comprises a tower that supports a nacelle, that is the main shell containing the electric generator and to which the turbine blades attach via a hub. The nacelle has an anemometer attached so that the direction in which the blades face can be altered to maximise wind capture.



Main parts of a wind turbine installation

It is important to select a colour that will relate positively to a range of backdrops seen within different views and in different weather conditions. If wind turbine components are of different colour, it can create a more complex image and means the visibility of different sections varies.

Colour selection should form a key part of the landscape design approach. Conventionally, a light grey or off-white colour has been considered to achieve the best balance between minimising visibility and visual impacts when seen against the sky. However, alternative colour mixes should be considered and tested as part of the landscape design assessment. For multiple wind farm groups or wind farm extensions, the colour of turbines should be considered for the combined visual effect. Light grey can relate positively to a range of backdrops seen within different views of, and in different, weather conditions.

5.5 Turbine lighting

In some locations it may be necessary to light wind turbines for reasons of civil or military aviation safety. Lighting on top of the turbine may be inappropriate in predominately unlit rural

areas. Therefore, it is necessary to design lighting to minimise landscape and visual impacts, whilst satisfying health and safety or navigation requirements.

5.6 Local environmental impacts

Wind turbine design layouts should demonstrate that care has been taken to screen local communities from unacceptable environmental impacts, including noise from turbines and generators, light/shadow flicker, and from traffic and other impacts arising during installation, maintenance and decommissioning. This includes consideration of the impact of night-time aircraft safety navigation lighting in darker skies areas (see Section 5.11).

The large land areas within turbine developments, which are additional to that required for the turbine operations, should be carefully assessed for the potential to provide nature conservation and biodiversity enhancement or continued agricultural use. Local scale landscape screening and enhancements should also form part of the site design scope, including offsite. Wider benefits are particularly important when associated with the use of commercial forestry plantations, where the opportunity exists for a full re-evaluation of the use of the forests for recreation, particularly mountain walking, biking and forest accommodation.

5.7 Movement

Wind turbine structures attract attention in the landscape by their size and the rotation of their blades. Two design considerations arise from this dynamic characteristic of turbines. Firstly, the movement reinforces the visual prominence of the installations caused by their scale discussed above. Secondly, shadow flicker may occur under certain circumstances with potentially negative impacts. Careful consideration must therefore be given to turbine locations to avoid and reduce these impacts on neighbouring communities.

5.8 Shadow flicker

Shadow flicker may occur under certain circumstances of geographical position and time of day, when the sun passes behind the rotors of a wind turbine and casts a shadow over neighbouring properties. As the blade rotates, the shadow flicks on and off, an effect known as shadow flicker.

Shadow flicker and its effects, especially on properties, can be reduced and should be minimised through the layout and siting of the wind farm, and/or operational controls. Generally, the larger the turbine, the slower the rotation of the blades.

5.9 Noise

Irrespective of location or scale, the design and micro-siting of wind turbines must seek to minimise their noise impact, particularly where turbines would be near homes and tourism receptors.

The current UK wind turbine noise assessment guidance is set out in ETSU-R-97, a Good Practice Guide on the application of ETSU-R-97, and Supplementary Guidance Notes. The Welsh Government has endorsed the use of this guidance in Wales.

A review of noise guidance for on-shore wind turbines has recently been published and any changes to UK guidance arising from this review will be considered by the Welsh Government¹³.

5.10 Cumulative impacts

Proposals for new wind farms may be set in the context of existing or consented farms. It is necessary to consider the cumulative visual effects from local communities, main transport and recreational routes. Of particular importance are: how these developments relate to each other in design and relationship to their settings; their frequency as one moves through the landscape; and their visual separation to allow experience of the character of the landscape in between.

5.11 Telecommunications, television and aviation systems

Large structures such as wind turbines have the potential to interfere with telecommunication links, television reception, radio communication and flight paths, through physical obstruction or reflection of signals. The correct siting and layout of wind turbines can reduce these interferences. Early engagement should take place with the appropriate authorities, including NATS, the Ministry of Defence, and Operators of Officially Safeguarded Civil Aerodromes to ensure these matters have been properly considered in the design process. Further information can be found here on the NATS website [Wind farm self-assessment maps - Wind farm services - NATS](#).

5.12 Ornithology

Poor design of wind farms could result in loss of bird habitat and feeding grounds, collision and interruption to flight paths and migratory routes. The EIA should inform the design process, so that site layouts are modified to accommodate bird movements prior to the planning application. As with ecological issues above, early consultation with Natural Resources Wales as

¹³ [Report for BEIS: A review of noise guidance for onshore wind turbines | WSP](#)

well as the Royal Society for Protection of Birds (RSPB Cymru) will also assist the iterative design process. Further information can be found here [Wild birds: surveys and monitoring for onshore wind farms - GOV.UK \(www.gov.uk\)](https://www.gov.uk/guidance/wild-birds-surveys-and-monitoring-for-onshore-wind-farms).

5.13 Archaeology

Construction of wind farms could affect visible or buried archaeological remains, such as non-designated features and designated features (Listed Buildings and Scheduled Ancient Monuments). Careful consideration of the siting and layout of a wind farm can reduce the adverse impacts on archaeology.

5.14 Local physical impacts

Once installed, turbine towers cover very small areas of the land on which they are constructed, leaving most of the turbine site available for other nature conservation or agricultural uses. However, the construction process, and in particular the access and haul roads, drainage structures, borrow pits/quarries, temporary and permanent signage, substation(s), grid infrastructure, and access for regular maintenance and eventual decommissioning, will cause greater local impact over the short or medium term, which must be considered in the design process.

The sensitive design and siting of the access roads and associated substation(s) is likely to be a significant consideration for the largest of wind farms, where extensive lengths of associated infrastructure will be necessary. Every opportunity should be sought to integrate such infrastructure into the existing landscape fabric, with existing large-scale forestry plantations in particular having the existing tracks, borrow pits/quarries and drainage which can be utilised in full or in part by the wind farm.

5.15 Ancillary infrastructure

The siting and design of ancillary infrastructure needs to relate to the key characteristics of the landscape. Careful siting of the substations, transmission lines, access tracks and control buildings will help to enhance a wind farm design.

In addition, landscape and visual impacts, as well as ecological connectivity associated with widening of roads, access tracks and corners to enable the delivery of large turbine components, should be taken into account when designing and siting a wind farm.

6.0 Designing solar farms

The direct conversion of solar energy to generate electricity forms an important part of Welsh Government's ambitious, integrated strategy for renewable energy generation. The technology for delivering this part of the strategy is well established and rapidly developing to provide ever-greater electricity generating capacity.

Solar electricity generating plants are comprised of large panels of cells made from a suitable semi-conducting material, generally silicon, which directly converts over 30% of the solar energy falling on the cell surface into electricity. Cells are combined into panels, which are then connected together to provide the required electricity generating capacity.

The scale of solar arrays or installations can vary significantly depending on the purpose, from single panel installations powering an individual device, to arrays of panels covering many hectares of land to power large energy users (such as healthcare) or the national grid. This design guide is focused on these large-scale arrays of panels, which are frequently referred to as solar farms. Currently one of the largest solar farms in the UK is Shotwick Solar Park, located in Flintshire, Wales. Commissioned in March 2016, it produces 72.2 MW per year and is spread over 250 acres.

The design of solar farms is a complex, many faceted challenge. The following are some of the principal issues that the designs will need to address and demonstrate an appropriate response to, in addition to the general points raised in Section four.

6.1 Landscape change

The Welsh Government strongly supports the development of renewable and low carbon energy, including as part of its energy transformation strategy, and sets out its policy position in policies 17 and 18 of *Future Wales: The National Plan 2040*, shown at the beginning of this document. Solar arrays/farms/installations above the 10MW threshold for DNS must respond to the requirements of Future Wales Policy 18.

It is fully acknowledged that solar farm development, as with wind turbine development, will impact on the appearance of the Welsh landscape. The ambition of these guidelines is that solar farms will be designed in a manner that complements the qualities of existing landscapes.

6.2 Design process

The construction of large-scale solar farm installations should follow from a thorough, multi-disciplinary design process, starting with the development of a comprehensive design brief. The brief should be prepared in participation with all stakeholders to the process, including local authorities and local communities. The scale and impact of these types of projects necessitates engagement and agreement with a wide range of stakeholders, which may include the involvement of multiple approving authorities.

Solar farm design is fundamentally a landscape design challenge of integrating a wide range of ecological and conservation disciplines with engineering, project and construction management skills. This type of landscape change needs to be designed in ways that directly address the inherent challenges and make a positive contribution to these landscapes. The design approach should not merely rely on mitigation measures to ameliorate scenic and nature impacts.

6.3 Location

Solar farm panel arrays are normally mounted on support frames above ground, angled to optimise the panel orientation to sunlight and maximise generating capacity. The support frames also allow for maintenance access and frees the ground level to be used for other complementary purposes. Sites can provide an opportunity for land use change under and around them for some forms of farming, and, via developer contributions, be catalytic to adjacent habitat and farming environmental improvements.

Site considerations for selection of suitable locations for solar farms include:

- Low grade farming land, which provides poor setting for agricultural production;
- Sites with suitable solar orientation;
- Sites with appropriate connection to the national power grid or facility that it serves;
- Sites with adequate access for construction, maintenance and decommissioning;
- Sites capable of screening from surrounding land, with perimeter planting and screens, or where sites are visible, the possibility of integrating the design of the solar array into the existing landscape pattern; and
- Sites with low impacts on exiting settlements and communities.

6.4 Solar farm layout and response to landscape scale

Important factors to be considered in generating the site landscape approach include the scale of panel arrays; how they are subdivided into smaller 'fields' of panels; the spacing between 'fields' of arrays; and planting of land strips between them.

There is the opportunity with larger arrays to split the solar farm into smaller elements, connected together to a common substation or transmission route, with the consent containing several discrete 'farms'. This more dispersed approach maybe more appropriate in smaller scale landscapes and may also aid successful screening of the development.

6.5 Perimeter screening

In most cases, solar farms will be visible from some vantage points in the landscape. In flat landscapes, modest height perimeter planting can provide complete visual screening even for large installations. In hilly landscapes, which are by far the most common type in Wales, solar farms can be more visible across long distances where they create large geometric patterns on the land surface. Where possible, hedgerow and screen planting around the perimeter and within solar farms should be considered to limit local impacts.

Reflected light from the surface of panels may appear to be shimmering lakes under some circumstances. The landscape design challenge, where solar farms are visible, is to find ways to arrange these large geometric forms to work with the prevailing landscape forms.

Local impacts from solar farms will generally be less than those from wind farms and can more easily be addressed through landscape screening.



Solar farms, such as this, could be screened from view with suitable perimeter planting



Without perimeter screening, solar farms can be visible over long distances

6.6 Colour

Colour selection of panels, and panel support structures, should be carefully considered to reduce the contrast between the panel array and the geometry, colours and textures of the landscape context.

6.7 Local environmental impacts

Solar farm design layouts should demonstrate that care has been taken to screen local communities from unacceptable environmental impacts, including noise, ancillary plant and traffic, and other impacts arising during installation, maintenance and decommissioning.

The large land areas within solar farm developments, which are additional to that required for the solar panel operations, should be carefully assessed for the potential to provide nature conservation and biodiversity enhancement or continued agricultural use. Local scale landscape screening and enhancements should also form part of the site design scope, including screening beyond the immediate site.

6.8 Cumulative impacts

The cumulative effect of developing solar farms adjacent to existing facilities should be carefully considered for their combined impact on the landscape. In these instances, consideration should be given to the geometric patterns and forms that will result, and to landscape planting strategies to divide solar farms from one another, to retain the scale of landscape subdivision that is characteristic of the setting.

6.9 Ancillary infrastructure

The siting and design of ancillary infrastructure needs to relate to the key characteristics of the landscape. Careful siting of the substations, transmission lines, access tracks and control buildings will help to enhance a solar farm design.

Landscape and visual impacts, as well as ecological connectivity associated with widening of roads, access tracks and corners to enable the delivery of solar farm components, should be taken into account in the design.

6.10 Long term design considerations

Consideration should be given from the start as to how a site can potentially be restored visually to its pre-development appearance following decommission of the solar farm. TAN 6 identifies that, once land is built on, the restoration of semi-natural and natural habitats and landscape features is rarely possible and usually expensive, and archaeological and historic features cannot be replaced. Once agricultural land is developed, even for 'soft'

uses, its return to agriculture as best and most versatile agricultural land is seldom practicable. Careful consideration should be given to the impact on habitats and important features, both during and post operation. Future Wales Policy 18 requires that there are acceptable provisions relating to the decommissioning of the development at the end of its lifetime, including the removal of infrastructure and effective restoration.