

Scottish Natural Heritage

**Siting and Designing
Wind Farms in the Landscape**

Version 2

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1. Introduction

- 1.1 This guidance provides advice on the siting and design of wind farms in Scotland's landscapes. It draws on two decades of experience of planning for wind farms by SNH, planning authorities and landscape assessors. Design is a material consideration in the planning process and good siting and design helps to produce development which is appropriate for a landscape whilst delivering renewable energy. It should also maximise the capacity for further development by reducing negative cumulative effects.
- 1.2 In 2001 we published '*Guidelines on the Environmental Impacts of Wind farms and Small Scale Hydroelectric Schemes*', which included guidance on the siting and design of wind farms. Our understanding of the effects of wind farm siting and design has developed significantly since then and new issues, such as the cumulative impacts of multiple developments, have emerged.
- 1.3 In 2009 we published version 1 of this guidance, following extensive consultation. This new version includes new photography and we have clarified some aspects of the text. References to new guidance and research are also included. However, the basic siting and design principles are the same as version 1 as these remain relevant and have proven to be valuable in determining applications. Knowledge and understanding in this area is evolving quickly and it is expected that this guidance will need to be regularly reviewed and updated as a result.
- 1.4 Version 1 contained two parts, with Part 2 focussing on strategic planning. The Scottish Government is currently undertaking a review of Scottish Planning Policy (SPP), with a new version due in June 2014. Part 2 of this version will be revised later this year to reflect the new SPP.
- 1.5 This is guidance on landscape issues, building upon areas of SNH renewables policy. It does not refer to wider technical design considerations (such as wind speed, access to grid) or to other natural heritage issues (such as impacts on birds, other wildlife and habitats) which are also of importance. A range of other considerations such as noise, archaeology, access and transport are also relevant to the design of wind farms and guidance on these topics is available elsewhere, such as the [GPWIND](#) website.
- 1.6 This document should be used alongside our ***Strategic Locational Guidance for Onshore Wind farms*** (2002, updated March 2009), ***Assessing the Cumulative Impact of Onshore Wind Energy Developments*** (2012), and ***Visual Representation of Wind farms Good Practice Guidance*** (2006)¹, available on our website. For offshore wind farms reference should be made to ***Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape*** (2012).
- 1.7 Developers and those involved in wind farm design should also refer to the Spatial Frameworks being developed by Local Authorities in response to ***Scottish Planning Policy*** (SPP). When considering an individual application the adopted development plan, supplementary guidance, wind energy capacity studies and SPP provide the framework within which the application should be considered.
- 1.8 The views expressed in this document are drawn from the experience of SNH staff who have advised on wind farm applications across Scotland in many different landscape settings and at many different scales of development. They have also been informed by a public consultation exercise and a workshop held at Battleby in March 2009. The first version was published in December 2009. Since then it has been referred to extensively at Public Local Inquiries. Experienced gained at Inquiry and decisions by Scottish Government Reporters have also influenced this revision.

¹ Note – this guidance is currently under review

Background

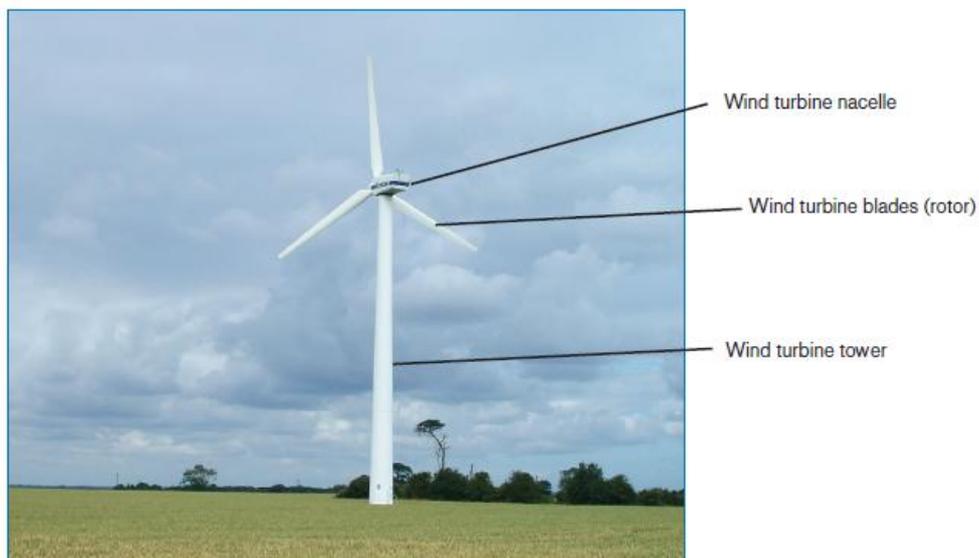
- 1.9 SNH strongly supports the adoption of renewable energy technologies, including wind farms, to address the effects of climate change. We support the Scottish Government's adopted policy in SPP and the current target of generating the equivalent of 100% of our electricity from renewables by 2020. Wind farms have an important role to play in this, taking advantage of the excellent wind resource in Scotland.
- 1.10 Our support for renewables has to be balanced with the Scottish Government's commitments and aspirations to conserve and enhance the natural heritage, including the quality and diversity of Scotland's landscapes. The purpose of this guidance is to help guide wind farms towards those landscapes best able to accommodate them and to advise on how they can be designed to minimise landscape and visual impacts.
- 1.11 Scotland is renowned for the diversity and quality of its landscapes and scenery. This contributes to the overall quality of life for all who live in or visit Scotland and provides a setting for our economic activity, including tourism. Landscape is the basis for many of our social, community and cultural values.
- 1.12 The European Landscape Convention applies to all landscapes and recognises landscape character assessment as a way of informing decisions. The Convention promotes integrated policies for landscape protection, management and planning, and encourages the involvement of the public in developing these. Our [Landscape Policy Framework](#) recognises the importance of landscape to Scotland's natural heritage and people's lives, while acknowledging that this relationship will change as landscapes evolve.
- 1.13 Wind turbines are generally large structures with the potential to have significant landscape and visual impacts. The development of wind farms, including associated infrastructure such as tracks, power-lines and ancillary buildings, has already had a major impact on many of Scotland's landscapes – arguably the biggest change since that resulting in some parts of Scotland from commercial afforestation in the 1970s and 80s. More wind farms will be needed to meet renewable energy targets and the challenge is to make sure these are sited and designed well in landscapes most suited to this form of development.
- 1.14 Wind farms should be sited and designed so that adverse effects on landscape and visual amenity are minimised and so that areas which are highly valued for their landscapes and scenery are given due protection. If wind farms are sited and designed well the capacity of our landscape to incorporate this type of development is maximised.

2. Wind Turbine Design and Layout

- 2.1 The landscape and visual impacts of a wind farm are strongly influenced by the design and layout of the turbines. This section focuses upon the different types of wind turbine and wind farm layout, while the following section considers how these principles relate to landscape and visual characteristics.
- 2.2 Impacts also result from infrastructure serving the development, such as access tracks and borrow pits, anemometers, control buildings, and substations (where necessary). Design and siting of this ancillary infrastructure are also considered in this section.

Turbine form and design

- 2.3 A wind turbine comprises a tower that supports a nacelle which contains the electric generator and to which the turbine blades attach via a hub. Further guidance on wind turbines is available in the Scottish Government Planning Advice Note “[Onshore wind Turbines](#)”.



- 2.4 The landscape and visual impacts of a wind turbine vary not only with its size, but also with the make and model of the turbine proposed. Turbines of the same height may have varying appearances due to their different design and technical characteristics. There is an increasingly varied selection of turbine designs now available, especially in the lower height ranges. For further detail see our guidance on the [siting and design of small scale turbines](#).
- 2.5 It can be difficult for wind turbine developers to specify the actual model of turbine to be used because market availability, costs, and turbine technology may change during the period between submitting an application and actual construction. However, they will usually have a shortlist of preferred models for consideration and applications should include details of these. The LVIA and EIA should assess, as far as is possible, impacts of the model within the shortlist that represents the ‘worst case scenario’.

2.6 Turbine properties which are important when choosing the most appropriate model for a site include:

- the proportion of blade length to tower height;
- overall height to blade tip, colour and individual design
- the turbine's dynamic impact, resulting from rotation of its blades (larger, slow moving blades will have a very different impact from shorter, faster moving blades which may give the impression of increased clutter); and
- consistency with other existing and consented turbines in the vicinity.



The proportion of the tower to the blades should be considered as the visual effects can be quite different.

Turbine colour

2.7 Selecting the most appropriate colour for a turbine(s) is an important part of detailed windfarm design and mitigation. It has previously been assumed that wind turbines could be painted a colour that would camouflage them against their background. Experience has shown that it is not possible to 'hide' turbines. There are a large number of variables which affect visibility of wind turbines. These include:

- the immediate landscape context and anticipated backcloth against which the turbines will be viewed predominantly (for example sky, heather moorland, woodland, sea horizon). Colour contrast is an important factor affecting visibility. Generally, the base of a turbine is seen against the land and the tower and moving blades seen against the sky, so colour choice will inevitably be a compromise between reducing contrast with the land or with the sky;
- the direction the turbines will most frequently be viewed from (including the angle of the sun and how it is likely to reflect on the wind turbines);
- the predominant weather conditions (which will dictate typical sky colour and will vary for different parts of the country);
- seasonal variation in landscape colours;

- the number and type of viewer (e.g. resident, worker, recreational) and the nature of the viewpoint;
- distance from the development. Colour is most apparent in close views, and in these situations turbines are most likely to be viewed against the sky;
- the proposed design and layout of the windfarm; and other windfarms within the area.

2.8 Colour choice is therefore likely to be an ‘on-balance’ judgement based on a clear design objective or objectives, in order for these to be tested. Examples of design objectives may include:

- reduce visual impacts;
- camouflage;
- integrate with the landscape;
- reinforce local identity;
- reduce cumulative effects; or
- make a statement.

When dealing with a situation where a large number of variables exist, it is important to focus on one or two key design objectives.

2.9 As a general rule for most rural areas of Scotland:

- a single colour of turbine is generally preferable;
- the use of graded colours at the turbine base should be avoided as public perception studies have demonstrated that aesthetic unity is viewed favourably. Therefore graduated schemes, or turbines with colour variation, should be used with caution;
- a light grey colour generally achieves the best balance between reducing visibility and visual impacts when seen against the sky, although this works less well when viewed against the land;
- the use of coloured turbines (such as greens, browns or ochres) in an attempt to disguise wind turbines against a landscape backcloth is usually unsuccessful although variation from the standard light grey colour may be successful when the wind farm is backclothed from important viewpoints or receptors. The chosen turbine colour should respond to the character of the site and its setting;
- light coloured turbines seen against a land backdrop may have greater prominence than light or dark turbines seen against the sky;
- there is more scope to vary the colour of smaller turbines, which are often located on lower ground than larger turbines, and therefore more often backclothed by land;
- paint reflection should be minimised. Texture is an important factor in reducing reflectivity, and matt or light absorbent finishes are preferable;
- for multiple wind farm groups or wind farm extensions, cumulative colour effects will be a key consideration. A strategic approach to turbine colour is desirable and the colour of turbines should generally be consistent;
- precise colour tone and the degree of paint reflectivity should be specified at the application stage. Commercial implications may be a limitation to varying turbine colour on a commercial scale, including cost, availability, lead-in-time and weathering/fading;

- colour may be subject to aviation restrictions or, for off-shore turbines, navigational requirements. For example it is a navigational safety requirement for the base of off-shore turbines to be coloured bright yellow for 25 metres above sea level.



Variable colouring of turbine bases typically does not correspond with the skyline from most viewpoints and increases contrast when seen against the sky. From some viewpoints, this effect can also make the turbines seem to 'float'



Different colour of wind turbine components creates a more complex image and means the visibility of different sections varies



Pale grey turbines will look bright in certain light conditions, but will tend to convey a positive image. This may be associated with cleanliness and existing white foci in our landscape such as white-washed cottages



Grey wind turbines will appear less prominent when seen against a grey sky, although they will rarely match the shade

Turbine transformer colour

2.10 It is preferable to house wind turbine transformers within the turbine towers to minimise the number of elements and visual complexity of a wind farm. However, where transformers are housed separately near the turbine bases, the colour of the housing requires careful consideration. This should be site specific, relating to the surrounding land cover, but not the wind turbines, as transformers are rarely viewed against the skyline. This reduces their visibility and ensures that they are seen as a separate element to the turbine. They are less likely to detract from the simplicity of the turbine's form if well located and coloured. Browns, khakis and 'earth' colours are generally the most successful colour choices for transformers, with greens often appearing too bright.



Poorly coloured external transformer units can detract from the relatively simple form of turbines and complicate the visual effect

Turbine lighting

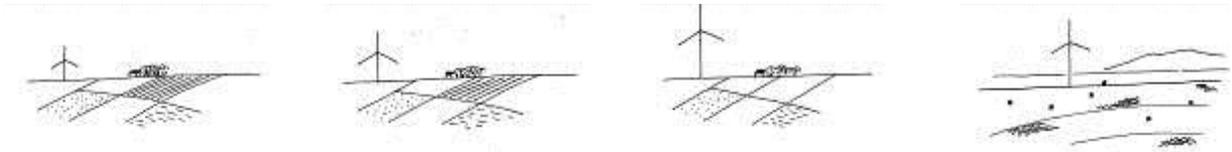
- 2.11 In some locations it may be necessary to light wind turbines for reasons of civil or military aviation safety or, for offshore wind farms, marine safety. Such lighting, typically at the top of the tower of the wind turbine, may appear prominent in night views and be incongruous in predominantly un-lit rural areas. Where lighting is necessary, it should be designed to minimise landscape and visual impacts whilst satisfying health and safety or navigation requirements. This may, for example, be achieved by incorporating shields so that the lights can only be seen from above. Developers should always refer to the [NATS](#), [CAA](#) and MoD for current requirements.
- 2.12 Lighting is predicted to become more widespread as sites are explored within flight paths and as larger turbines are considered. Current experience suggests that the main landscape and visual effects are likely to include:
- lighting visible over considerable distance. The Beatrice offshore turbines, off the Caithness coast are visible in clear conditions at distances of over 20 kilometres;
 - movement of turbine blades will create different effects depending on where the viewer is, in relation to the wind farm. If the turbine blades pass in front of the light, a flashing effect as they cut across the light is created. If the blades pass behind the light, there is a striped effect as the light runs up the passing blades. In both cases these effects draw the eye to the turbines;
 - there may be situations where constantly flashing lights are required, especially offshore;
 - in certain light conditions, lighting may appear to float above the ground even where the turbines themselves are not visible.

Turbine size

- 2.13 Wind energy technology has developed quickly and significantly larger wind turbines are now available. Turbines typically consist of 60 – 100 metre high towers with blades of 40 metres or more, so their overall height to blade tip is between 100 – 140 metres, though larger turbines are available. Longer blades result in a greater rotor area and this, combined with the fact that they extend upwards into higher wind velocities, means that their wind capture and energy production is significantly larger than the smaller turbines. Since 2010, mainly as a result of the Feed in Tariff, slightly smaller turbines have been more readily available, measuring between 60-80 metres to blade tip. This provides greater flexibility in choosing a turbine appropriate to local landscape characteristics.
- 2.14 Choice of turbine size is an integral part of the design process. Identification of the key landscape characteristics, their sensitivity and capacity to accommodate change will inform this. Generally speaking, large wind turbines will appear out of scale and visually dominant in lowland, settled, or smaller-scale landscapes, which are often characterised by the relatively ‘human scale’ of buildings and features. They are best suited to more extensive, upland areas, and set back from more sensitive upland fringes. This can reduce effects on settled and smaller-scale valleys and lowland landscapes.
- 2.15 Turbine size is also a key issue in upland landscapes, where they are viewed against, or from, landscapes of a more intricate scale and pattern; or where it is otherwise difficult to discern the landscape scale and distance. By illustrating the scale of an upland landscape, wind turbines may seem to compromise the expansive nature of these areas.



Increase of wind turbine height is not very noticeable within moorland landscape, due to lack of size indicators; nevertheless, there may be a threshold at which larger wind turbines no longer seem to directly relate to the local area of moorland but relate more closely to the neighbouring high mountains



The size of wind turbines is clearer within a distinct landscape pattern that includes definite scale indicators. Although older/ domestic wind turbines may relate to the scale of buildings, most commercial wind turbines will seem to dominate elements of landscape pattern. There may be, however, a threshold in some landscapes at which a larger wind turbine would no longer seem associated with the underlying landscape pattern but seem 'elevated' above it, by appearing to relate to larger components.

2.16 Our experience of different landscapes greatly varies, so it is not appropriate to provide generic guidelines on the turbine sizes to be used for particular landscape types. Site-specific assessment and design is essential for each development proposal.



Buildings act as a scale indicator and can accentuate the scale of turbines

Turbine scale

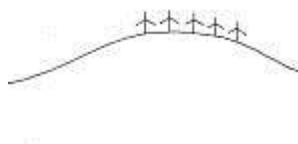
2.17 Size comparisons between wind turbines and other tall structures may help people visualise how tall a proposed development will appear in the landscape. Although the visibility of turbines will obviously increase with their greater height, the relationship between visual impact and turbine size is not directly proportional. This is because a wind farm is viewed within a surrounding context which varies, and because the actual size of a wind turbine is usually difficult to judge. Paragraph 3.33 provides further guidance in relation to scale relative to landform.

Ancillary infrastructure

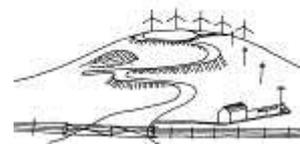
2.18 Ancillary elements for a wind farm development should be designed so they relate to the key characteristics of a landscape. It is important that these elements do not confuse the simplicity of the wind farm design, or act as a scale indicator for the turbines themselves. Undergrounding power lines within the wind farm, using transformers contained within tower bases (where possible), and careful siting of substations, transmission lines, access tracks, control buildings and anemometer masts will all help to achieve a coherent wind farm design. Simplicity of appearance and use of local, high quality materials will further enhance this.



Wind turbines can create an over-complex visual image in association with transmission lines and other infrastructure



Wind farm creates simple image in the landscape



Insensitive siting and design of wind farm infrastructure creates complex image and conflicts with underlying landscape character

2.19 There may be practical constraints in delivering large turbine components to a site, for example, due to the limitations of rural bridges, road junctions or corners. Additional landscape and visual impacts, associated with widening of roads, access tracks and corners to enable transportation of long turbine blades, should be taken into account.

2.20 Detailed advice on the siting and design of tracks can be found in [Constructed tracks in the Scottish Uplands](#).



Considerable road widening may be required to facilitate turbine access. These effects should be considered by the LVIA

Turbine layout / array

2.21 In a wind farm, turbines can be arranged in many different layouts. The layout should relate to the specific characteristics of the landscape - this means that the most suitable layout for every development will be different. The development process typically begins with a layout that responds mainly to wind speed and wind turbine specification, sited within defined land ownership / tenure boundaries. For a small wind farm, this might comprise a single row of wind turbines along a ridge; while, for a larger development, a grid of wind turbines is often taken as the starting point, with the turbines spaced at minimum separation distances to avoid turbulence.

2.22 From this starting point turbines will be moved or removed due to physical constraints, such as watercourses, areas of deep peat and steep slopes, and in response to sensitive habitat or wildlife species. During this process of modification, landscape and visual issues will also inform the layout. Although some landscape and visual concerns – such as the need to avoid visibility from a particularly sensitive viewpoint - may present an absolute constraint, many landscape and visual sensitivities can be addressed through good design. This commonly involves a number of changes to create the most appropriate wind farm.

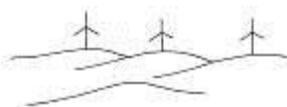


This wind farm appears linear from this angle and regular spacing between turbines helps achieve a relatively simple design

- 2.23 There are several common types of layout divided into regular or irregular formats. Generally, the fewer turbines and the simpler the layout on an even landform, the easier it is to create a positive feature - visually balanced, simple and consistent in image as it is viewed from various directions. This is most easily achieved by a simple line upon level ground. As soon as there is deviation from this, the design becomes more complicated.
- 2.24 A regular shape, such as a double line, a triangle, or a grid can appear appropriate within a wide open and level space where there is a regular landscape pattern, such as within agricultural fields. However, as you move through the landscape and see it from different directions and elevations, views of the grid change and reveal a variable effect, seemingly ordered along some rows, but in others overlapping. In addition, the rationale of the position of turbines appears confused if they are at different elevations.
- 2.25 Irregular layouts can be more appropriate in landscapes of variable elevation and pattern. However, irregular forms pose a greater challenge in terms of achieving a simple image, as the turbines will interact in varying ways with each other as well as with the underlying landscape. This can result in negative effects such as uneven visual densities of wind turbines, overlapping turbine rotors (often termed 'stacking'), partial screening behind a skyline and turbine outliers separate from the main group.
- 2.26 Wind farms should relate to underlying landscape characteristics of a similar scale and/or prominence. Wind turbines can be accommodated in areas of complex pattern, provided that their siting and design does not dominate the elements which define this. Odd numbers of turbines often present a more balanced composition than even numbers.
- 2.27 The design of offshore wind farms, with the greatest number of turbines in formal grid layouts, can lead to distinctive visual effects. From one part of the coast offshore turbines will be seen clearly in rows with the sea horizon visible between them, but by moving along the coast the design can appear more confused, with the turbines appearing as a constant mass on the horizon. It will be important to consider these design effects during project development and appraise the wind farm's image from sensitive receptors.



A wind farm layout appears simplest where it relates directly to the underlying landscape characteristics



Wind turbines relate to small-scale undulations at a local level. However, if the key views are distant, these undulations would not be obvious and the wind turbines would alternatively appear in closest association with the broad scale landform

Alternatively, the wind farm can be designed to relate to the broad scale landform

Micrositing

2.28 Micrositing is the siting of wind turbines in small incremental distances and is used at two main stages of wind farm development:

- firstly, during the design stage to ensure that turbine layout is satisfactory from key viewpoints and achieves the design objectives. It can also be used to maximise the screening benefits of landform or landcover from key viewpoints.
- secondly, during the construction phase of a project, where previously unexpected conditions are encountered on site. This may happen, for example, where a turbine needs to be located away from an area of peat that is deeper than predicted.

2.29 Developers should seek to minimise the need for micrositing during the construction phase by conducting thorough site investigation during the design process. Micrositing is usually covered by a planning condition which limits this to 50-100m from the consented turbine location.

2.30 Micrositing during construction can have a significant effect on the appearance of a wind farm, especially those set out in regular patterns such as grids or evenly-spaced lines. Any significant changes in layout should be assessed to ensure that the overall design objectives for the site are not compromised. Decision-makers should also consider the extent of micrositing that it is appropriate to allow when consenting development.



Regular layouts require careful assessment from key viewpoints and care is required during micrositing

2.31 Where there is a clear need to maintain turbine layout in accordance with submitted plans, the permissible micrositing distances may need to be strictly limited. This is particularly important for sites of limited numbers of turbines, where there is a strongly formal layout or where micrositing may result in changing the altitude of turbines and therefore affect the wind farm's relationship with surrounding topography.

2.32 Planning permissions should therefore contain a condition limiting the distance that turbines can be microsited without a requirement for further permission. It is important that micrositing conditions are tailored to the nature and scale of the proposed development, and to the possible effects on layout and the overall visual coherence of the scheme.

3. Wind farm Siting and Design

- 3.1 This section applies the design principles outlined in Section 2 to landscape and visual effects. Experience has shown that the application of these principles will reduce the overall landscape and visual impacts of a wind farm.
- 3.2 Reference is made to the categories of wind farm size listed below. This grouping is for the sake of simplification: landscape and visual impacts are not directly proportional to wind turbine numbers. Turbine height is also an important consideration in design.

Wind farm size	Number of turbines
Small	1-3
Medium	3-20
Large	20-50
Very Large	50+

Landscape character

- 3.3 The first step in the Landscape Impact Assessment (LIA) is to assess the landscape character of the study area and to identify the key characteristics relevant to wind farm development. Different places have different 'landscape character', comprised of distinct and recognisable patterns of elements. These relate to underlying geology, landform, soils, vegetation, land use and settlement. Taken together these qualities contribute to regional distinctiveness and 'sense of place'. Understanding a landscape's key characteristics and features is vital in considering how new development would affect it or, with appropriate design, could contribute to it.
- 3.4 Landscape Character Assessment (LCA) helps us understand what the landscape is like today, how it came to be like this and how it may change in the future. LCA helps to ensure that change does not undermine whatever is characteristic or valued about a particular landscape, and that ways of improving the character can be considered.
- 3.5 At a regional scale, [our Landscape Character Assessments](#) may inform this assessment. Our national programme of LCA comprises 27 studies and an overview report. These LCAs describe landscape character across the country, and also identify the main forces for change in these landscapes. It should be noted that many of the LCAs were produced during the 1990s and, although they remain relevant as descriptors of landscape character, do not necessarily address the sensitivity of particular landscape character types to wind farm development. We are currently working on refreshing the LCA suite, in order to bring the individual reports into a single digital database.
- 3.6 LIA should also include a more detailed assessment of local landscape characteristics and how they are experienced in relation to the specific proposal. Areas of transition between landscape character types are often particularly sensitive, such as the change from a lowland strath to upland foothills or scarp slopes. LIAs should include an assessment of the extent and distribution of predicted visibility within all relevant character areas.

Landscape and scenic value

- 3.7 A landscape may be valued for many reasons, such as its landscape quality, scenic beauty, tranquillity or wildness, for its recreation opportunities, nature conservation or its historic and cultural associations. A wind farm will not necessarily be incompatible with valued qualities of a landscape; this will depend on the nature of the development and the nature of the landscape qualities.
- 3.8 LCAs do not place value on one landscape type over another, but they may point to the reasons why a landscape might be valued, because of special characteristics or the experience the landscape offers. Landscape and scenic value is recognised at national and local levels through development plan policies and designations such as National Parks, National Scenic Area (NSA) or local landscape designations including new Special Landscape Areas (SLA) and Areas of Great Landscape Value (AGLV), World Heritage Sites and Conservation Areas. In many areas, wind farm development is located outwith but close to these designations. In these circumstances the effects on the setting of the designated landscape are a key consideration.
- 3.9 Designations are usually supported by legislation and / or specific planning policies at a national and local level. The lack of any designation does not imply that a landscape has no value. Some landscapes are strongly valued in cultural heritage terms, for example, while others may be valued for their perceived lack of human influence. In line with the **European Landscape Convention** we promote an ‘all-landscapes approach’, founded on the recognition of value in all landscapes.
- 3.10 The challenge is to ascertain why a landscape is valued and by whom, and then assess the predicted impacts of the proposed development on these values. The quality of a valued landscape is often set out in a citation or description. NSAs for example are described in ‘**Scotland’s Scenic Heritage**’ and our series of **Special Qualities reports**.
- 3.11 The key test applied in relation to NSAs, but often employed for other valued landscapes too, is whether impacts would affect the *integrity* of a valued landscape. It is important to consider the effects of wind farms located just outside areas identified for their scenic quality, as these have the potential to affect the setting, and potentially the integrity, of that designation.
- 3.12 For local landscape designations, relevant information is contained within Development Plans. Where Planning Authorities have undertaken recent reviews of their local landscape designations, there may be Statements of Significance which can be referred to. However, for some valued areas, this information may not be available and the LVIA needs to first establish the quality of the valued landscape through assessment of the baseline conditions and how people use and benefit from the landscape (for example through consultation, visitor information and user websites).

Wild land and places with a strong sense of remoteness

- 3.13 Areas of Scotland which are remote, inaccessible and rugged, with little evidence of human influence are widely referred to as ‘wild land’. These characteristics and the value they receive are discussed in ‘**Wildness in Scotland’s Countryside**’ (2002). The majority of the population think it important for Scotland to have wild places (**Public Perceptions of Wild Places and landscapes in Scotland**, 2008).
- 3.14 Some of the areas where wildness qualities predominate lie outside designated areas and therefore lack any statutory protection. However, SPP recognises their sensitivity and tasks Planning Authorities to take great care to safeguard their character through specific policies in Development Plans. In 2002, we identified ‘**Search Areas for Wild Land**’ (SAWLs) which represented the broad areas where wild land is likely to be present. Further work to update this map has been taken forward, and this section will be updated when the new SPP is published.

- 3.15 Our Strategic Locational Guidance states that the mapped SAWLs have high sensitivity to wind farms and proposals in these areas are unlikely to be compatible with their wild land qualities. Perception of wild land relies on there being no, or minimal, visibility of man-made features. Wind farms, like any built structure, will generally be out of character in these areas – and the scope for mitigating impacts is very limited. In addition, the potential visibility of wind farms, individually and cumulatively, seen from within wild land areas can be a concern. Proposals likely to affect an area of wild land merit careful consideration. Our **interim guidance** sets out a method for this assessment.
- 3.16 Where there are isolated, built features within a landscape perceived to be wild land, such as bothies, shepherds' cottages, or shooting lodges, small-scale wind turbines should be located near to these structures where possible. Care is still required to ensure that wild land qualities would not be adversely affected.

Experiencing wind farms in the landscape

- 3.17 People's responses to wind farms vary – to some a wind farm may seem to dominate its surroundings, while others may view it as an exciting, modern addition with symbolic associations with clean energy and sustainability. Our understanding of people's responses to wind farm development is informed by a number of public attitude studies. **UK-wide research** has shown that two thirds of adults are in favour of wind power.
- 3.18 The impact of a wind farm will depend on how, and from where, it is experienced; for example, from inside a residence, while moving along a road, or from a remote mountaintop. These factors are taken into account through LVIA when determining the sensitivity of the landscape and visual resource, and the people that will be affected by the development (receptors). LVIA includes assessment of impacts upon the key users of the landscape, including residents, motorists, workers, those partaking in recreation and tourists.
- 3.19 A wind farm's impacts on local residents requires particular attention as, unlike visitors, they will experience a wind farm from different locations, at different times of the day, usually for longer periods of time, and in different seasons. Conversely, impacts on tourists and those taking part in recreation may be relatively brief, but their sensitivity to landscape change is regarded as high because their purpose is often to enjoy their surroundings.
- 3.20 It is important to take account of how a wind farm will be experienced from surrounding roads, transport, and recreational routes. Views will vary depending on proximity to the road, the mode of transport, the angle of view, and intervening landscape features. The first glimpse of a wind farm is important, and careful consideration should be given to the design of the wind farm layout in relation to these views.
- 3.21 As larger numbers of wind farms are built it has become increasingly important to consider their cumulative effects and the context in which they are seen. Of particular importance are: how 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. Further detail on this aspect of LVIA can be found in our '**Cumulative Effect of Wind Farms**' guidance.
- 3.22 The visibility and visual impacts of a wind farm are affected by the distance from which it is viewed, as well as other aspects such as weather conditions, siting and its context. In the past, several guidance notes offered generic categories of degrees of visibility and visual impact related to distance. This is no longer considered helpful as there is now such variation in turbine size and design. Wind turbines of between 100 – 150m can be visible at distances of up to 40 or 50km in some conditions; whilst single turbines of up to 50m are only visible at smaller distances. The LVIA needs to assess the likely visibility of an individual application in detail.

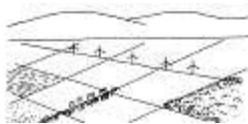


Views from above the wind farm should be considered if there are sensitive recreational viewpoints

Wind farm siting and design in relation to landscape and visual characteristics

3.23 It is important to site and design a wind farm so that it relates directly to the qualities of a specific site. The main design elements are likely to include the following:

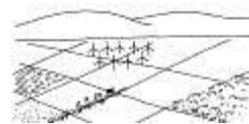
- layout and number of wind turbines;
- size, design, and proportion of wind turbines;
- type, route and design of access tracks, including the amount of cut and fill required and the junctions with public roads;
- location, design and restoration of hardstandings
- location, design and restoration of borrow pits;
- location, design and restoration of temporary construction compounds;
- location and size of wind monitoring masts;
- positioning and mitigation of turbine lighting (if required);
- visitor facilities, including paths, signs, parking and visitor centre (if proposed); and
- land management changes, such as muirburn, woodland management or felling, fences, and stock grazing.



Line of wind turbines relates to landscape pattern



Line of wind turbines appears irrational across open hill

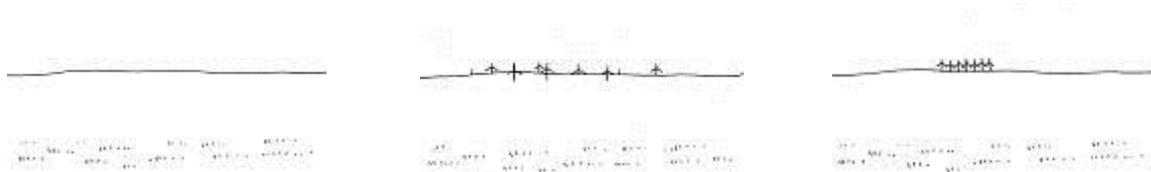


Cluster of wind turbines appears irrational in relation to linear elements of landscape pattern

Landform

3.24 Landform is a key landscape characteristic, affecting whether it is rugged, flat, undulating or rolling, upland or lowland. In flat landscapes, any undulations tend to become accentuated so that even low hills appear substantial.

3.25 It is very difficult to design a wind farm upon a variable landform, such as undulating, rugged moorland or hills, without presenting a confusing image. This is because the wind turbines will be seen from different directions, at varying elevations and spacing, and against varying backdrops. To avoid this effect, it is generally preferable for wind turbines to be grouped on the most level part of a site so the development appears more cohesive, rather than as a poorly related group of turbines.

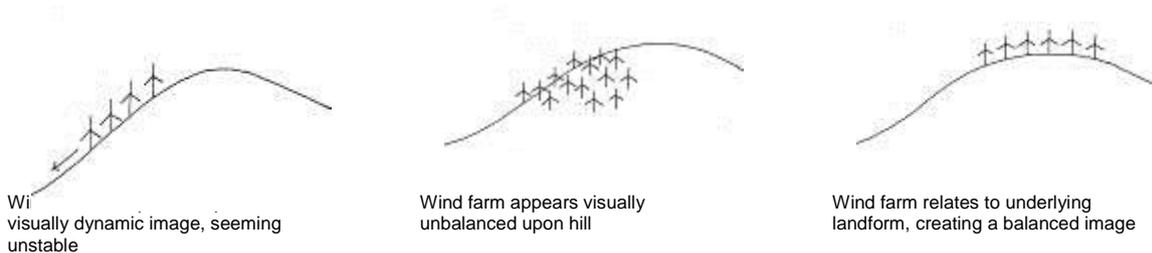


At a broad scale, moorland appears fairly simple in landform and pattern

Relative positions of wind turbines illustrates landform undulations that actually exist and, consequently, create complex image

One option is to cluster wind turbines close together upon a local area of flatter ground, so that the variation is less obvious than the image of a single collective feature

3.26 It is important to site and design a wind farm so that it appears visually balanced in relation to the underlying and surrounding landform. Turbines seen upon steep slopes often appear to be 'unstable'. It is also important that the scale and extent of a wind farm do not seem to overwhelm the distinctive character and scale of a landform, especially prominent landforms. Single turbines are particularly challenging to site as they are often the only major vertical forms in the landscape.



Wind farm on steep slope is visually dynamic image, seeming unstable

Wind farm appears visually unbalanced upon hill

Wind farm relates to underlying landform, creating a balanced image

3.27 Skylines are of critical importance. This is illustrated by the contrast between the simple, horizontal skylines of wide, flat landscapes and the more complex, vertical and diagonal components of skylines formed by mountains and hills. The viewer's eye is naturally drawn to the skyline, although the extent to which this happens depends on the nature of the skyline, the distribution and type of other elements and foci within the scene. The skyline may be especially valued if it conveys a sense of wildness; forms the backdrop to a settlement; is a particularly distinctive landform, or where notable landmarks and/or cultural features appear on it.

3.28 Given the prominence of skylines, it is particularly important that a wind farm avoids, or is sited and designed to relate to them. A key challenge is that the skyline will vary in relation to the

position and elevation of a viewer, and the weather. Nevertheless, the design of a wind farm from key viewpoints and routes should ensure it does not detract from the character of a distinctive skyline.

- 3.29 Care should be taken to ensure that the wind farm does not overwhelm the skyline. Distinctive and prominent skylines should not be interrupted by turbines. If the skyline is 'simple' in nature, for example over moorland and hills, it is important that wind turbines possess a simple visual relationship to this feature, avoiding variable height and spacing, the overlapping of turbines, or blade tips intermittently 'breaking' the skyline.



The relationship between a wind farm and more distant skylines should be considered, particularly in open landscape where long distance views are important

- 3.30 The landform may provide a design opportunity to limit visibility of wind turbines and site infrastructure. For example, where a wind farm is to be sited on a hill ridge, turbines may be set back from the edge and placed such that the slopes preclude visibility from below, reducing visual intrusion on the more settled lowlands, even if they may be clearly visible from adjacent hills. Narrow bands of uplands between settled and smaller-scale valleys should be avoided, if a windfarm on the hills would dominate the landscape on both sides.



Wind farm relates simply to skyline



Wind farm contrasts in character to skyline



Wind farm seems to overwhelm visible extent of skyline



Wind farm appears as isolated and minor feature on skyline

Landscape scale

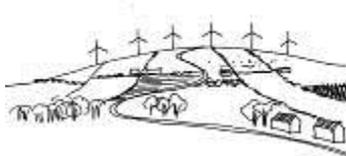
- 3.31 The term 'scale' does not refer to a definite dimension, but describes the perception of relative size between elements, for example a large-scale, open moorland or mountainous landscape and a small-scale, sheltered glen. To perceive scale, we rely on elements whose size and extent are recognisable to us – common features such as trees and houses. We use these as scale indicators to gauge the size and distance of other elements and make spatial judgements.
- 3.32 Landscape scale and openness are particularly important characteristics in relation to wind turbines because large wind turbines can easily seem to dominate some landscapes. For this reason, landscape scale can dictate the ability of an area to accommodate wind farm development, both horizontally and vertically.
- 3.33 A key design objective will be finding an appropriate scale for the wind farm that is in keeping with that of the landscape. The wind farm should be:
- of minor vertical scale in relation to the key features of the landscape (typically less than one third);
 - of minor horizontal scale in relation to the key features of the landscape (where the wind farm is surrounded by a much larger proportion of open space than occupied by the development);
 - of minor size compared to other key features and foci within the landscape; or separated from these by a sufficiently large area of open space (either horizontally or vertically) so that direct scale comparison does not occur.

Perspective

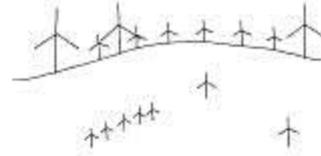
- 3.34 Scale indicators within a landscape affect our judgement of perspective and thus our recognition of whether a feature is small or far away, large or near. The introduction of turbines into a landscape can confuse this sense of perspective as they are of undefined size, yet often much larger than any other man-made structures that would help us judge how large and how near they are. Careful consideration is therefore needed in the siting and design of wind farms, and between wind farms, to avoid confusing our sense of perspective. This is particularly the case where different turbine sizes are used and / or where there are gaps between groups of wind turbines at varying distances to viewers. Further guidance is given in [Siting and Design of small-scale wind turbines of between 15 and 50 metres in height](#).



Wind farm relates to key characteristic of the landscape, which is that it is difficult to perceive scale and distance within moorland



Visual link between wind farm and elements of known size, aid perception of scale and distance, emphasising the height of the wind turbines



Perception of scale and distance seems distorted due to variable sizes of wind turbines combined with an absence of reference points and size indicators

Land use

- 3.35 Land use is an important aspect of landscape character, reflecting the past and current activity of an area. In turn, land use influences landscape pattern, texture, colour, foci and the framework of these elements within an area, which may be simple or complex and affect how people move through and view a landscape. Land management can also affect the condition of a landscape and the perception of its value, e.g. whether it seems neglected or well-maintained.

- 3.36 Wind energy generation may form one part of many different land uses. Existing developments vary in their location from urban areas, industrial and harbour areas, agricultural ground, woodland, and moorland. Wind energy can relate to some land uses. Conversely, wind farms are less likely to relate well to wild land areas and sensitive residential locations. A key design objective is to relate directly to the specific characteristics of the land use or, alternatively, to appear separate and removed from these, avoiding conflicts in nature and function.



This wind farm relates well to neighbouring land use and maintains the distinction between agricultural, forestry and upland character

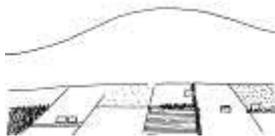
- 3.37 Where appropriate, the development of a wind farm can act as the stimulus for restoration and/or improvement of land use within or around the site. For example the removal of commercial forestry can lead to new uses such as grazing, heathland or peatland.

Landscape and visual pattern

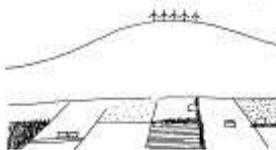
- 3.38 Landscape and visual pattern are created through the presence and arrangement of key landscape elements and features. They are strongly influenced by land use. They arise from the way in which features in an area interact, be they a network of drystone dykes, hedgerows, shelter-belts, drainage channels, the distribution of drumlins along a valley, or repeated rock formations.
- 3.39 Wind energy developments should be designed to relate to landscape pattern where this contributes to landscape character and visual composition. However, the elements of landscape pattern to which a wind farm should relate will be strongly affected by their scale and prominence.
- 3.40 The distinctive character of some landscapes relies on strong contrasts of pattern, for example an intricate arrangement of fields and regular spacing of croft houses seen against a simple moorland hill backcloth. In these locations, it is important that the addition of a wind farm neither compromises the simplicity of the backcloth hills, nor the hierarchy or pattern of the lowland landscape below.



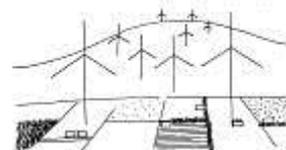
Lowland settings often have more complex landscape patterns



Distinction of lowland landscape pattern relies partly on simple backcloth that highlights this in contrast



Wind farm detached from landscape pattern. Creates a focal feature that will distract slightly from lowland landscape, but distance maintains most of simple hill backcloth.



Wind farm not only contrasts to lowland landscape pattern, but reduces distinction by crossing over into neighbouring area of simple hill.

Focal features

3.41 Focal features can be natural features, such as mountain peaks, ridges, rock outcrops or clumps of trees; or they may be man-made structures like hill-forts, masts and towers. They can also be formed by existing wind turbines / wind farms. They may form part of landscape pattern or be seen as isolated features within a landscape. Often, where the landscape panorama is complex, there will be a hierarchy of foci that will be influenced by the relative size, distribution, position, prominence and cultural value placed upon them.

3.42 Wind farms, because of their very nature and typical location within open landscapes, often become major focal points. Their interaction with the existing hierarchy of foci needs to be considered in their siting and design, in order to minimise visual conflicts or avoid compromising the value of existing foci.



Existing focal points within landscape



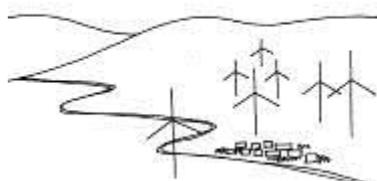
Wind farm reduces focal prominence and distinction of original foci



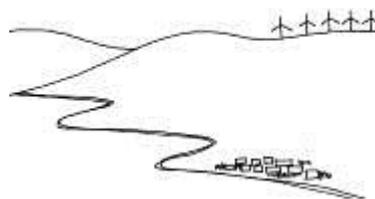
Wind farm creates prominent focal feature, but does not seem to intrude upon or reduce distinction of existing foci due to separation

Settlements and urban / industrial landscapes

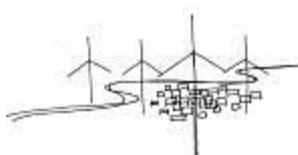
- 3.43 Settlements and buildings within a landscape tend to be sensitive to the development of a wind farm for three main reasons:
- by being places from which people will view a wind farm and within which a key quality may be the provision of shelter and a sense of refuge that may seem impinged upon by the movement and proximity of a wind turbine;
 - because buildings act as a size indicator in views that may emphasise the much greater scale of wind turbines in comparison; and
 - because the settlement itself often forms a focal feature / landscape pattern to which a development would need to relate.
- 3.44 It is important that wind farms do not dominate or negatively affect settlements. The threshold for this effect will vary in different landscapes, for different settlements and with different wind farm and wind turbine designs.
- 3.45 Individual domestic-scale turbines can be located nearer to buildings for small-scale industry, agriculture or for residential use. These may be relatively noticeable due to the faster blade rotation of smaller machines. We have published separate **guidance** on the siting and design of small-scale turbines.
- 3.46 There may be some locations where larger wind turbines can be accommodated near to or within urban and industrial locations. Key issues to address in these situations will be residential amenity, noise and shadow flicker. In these settings, large wind turbines can appear most appropriate where they are separated slightly from buildings; are seen set back against an area of open space and visual simplicity; or are marginal to the urban/industrial area, for example, along a river edge, road corridor, the coast or large open space.



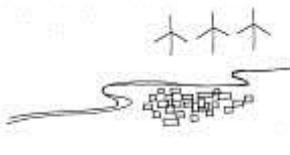
Wind farm appears to impinge upon neighbouring settlement



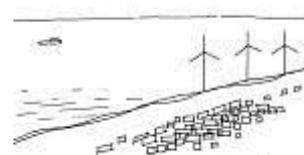
Wind farm separated from settlement by open space



Wind farm impinges upon space and views of adjacent settlement



Wind farm prominent in views from settlement but does not seem impinging because of separation space



Wind farm near to settlement, but seems less impinging due to adjacent open space offered by sea

- 3.47 The aim should be to minimise the sense of imposition upon buildings and more intimate spaces. This can be achieved by setting the turbines against an open background and avoiding the creation of a visually complex image. In these circumstances, careful consideration of the nature of views in and out of these areas is needed, along with appreciation of the nature of impacts from recreational areas and residences.
- 3.48 In some places, larger turbines with slower rotation of blades may be preferable to smaller turbines with faster speeds. However, there will always be a need to relate the size of the turbines to the local context, taking account of the existing buildings and foci.
- 3.49 Landscape value, which may be reflected by designations such as World Heritage Sites, Conservation Areas or areas with Tall Building Policies, will also need to be considered.



Wind turbines can fit well in an urban / industrial context but the scale of the turbine must relate to local landscape features and buildings

- 3.50 Other factors to consider within urban situations, and which should be addressed through LVIA are;
- intervisibility between urban and rural landscape;
 - setting of turbines;
 - lines of sight between well known viewpoints;
 - views to and from existing focal points; and
 - the relationship between wind turbines in urban areas and those in the surrounding landscape and seascape.

Coast

- 3.51 Scotland has a great diversity of coastal landscapes and onshore wind farms near to the coast require careful consideration. Many are remote, isolated and undeveloped. They range from low-lying beaches with dunes to craggy intricate cliffs and headlands. An **assessment undertaken for SNH** characterises the coastline of Scotland into 33 seascape units. Recent

work, linked to landscape character assessment, sets out how to assess coastal character. Guidance on Coastal Character Assessment will be published later in 2014.

- 3.52 Wind farms, both on- and off-shore, should relate to the sense of openness and exposure within coastal areas. However, as Scotland's settlement pattern has a strong coastal focus, and views are typically drawn to the coast, these areas will be sensitive to wind farm location and design. These considerations relate to the inland and offshore land/seascape character and views, including views from boats and ferries. Simple, open, less settled, flat coastal areas can better accommodate wind farms than complex coastal landscapes, such as those with inlets and islands. Industrial or port areas may be considered more suitable than less developed coasts.
- 3.53 Due to the focus of views along coastlines and the typical concentration of settlements within these areas, a wind farm located near the coast will tend to create a new focal feature or landmark. For this reason, it is important that they do not detract from existing landmarks like historical or navigational features (such as lighthouses), distinctive coastal landforms, coastal settlements and areas valued for recreation.
- 3.54 Cumulative impacts can occur between onshore and offshore wind energy developments. This becomes an increasingly important design consideration as leases are granted to develop wind farms in Scottish inshore and offshore waters. From inland areas it may not be apparent that a wind farm is situated offshore if its location within the sea is screened by inland features. In turn, onshore developments may affect how those offshore are perceived. It may, for example, be undesirable to view off-shore development with onshore development in the foreground. Further guidance can be found in '[Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape](#)'.

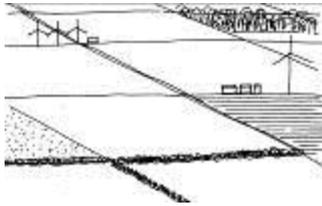
Woodland

- 3.55 Where turbines are seen from a distance in combination with woodland, their large scale can be difficult to discern. However, where wind farms are sited immediately adjacent to, or within woodland areas, trees act as a scale indicator accentuating turbine size.
- 3.56 Trees are only likely to have a screening effect if they occur within the fore or midground of views looking towards turbines in the distance. If this occurs, the screening effect may change or be lost as one moves through the landscape. The felling or harvesting cycles of commercial forestry will determine how long screening is effective for.
- 3.57 Large-scale conifer plantations, particularly when seen from a distance and upon slopes, can create distinctive lines, colour, texture and shape. Ordinarily, the design objective would be to relate to this distinctive landscape pattern. However, in contrast to native woodland, forest plantations are less permanent features of the landscape. For this reason the designer needs to consider future plans for a forest and consider whether this, or the underlying and surrounding landscape, is of greater relevance in defining the character of the landscape to which the wind farm should relate.
- 3.58 If a wind farm is located within a forest, the clearance of trees to create open spaces for the turbine bases and access tracks can create a pattern of spaces, lines and shapes that may increase the complexity of the wind farm from distant views.

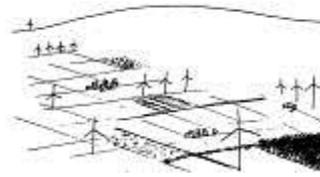
Small / Community Wind farms

- 3.59 Small-scale community owned wind farms can make a very positive contribution to rural economic development. However, single turbines or small wind farms do not necessarily result in less landscape and visual impact than a larger development. As the efficiency of wind turbines increases this may lead to proposals with fewer yet relatively large turbines in

landscapes which have limited capacity to accommodate them. Whilst a community development may be preferred within an area due to its contribution to the local economy, the ownership of a development does not mitigate landscape and visual impacts. All wind farm development should be carefully and consistently assessed through LVIA (albeit scoped to fit the scale and nature of the development), including cumulative effects.



Single and small wind farms fitted to agricultural landscape pattern

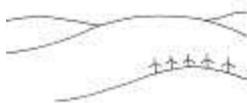


Although individual developments are all small-scale and fitted to local characteristics, developments cumulatively become defining element of character type – a 'wind farm landscape'

- 3.60 Multiple individual wind turbines and / or small wind farms can cause considerable cumulative impacts, especially where these are randomly located or of different designs. Despite generally smaller turbine heights there is still a need for developments to be sited and designed in relation to each other in order to avoid negative impacts on landscape character and visual amenity. It is recommended that Local Authorities have robust spatial and design policies to help minimise landscape and visual impacts from smaller scale wind farm development.

4. Designing in landscapes with multiple wind farms

- 4.1 The previous section highlighted the factors to be considered when designing individual wind farms. In many parts of Scotland the issue is how best to plan for and accommodate multiple wind farms. Many current proposals either form extensions to operational wind farms or are independent developments lying close to operational wind farms. This is complicated by the fact that, at any one time, many developments may be consented but not built, or submitted but not determined. This means that planning, siting and designing wind farms tends to be based on constantly changing baseline conditions.
- 4.2 Cumulative impacts occur when one wind farm is proposed in the vicinity of another existing or proposed wind farm. We have published guidance on assessing the **Cumulative Effects of Wind Farms** which sets out when and how cumulative effects should be considered. This section contains design guidance to be used in circumstances where cumulative effects are expected to arise.
- 4.3 As part of the design process where other wind farms exist or are proposed, it will be important to undertake an assessment at a strategic level of the potential cumulative landscape and visual impacts. The impact of smaller wind farms, and in some cases individual turbines, will also require consideration. The methodologies contained with the Cumulative Effects of Wind farms guidance should be helpful, as may **Topic Paper 6 'Techniques and criteria for judging capacity and sensitivity'** (Natural England, 2004).
- 4.4 When designing an individual wind farm key design objectives should be developed as discussed in section 3. Where cumulative impacts are likely to occur within an area it is important to establish design objectives that can be consistently applied to all proposed developments. This should result in a similarity of design and wind farm image within an area that limits visual confusion, and reinforces the appropriateness of each development for its location. Cumulative design objectives should relate to ancillary infrastructure as well as wind turbines.



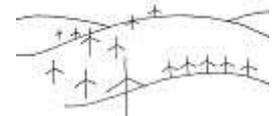
Individual wind farm relates directly to landform characteristic as single line upon horizon



Several developments relate consistently to key characteristic of the landscape, but not prevalent and thus remain as isolated features.



Multiple wind farms relate to same characteristic, to create consistent image and reinforce perceived appropriateness of each wind farm. However, by occupying every incidence of specific characteristic, will become key characteristic that affects overriding character



Additional wind farms contrast in pattern, scale and relationship to key characteristics, creating a confusing image and questioning relationship of original development to its surroundings.



The key characteristics of the landform are often illustrated most clearly by the skyline. In this open landscape, the skyline has a horizontal emphasis and uninterrupted character.



Wind farm acts as a prominent focus. Although it does not occupy a major proportion of the skyline, it contrasts to the horizontal emphasis at a local level as a single collective feature.



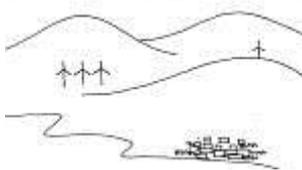
Additional development results cumulatively in major proportion of skyline being occupied by wind farms. In addition, its siting and shape does not relate to the skyline feature, nor horizontal emphasis.



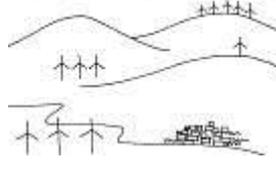
Wind farms cumulatively dominate the skyline feature, although they relate to its horizontal emphasis and simplicity of line.

4.5 The development of multiple wind farms can create different types of cumulative effect if they:

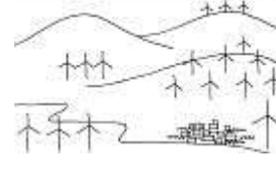
- are seen as separate isolated features within the landscape character type, too infrequent and of insufficient significance to be perceived as a characteristic of the area;
- are seen as a key characteristic of the landscape, but not of sufficient dominance to be a defining characteristic of the area;
- appear as a dominant characteristic of the area, seeming to define the character type as a 'wind farm landscape character area'.



Separate isolated features

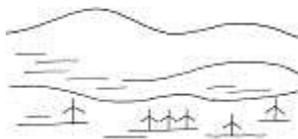


Wind farms become key characteristic of the landscape

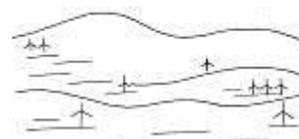


Wind farms become dominant characteristic of the area, creating a 'windfarm landscape'

4.6 These effects can occur at varying scales, for example affecting a local character type, or at a regional level. The appropriateness of these different effects will depend on the character and value of a landscape and the objectives for change as defined in Local Authorities' capacity studies.



Dominance of landscape character by wind farms occurs at local level only. Other areas of similar character not affected.



Dominance of landscape character at wider scale, but local pockets perceived as unaffected

Relating to landscape character

- 4.7 If wind farm development, or the visibility of wind farms, extends over several different landscape character areas or types, this can reduce the distinction between them. If wind farms already exist within a particular landscape character area or type, and it is appropriate to encourage further development, further wind farms should be limited to the same or similar types within the neighbouring area. An exception could be where these developments are of distinctly different character themselves, for example if they strongly contrast in scale.
- 4.8 The relationship of multiple developments to neighbouring landscape character types is very important, especially where developments are located near the boundary of these or will be highly visible from neighbouring landscape character types.



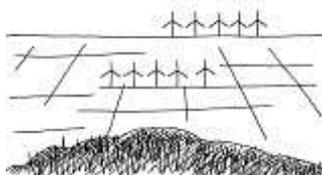
Distinct combination of contrasting character types – open hill, settlement and firth



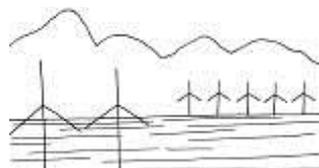
Wind farm creates new feature. This distracts from existing focus of view; however, distinction between character types is maintained.



Wind farms cross different character types, reducing the distinction between these.



Wind farm siting and design relates to simple landform and appears distant enough not to impose on nearby hills



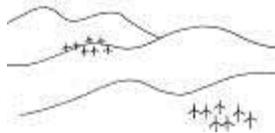
From alternative viewpoint, looking over agricultural ground, visibility of wind turbines is highlighted by backcloth. The turbines also compete with the visual prominence of the hill range.

Establishing new patterns

- 4.9 The opportunity to introduce a new landscape pattern through consistent design of turbine arrays will be important where a 'wind farm landscape' would be established. Existing landscape scale and pattern should be respected. Where a new pattern is proposed it will be important to identify key design prompts or cues within the landscape (which may be existing wind farms) and work with these. Consideration needs to be given to how the new pattern would relate to any existing neighbouring wind farms, and adjacent landscape character.

Relationship between wind farms

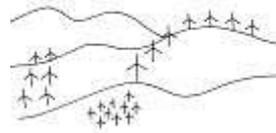
- 4.10 Where two or more wind farm proposals entering the planning system in parallel have the potential for landscape and visual effects in combination with existing or consented wind farms, this should be a material consideration in the planning process.



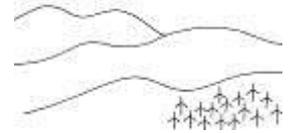
Distinct wind farm groups. Similarity of design and relationship to the landscape. With large areas of open space in between, character of underlying landscape prevails.



No clear distinction between group(s). Extending beyond skyline, it is not possible to confirm whether the groups link.



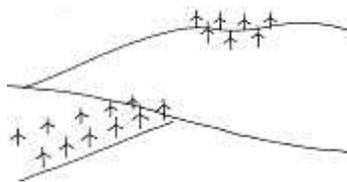
Although no clear area of space between wind farm groups, distinction highlighted due to contrasts of turbine scale and layout (variety of development type creates visual complexity).



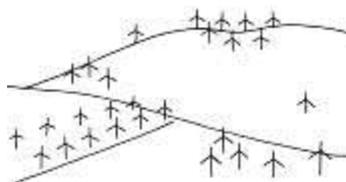
Extension to original development creates larger single wind farm. This has increased impacts in the local area, but limits the extent of impacts through the wider landscape.

4.11 A key factor determining the cumulative impact of wind farms is the distinct identity of each group. This relates to their degree of separation and similarity of design. This applies whether they are part of a single development, a wind farm extension, or a separate wind farm in a wider group. A wind farm, if located close to another of similar design, may appear as an extension; however, if it appears at least slightly separate and of different design, it may conflict with the other development. In these cases, if a landscape is unable to accommodate the scale of a combined development, wind farm groups should appear clearly separate. It is important to achieve a balance between wind farms and the undeveloped open landscape retained between them. Adequate separation will help to maintain wind farms as distinct entities. However, the separation distance required will vary according to the landscape characteristics.

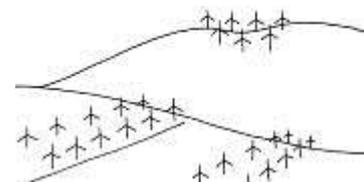
4.12 In some locations the existing pattern of wind farm development may be complex. Relating further development to a complex pattern will be challenging, but the same key principles should apply, focusing on improving the overall pattern and character of development rather than exacerbating existing conflicts between designs. Ancillary infrastructure, such as tracks, road upgrades, crane pads, fences, borrow pits and substations should be included in this assessment, as they may also cumulatively affect the character of the area.



Existing wind farm developments of contrasting design and relationship to the landscape.



Additional wind farm designs amplifies adverse cumulative impacts



Additional wind farm reinforces character of one original windfarm, although increases the sense of incongruity of the other.

- 4.13 In some circumstances, intervening topography may limit visibility and reduce the need for visual compatibility between neighbouring proposals, although site design should always be compatible with landscape character

Focal point pattern and scale

- 4.14 As multiple wind farms are built they are more likely to 'compete' with the landscape's original foci and it may lack a sole dominating focal point as a result. The design aspiration should be to avoid visual confusion and to maintain focal point pattern and hierarchy.

Settlements

- 4.15 Care should be taken to avoid multiple wind farms dominating the landscape setting of a settlement. Wind farms may do this if they are close to it at high elevation, surround or enclose the access and main approaches, dominate approaches through sequential cumulative effects (through the presence of several wind farms in succession), or are physically too close. How a 'wind farm landscape' relates to a settlement will depend on the design of the wind farms and their spatial relationships with each other, and how the settlement relates to its hinterland.

Wind farm extensions

- 4.16 Proposals for extensions to existing wind farms can give rise to similar issues of consistency as those arising from adjacent wind farm developments, and similar design principles should apply. Design objectives and principles should echo those of the original wind farm. Extensions should use turbines which are compatible with those in the existing wind farm, including aspects of scale, form, colour, and rotation speed. The design rationale of the original wind farm development should not be eroded.
- 4.17 Such compatibility issues will be more important the closer the wind farms are. Extensions should not compromise the landscape setting of neighbouring wind farms and should respect existing focal points in the landscape. The potential for a wind farm extension to 'outlive' the existing wind farm (if this is decommissioned), and therefore stand on its own, should also be considered in the design process.



The turbines used in wind farm extensions should closely match the existing turbines, such as in this example (original turbines in foreground, new turbines in background)

5. Landscape and Visual Assessment of Wind Farms

What is Landscape and Visual Impact Assessment?

- 5.1 Landscape and Visual Impact Assessment (LVIA) is a standard process for examining the landscape and visual impacts of a development. The methodology for this is set out in the 'Guidelines for Landscape and Visual Assessment' (GLVIA), produced by the Landscape Institute and the Institute of Environmental Management and Assessment (3rd Edition, 2013).
- 5.2 LVIA follows an iterative process by which alternative sites and designs for a development are assessed and amended (a process often referred to as mitigation). Through this, LVIA identifies the preferred siting and design option for a development, balancing different environmental issues as well as functional, technical and economic requirements. Ultimately, the final scheme is assessed for predicted residual impacts on the landscape and visual resource.
- 5.3 LVIA is usually carried out by Chartered landscape architects who apply professional judgements in a structured and consistent way based on landscape design principles. The LVIA should assist decision makers, members of the public and other interested parties by providing a clear and impartial understanding of the predicted effects of wind farm proposals.

Context for Landscape and Visual Impact Assessment

- 5.4 LVIA is a standard process of assessment that may be presented as a separate report, or form part of an Environmental Statement (ES). While a LVIA will usually be required for every wind farm proposal, an EIA is only a statutory requirement for wind energy proposals where the proposal is likely to have significant effects on the environment. **The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011** set out when EIA may be required for wind farms.

Landscape and visual impacts of Wind Farms

- 5.5 LVIA comprises two separate parts, Landscape Impact Assessment (LIA) and Visual Impact Assessment (VIA), although these are related processes as described within the GLVIA. LIA considers the effects of the proposal on the physical landscape which may give rise to changes in its character, and how this is experienced. This includes a consideration of the effects on landscape designations. VIA considers potential changes that arise to available views in a landscape from a development proposal, the resultant effects on visual amenity and people's responses to the changes.
- 5.6 Early in the LVIA process it should be determined which landscape and visual characteristics are particularly relevant or sensitive to the development proposal. Focussing on these, the designer can explore what the potential impact of a wind farm will be if it is sited and designed in different ways. The main design aim should be to create a wind farm that relates well to the landscape.
- 5.7 Clearly other technical and economic factors will also be important in the decision-making process, as will other environmental impacts such as effects on wildlife and habitats. Cumulative effects with other wind farms will also be a consideration, and guidance can be found in ***Assessing the Cumulative Impact of Onshore Wind Energy Developments***.

Design Statements

- 5.8 Design Statements help communicate the issues, constraints and decision making processes behind a design. A design statement need not be a lengthy or complex document and diagrams can be used to summarise the design process. They are a valuable way for designers to explain why a particular layout or appearance has been chosen to consultation bodies, Local Authorities and the public, and their preparation is encouraged. They should examine design permutations based on the number and arrangement of turbines tested against key viewpoints and turbine height, where this could reduce landscape and visual effects. Further guidance on producing design statements is provided in [PAN 68](#).
- 5.9 Design Statements are also helpful in establishing design objectives. These may need to be referred to in the future if the scope of a scheme changes: for example for a wind farm extension, amendment of the type of wind turbines, or for another wind farm nearby. Design objectives can help to:
- maintain the integrity of a scheme in changing circumstances;
 - explain the design objectives of wind farm extensions; and
 - indicate how existing nearby wind farms or cumulative impacts have influenced the design and layout of a new proposal.

Presentation of information within landscape and visual impact assessment

- 5.10 A number of methods are used to illustrate the potential landscape and visual impacts of a proposal. In LVIA, illustrations are used by landscape and planning professionals in four main ways to:
- record site assessment, in the form of photographs and sketches, and as an aide-memoire;
 - provide computer generated Zone of Theoretical Visibility maps (ZTVs) to show the area from which a proposal may be visible;
 - provide visualisations that show potential visibility from a specific viewpoint and aid an assessment of the magnitude of impact, typically in the form of computer-generated wireline diagrams and photomontages, and
 - illustrate key concepts and design principles using line drawings and diagrams.
- 5.11 When used on site, these illustrative tools are typically sufficient to make judgements of predicted landscape and visual impact for the LVIA. However, in addition, other illustrative techniques may be useful, such as computer generated simulations, fly-throughs and video-montage. Further guidance on the selection, production methods and use of illustrative techniques is available in the '[Visual Representation of Wind farms: Good Practice Guidance](#)' (2006) which is currently under review.

Small wind farms and the need for assessment

- 5.12 In addition to large wind farm developments there has been a recent increase of interest (driven mainly by the Feed in Tariff) in single turbines and small groups of turbines. This is particularly evident in lowland settings, where schemes typically include between one and three turbines. If there are more than two turbines, or the turbines are more than 15m in height, they are Schedule 2 developments under [The Town and Country Planning \(Environmental Impact Assessment\) \(Scotland\) Regulations 2011](#). It is for the Planning Authority to decide whether they are likely to have significant environmental effects and therefore require an Environmental Impact Assessment (EIA).

- 5.13 Even if an EIA is not required, there is usually a need for submission of a LVIA in support of a planning application. This assessment should be carefully scoped so that it is appropriate to the size and scale of the development, and the likelihood of significant landscape and visual impacts, including cumulative effects. Our guidance on '[Assessing the impact of small-scale wind energy proposals on the natural heritage](#)' provides advice on the level of landscape and visual assessment likely to be appropriate for different scales of turbines. It is important to highlight that the landscape and visual impacts of turbines are not directly proportional to their height. We have also produced more detailed [guidance on the installation of micro wind turbines \(<50kw\)](#) and [siting and design of small scale wind turbines of between 15 and 50 metres in height](#) (2012).

Duration of impacts and decommissioning

- 5.14 The expected lifetime of wind turbine generators is typically around 25 years, and planning permission is usually granted for this period. Decommissioning of the turbines at the end of this operational phase is often a specific condition of planning permission and is an important consideration when designing and assessing a wind farm.
- 5.15 Decommissioning commonly proposes that turbines and ancillary buildings are removed. There is the potential for some residual visible change to the landscape, even when infrastructure is removed, although this can be minimised through careful design and consideration of how decommissioning will proceed at the project outset. The use of carefully worded legal agreements or planning conditions to ensure restoration of the site is critical. We have published [research on the restoration and decommissioning wind farms](#) which explores these issues in more detail, including the issue of repowering.
- 5.16 There is likely to be continued demand for renewable energy generation for many decades ahead. It is possible that existing well-designed wind farms may remain in use well beyond 25 years, with turbines either refurbished or replaced and a planning consent renewed. However, a time-limited consent provides the opportunity for decommissioning and a change in land use, if the location is no longer considered appropriate for a wind farm.



Partial restoration of access tracks to grass

GLOSSARY

Ancillary infrastructure	The built elements and structures of a wind farm, apart from the turbines, which serve the development, such as access tracks, borrow pits, the control building and substation.
Anemometer mast	A mast erected on a wind farm site, usually the same height as the turbine hubs, to monitor wind speed.
Borrow pit	A quarry within a wind farm site excavated to provide stone for site infrastructure.
Capacity Study	Research which attempts to identify the acceptable limits to development in a given area.
Decommissioning	The process by which a wind farm is dismantled and the site restored.
Design Statement	A document which records the design process that is undertaken for a development.
EIA	Environmental Impact Assessment, the process by which the identification, prediction and evaluation of the key environmental effects of a development are undertaken.
LCA	Landscape Character Assessment, a documented process which describes and categorises the landscape, highlighting key landscape characteristics and the main forces for change.
LIA	Landscape Impact Assessment, part of the LVIA process which explores the potential effects on the landscape of a proposed development (see below).
LVIA	Landscape and Visual Impact Assessment – a standard process for examining the landscape and visual effects of a development.
Micrositing	The movement of wind turbines by small distances within the overall wind farm layout, either at the design or construction stages of development.
PAN	Planning Advice Notes are issued by the Scottish Government, providing advice on good practice and other relevant information, e.g. PAN 68 on Design Statements.
Strategic Locational Guidance	(SLG) SNH Policy Statement which sets out a number of principles that should guide the location of onshore wind farm projects so as to minimise effects on the natural heritage. Provides broad overview at a Scottish level of where, in natural heritage terms, there is likely to be greatest scope for wind farm development, and where there are the most significant constraints.
VIA	Visual Impact Assessment, part of the LVIA process, which considers potential changes that arise to available views in a landscape from a development proposal, the resultant effects on visual amenity and people's responses to the changes.