

Wind Energy Projects: Ecological, Technical and Social Impacts

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Renewable energy is becoming a major industry for Scotland, however the scale and location of developments is very important. One of the conclusions of the Orkney Renewable Energy Resource Assessment was that Orkney could produce a minimum of 30 times more electricity than is used in the Islands, with much of this power predicted to come from marine energy developments. Onshore wind turbines are expected to be the main source of renewable energy on the islands, at least until marine energy is available, however finding the correct location for these wind turbines is very important. As well as addressing ecological concerns, projects should consider the social issues of visual impact, noise and shadow flicker effects, and the technical constraints of television and radiocommunications interference.

Ecological Impact

The ecological impacts of a wind energy project are the possible effects on birds, mammals and the loss of important vegetation. The siting of wind turbines is largely the most important consideration when considering ecological impacts, and possible effects should be considered at the earliest stages of design and development:

- **Mammals:** The aim of any mammal survey should be to determine the presence and extent of activity of protected mammals in and around the windfarm development. Various protected mammals occur in Scotland and include Badgers, Otters, Wildcat, Water voles and various bat species. The evaluation of mammals in ecological impact assessment is largely governed by their legal status, which does not necessarily equate to their conservation importance. As an example, Badgers are specifically protected, but are widespread and very common in places, and not of any conservation concern in many parts of the UK. Nevertheless Badgers should be evaluated as nationally important wherever they occur. Similarly, EU legislation defines the importance of Otters, Wildcats and all bat species as international, although the various species are of different conservation concern and status within and across the UK.
- **Birds:** A breeding bird survey, a raptor and diver survey, a swan and geese survey and analysis of flight paths by birds from neighbouring protected areas are generally required at most wind energy sites. Although birds can largely co-exist with wind turbines it is sometimes necessary to conduct collision risk assessment to calculate possible effects. There are various factors to take into account when assessing the scale of possible impacts. These relate to the nature of the impact and to the sensitivity of the species. Sites are appropriate for wind energy developments when there are low densities of breeding birds in the surrounding area and relatively large distances between turbine positions and nest sites. It is also important that any wind energy site should avoid locations with heavily used bird flight paths or favoured feeding areas. Potential impacts can be mitigated by planning the timing of construction work, and improvements to vegetation on the site can offset the impact of any habitat loss.

Visual Impact

The visual impact of a windfarm is sometimes thought of as being a major difficulty, however this is really a subjective issue, with some people enjoying the sight of the machines, and others unable to accept the development. Provided the turbines do not dominate the landscape, wind energy projects do tend to become acceptable over time; five years ago there were people who didn't want to see the old machines on Burgar Hill taken down, as they had become such a recognisable part of the Orkney landscape. Clearly as more and more projects come forward, there is the risk that the cumulative impact of developments creates a wind farm landscape. The hilly nature of Orkney does control this to a certain extent, with the hills and islands blocking the views of projects. For example, the Sanday wind turbines cannot be seen by residents in the West Mainland, and the Burgar Hill machines cannot be seen in the South Isles. The Orkney landscape is appropriate for small developments of single turbines, or small wind farms, such as the Burray turbine and the Burgar Hill windfarm. Large scale projects are unlikely due the lack of suitable land. On mainland Scotland and on Shetland and the Western Isles, extensive areas of moorland has allowed development of large scale windfarms, and although these projects can have significant visual impact, these developments are largely proposed for sparsely populated areas.



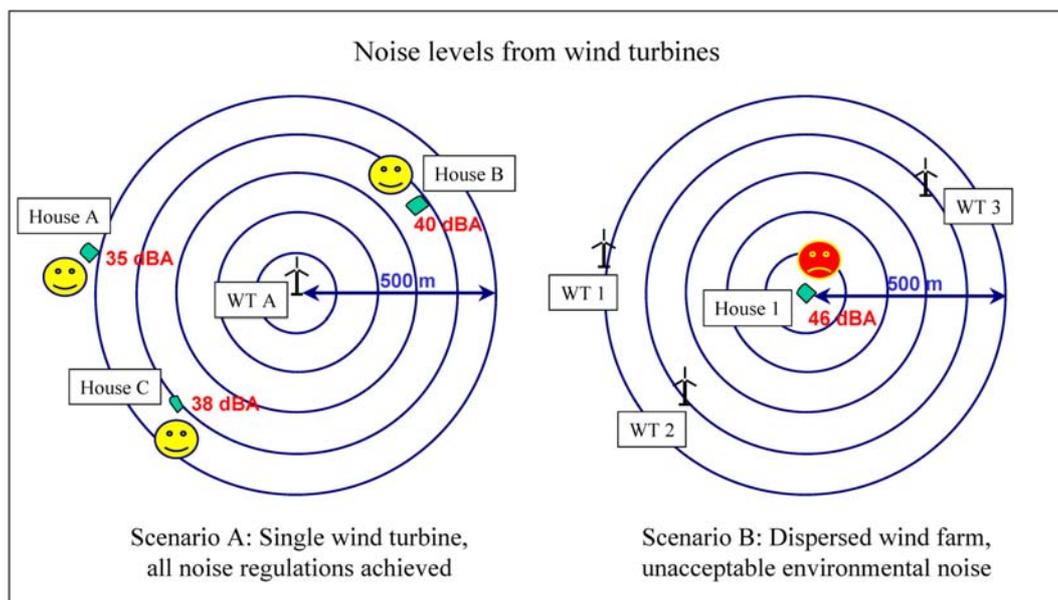
Burray wind turbine and Burgar Hill windfarm



Noise Impact

Noise impact is an important issue, and care must be taken to ensure that wind turbines operate within certain limits. All machines emit noise, and in the case of a wind turbine there are two sources: the noise of the blades cutting through the air and the sounds emitted from the gearbox and generator. The working parts of the turbine are enclosed to damp down any noise, however the blades can sometimes act like a loudspeaker. It is important that there is a reasonable distance between a turbine and the nearest neighbours. As a rule of thumb, 400-500m is usually required for a single machine, and around 700m for a small cluster of turbines will be sufficient to meet guidelines. The noise issue becomes more complicated when you have a dispersed windfarm, with turbines mixed in with properties, which could occur if large scale developments proceed in Orkney. When this happens, the noise from individual turbines add together, resulting in a greater impact which will exceed noise recommendations.

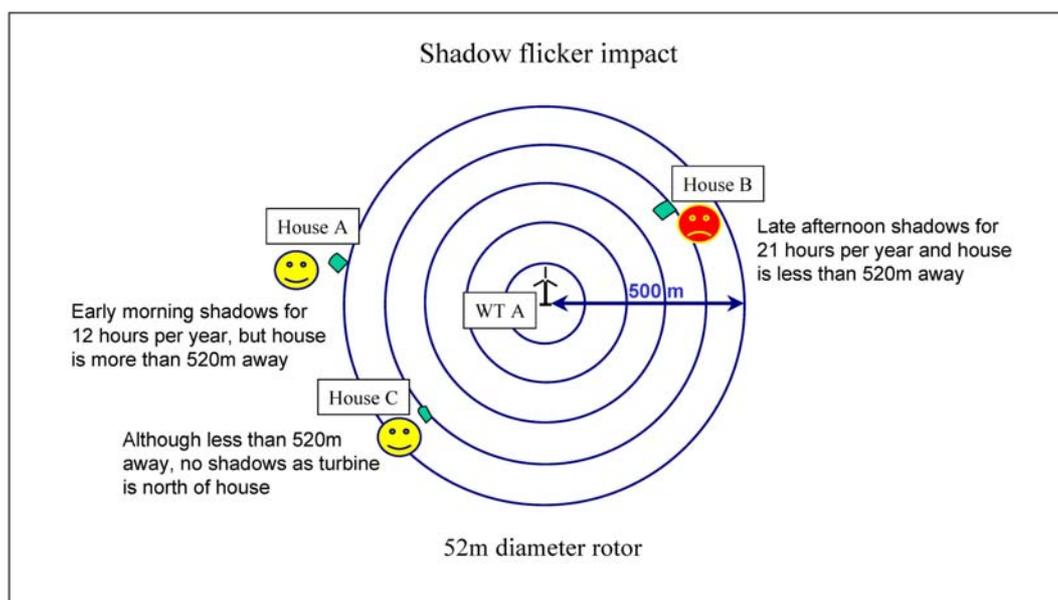
This is illustrated in the following example, where there is a turbine surrounded by a three houses, compared with a house surrounded by three wind turbines. Although single turbines can be fitted into the Orkney communities fairly easily, larger projects do run the risk of breaching environmental health regulations. For large scale developments of ten or more wind turbines the clearances to neighbours must be greater again, with a spacing of 1km or more required to achieve World Health Organisation noise limits.



Shadow Flicker

Shadow flicker is a recognised problem, which can occur when the moving shadow from a wind turbine blade flicks on and off when viewed through a window. The layout of the project is important in minimising this impact, and planning guidelines indicate that a spacing to neighbours of ten times the rotor diameter should be sufficient to prevent a nuisance. This would be 520m for the Burray turbine, and 920m for the large machines on Burgar Hill and Sanday. If you have a wind turbine due north of a neighbour, shadow impact will not be an issue as the sun is never in a position to cause a shadow at the house, and accordingly you can place the turbine nearer to the property, provided noise guidelines are not exceeded. Sometimes the other restrictions at a wind turbine site can mean that the distances to neighbours are nearer than recommended. When this occurs modern turbines can be made to operate in a low noise mode, and a special device can be fitted which switches off the machine during the brief periods when a shadow flicker could occur on sunny days.

There is an interesting case study on this problem, where a large 2MW wind turbine has been erected 300m away from HM Prison Whitmoor, in the Fenlands of Cambridgeshire. On the other side of the turbine a new housing development has been built, again around 300m from the site. Normal planning regulations would not allow a turbine this near to housing, however in this case the houses received their consent after the wind turbine. Both shadow flicker and noise were potential problems, however both were resolved by letting the machine operate in a low noise mode, and by installing a shadow flicker module to shut the machine down on the days of the year when shadows could occur.



Radar and radiocommunications interference

There are microwave radio transmitters on most of the hilltops and islands in Orkney, used by the emergency services and the commercial mobile phone companies. A wind turbine cannot be positioned in a microwave corridor, as this would disrupt the data transmission. A 200m wide exclusion corridor is required, which must be taken into account during the design of a windfarm. Unfortunately these radio links tend to be located in the same places that are best for wind farms, which can lead to conflicts between developers and the mobile phone companies. Impact on radar systems is also an important issue across the United Kingdom. The Ministry of Defence have a blanket ban on any wind turbine within 74km of primary defence radar stations, such as RAF Buchan in Aberdeenshire. There are also major constraints around Saxa Vord in Shetland, and at South Clettraval in the Western Isles, and most of Caithness and Sutherland is covered by a ban on wind turbines within the low flying tactical training area. Kirkwall and Sumburgh airports have 17km safeguarded areas around each site, extending to a 35 km exclusion zone along the line of the main runways, where a wind turbine could affect instrument landing systems. The mainland Scotland airports have similar restrictions, and in the case of Aberdeen, all of the north-east of Scotland from Banff to Stonehaven is excluded from large scale wind energy development. Radio and television interference is a further potential problem when wind turbines are operated in areas that do not have good reception. The blades and towers of turbines can sometimes reflect television signals, so that nearby properties get a double transmission. This occurred at Burgar Hill, and the problem can normally be fixed by installing digital receivers, which tend to be less prone to interference.

With wind energy deployment restricted over much of Scotland, there has been intensive wind farm speculation in the unconstrained areas, such as Caithness and Moray. In locations like Orkney projects should be designed to ensure that impacts are not significant when placed within environmentally sensitive designated areas. As developments come forward it is important that the planning process fully considers all constraints, and as well as recognising possible impacts on the environment, renewable energy projects must consider technical restrictions and should limit impacts on the people that live and work in the area.

