Good Practice WiND

Supported by INTELLIGENT ENERGY EUROPE

GP WIND – Good Practice Guide

A new resource for reconciling wind energy development with environmental and community interests

www.project-gpwind.eu

SUMMARY

1. GP WIND PROJECT

This document provides an introduction to the GP WIND online Good Practice Guide and Toolkit. Here you will find background information on the GP WIND project, as well as examples of the recommendations and good practice contained in the online version.

This introductory guide has been designed to help the reader see the relevance of the good practice recommendations at each stage in a project's life. For each stage, a set of relevant general recommendations will be listed. In the online Good Practice Guide these are supported by more specific recommendations which are, in turn, backed by a number of 'real life' examples of good practice. Not all this information is included in this document; instead, further detail is provided on one of the general recommendations to give a flavour of the depth of material to be found online.

GP WIND Project – an overview of the project

GP WIND was set up to investigate barriers to the deployment of onshore and offshore wind energy generation, by recording and sharing good practice in reconciling renewable energy objectives with wider environmental objectives and actively involving communities in planning and implementation.

The project is co-funded by Intelligent Energy Europe Programme and coordinated by the Scottish Government, bringing together industry, regional and local authorities, environmental agencies, NGOs and academia from eight European countries (Belgium, Spain, Ireland, Italy, Malta, Norway, Scotland and Greece).

The sharing of experience of a broad variety of partners has enabled the development of a Good Practice Guide and a Toolkit, which can be used to aid more effective and efficient deployment of renewable energy in support of renewable energy targets. The guidance and toolkit will continue to be available online following the completion of the project.

GP WIND Objectives

The **objectives** of the project were as follows:

1. Build evidence based support for the design, planning and implementation of projects which are sensitive to environmental and community concerns.
2. Increase the consenting rate for on and offshore wind projects, and reduce the processing period for applications.
3. Increase the efficiency of processing applications, thereby reducing process costs.
4. Assist quicker, more transparent and less costly deployment of wind energy across Europe, contributing to the achievement of targets for renewable energy generation.
5. Secure endorsement of project outputs by participating partner administrations and commitment to adopt relevant good practice.

The GP WIND Methodology

The GP WIND project began by identifying market barriers and process failures that have resulted in projects not proceeding efficiently and then sought examples of good practice that could be used to address these and which could be transferred to other regions and technologies.

These good practice recommendations are based on surveys of key actors and stakeholder groups, and a number of detailed case studies of onshore and offshore wind energy projects were analysed and presented using a common methodology. This allowed for transnational comparison and examination of which approaches are suitable for transfer to other regions. The project focused on environmental and social issues and how to get local involvement and support for well planned and consulted wind projects.

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1.2 GP WIND OUTPUTS

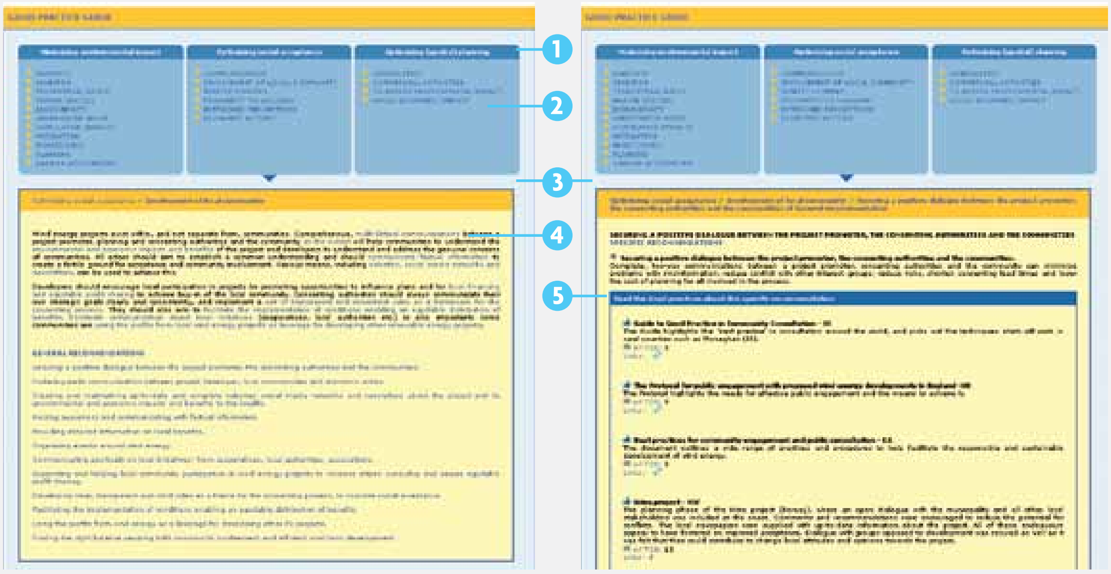
The detailed examination of the case studies, supported by peer review by partners from other regions and stakeholder consultation events, has led to the creation of a Good Practice Guide and a Toolkit. All the material is available at **www.project-gpwind.eu**.

"The GP WIND Guide looks good! It will enable the wind sector to illustrate and adopt good practice. It should stimulate a more transparent and faster wind deployment with a view to reaching Europe's 2020 RES targets"

Jacopo Moccia
Head of Policy Analysis, EWEA

1.3 THE GP WIND WEBSITE

Guidance on how to use the website



1. **Select an area of interest**
2. **Chose a topic**
3. **Access the general recommendations**
4. **Click on a general recommendation...**
5. **... to access the specific recommendation and associated good practice examples**

The website offers you the opportunity to visit the full version of the GP WIND Good Practice Guide as well as the Toolkit.

The **Good Practice Guide** includes around 70 recommendations supported by over 130 examples of good practices, which are collected in three categories:

MINIMISING ENVIRONMENTAL IMPACT
OPTIMISING SOCIAL ACCEPTANCE
OPTIMISING SPATIAL PLANNING

The **Toolkit** gives you access to 3 categories of documents:

- The online library, comprising more than 300 documents illustrating good practices. Tools and guidance enabling you to assess some aspects of a wind energy project autonomously are also included.
- A Comparison by Country table, which enables comparison between 10 European countries with regard to environmental and regulatory issues, as well as those related to local community involvement.
- The 16 Thematic Case Studies, which served as the basis for the Good Practice Guide.

2. GOOD PRACTICE GUIDE

The GP WIND **Good Practice Guide** is available in full at **www.project-gpwind.eu**. This document provides a taster of the Good Practice Guide and is structured around the typical process for developing a wind energy project, as follows:

The following sections provide a selection of the general and specific recommendations and examples of good practice from the online **Good Practice Guide**.

2.1 PLANNING AND POLICY CONTEXT

The planning and policy context sets the scene for the wind energy development process. To achieve planning consent, the site selection, design and consenting should align with the planning and policy context at local, national and European levels. This context will be revisited at several stages during the process and will inform the final decision and planning conditions.

Relevant general recommendations include

- Early planning and mapping
- Defining and applying clear planning and guidance on scoping procedures
- Mapping of most suited sites to avoid landscape saturation
- Establishing a clear, consistent and proactive communication on strategic goals by the consenting authorities
- Developing clear, transparent and strict rules as a frame for the consenting process, to improve social acceptance
- Developing clear and transparent spatial planning to improve social acceptance
- Developing official guidance or standards to assess potential socio-economic impacts

These general recommendations are supported by specific ones. For example, in terms of planning it is recommended that, in order to increase social acceptance and to improve the integration of wind farms into their environment, early spatial planning and mapping and the implementation of mitigation measures are undertaken. With community involvement, this will help to identify the most suitable zones for wind energy development, facilitating the increased deployment of wind energy production while minimising environmental impacts and disturbances to communities. This mapping can cover everything from large zones to micrositing and should take cumulative impacts into account.

A clear planning strategy and guidance on administrative procedures will help to facilitate wind energy development and improve the

2. GOOD PRACTICE GUIDE

confidence of the local population in the overall process. More specifically, a process aimed at minimising the impacts caused by wind turbine installation and operation must be based on a clear mitigation hierarchy ranging from the prevention of negative effects in the first place to mitigating for any unavoidable impacts. Compensatory measures for residual effects should then be considered and a monitoring process carried out to assess the efficiency of the procedures that are implemented.

Examples of good practice related to early planning and mapping include:

Onshore wind planning and mapping

Planning approach (Wales - UK)
The Welsh Government have identified seven Strategic Search Areas, within which there is a general presumption in favour of onshore wind. This is presented in their Technical Advice Note (TAN) 8: Planning for Renewable Energy[1] which advises on:

- Renewable Energy and Planning;
- Onshore Renewable Energy Technologies;
- Design and Energy;
- Implications for Development Plans;
- Development Control; and
- Monitoring.

Further information and related studies can be found at *http://www.wales.gov.uk*

Spanish Wind Atlas - SP
The Spanish Wind Atlas[2] developed by the Institute for Energy Diversification and Saving are used by the Spanish Public Administrations for wind farm planning and other wind-related studies, and also to provide the stakeholders and the general public with a tool enabling them to identify and evaluate the existing wind resource in any area of the national territory.

RSPB bird sensitivity advisory map for onshore wind power development in Scotland

The functionality of Geographical Information Systems has been highlighted by including complementary information of interest: cartographic and topographic, environmental figures, maritime zoning, etc. Also the interface includes intuitive navigation devices to make browsing easier for the user.

1- Welsh Government (2005) Technical Advice Note (TAN) 8: Planning for Renewable Energy. 2- http://atlaseolico.idae.es/index.php?idioma=EN

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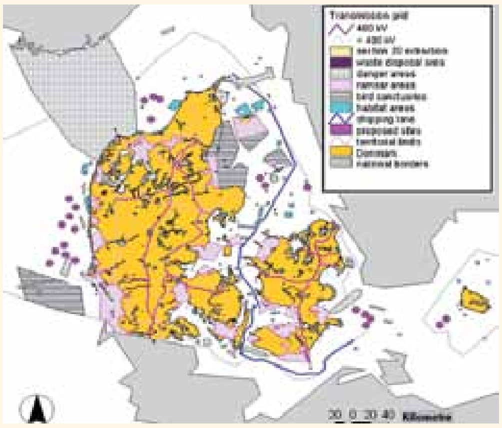
Offshore wind planning and mapping

The seas are generally multiple use areas and integrating wind energy optimally in this mix is a challenge. In order to ensure that the future development of offshore wind turbines does not clash with other major public interests and that development is carried out with the most appropriate environmental and socio-economic prioritisation, it is important that the most suitable sites for future offshore wind farms are identified through the use of mapping systems. Areas that it is important to map are: shipping routes, cruising routes, fishing areas, areas in which other marine industries such as oil and gas operate and areas with other technical constraints.



Danish indicative planning map for offshore wind power development

Examples of spatial planning are:

- The IEE funded SEANERGY2020[3] project provides in-depth analysis of national and international Maritime Spatial Planning (MSP) practices, and policy recommendations for developing existing and potentially new MSP for the development of offshore renewable power generation.
- “Roadmap for Maritime Spatial Planning”[4]. This is a key instrument for the Integrated Maritime Policy of the EU. It helps public authorities and stakeholders to coordinate their action and optimises the use of marine space to benefit economic development and the marine environment. It is a tool for improved decision-making and it provides a framework for arbitrating between competing human activities and managing their impact on the marine environment.
- “Blue Seas Green Energy”[5] is the Sectoral Marine Plan for Offshore Wind in Scottish Territorial Waters and utilised a marine planning approach to guide development of offshore wind energy around the coast of Scotland. The process identified that there are generic issues related to shipping, fishing and environmental impacts which apply in all offshore wind plan regions around Scotland. In addition, there are significant environmental and cultural issues in certain regions such as visual impact and the effects on tourism. In the West and South West regions, community engagement and public acceptability were viewed as significant issues. A marine spatial planning tool, the Marine Resource system (MaRS)[6] was used as a scoping tool in order to identify options (areas of search). These areas are the least constrained with enough wind resources.

“Climate change is a grave threat to birds and all wildlife, and wind power is a key technology for reducing these long-term risks. Applying good practices in line with this guide will help ensure nature is also protected in the shorter term - in the planning, construction and operation of wind farms” Ariel Brunner
Head of European Policy, BirdLife Europe

3- www.seanergy2020.eu/ 4- European Commission (2008) Roadmap for Maritime Spatial Planning: Achieving Common Principles in the EU. 5- Scottish Government (2011) Blue Seas - Green Energy A Sectoral Marine Plan for Offshore Wind Energy in Scottish Territorial Waters Part A The Plan. 6- The Crown Estate, Marine Resource System

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2.2 PROJECT INITIATION - COMMUNICATION AND SCOPING

From the very outset it is advisable that the applicant is in contact with key consultees and engaging with the public to get early indication of any sensitivities around their chosen site. This consultation can inform the early design of a project before presenting the scope of the project to the planning authority. Further consultation may be made by the planning authority to inform the scope and methodologies required for the Environmental Impact Assessment which is conducted by the developer.

Relevant general recommendations include:

- Securing a positive dialogue between the project promoter, the consenting authorities and the communities
- Fostering early communication between project developer, local communities and economic actors

These general recommendations are supported by specific ones. Effective, meaningful and early communication between project developers, local communities and other economic actors is essential to the harmonious integration of wind farms within local natural and economic environments and to secure a positive dialogue between all parties concerned.

Proactive communication, providing detailed information on the permitting and consenting procedures, the management (including mitigation and monitoring) of impacts (noise, visual etc.), on local benefits and their equitable distribution, as well as on financial participation possibilities for cooperatives or local authorities in the wind farm, is required to increase social acceptance of a project.

Positive communication and the dissemination of factual information through social media networks and newsletters, on websites, in school curricula or during specific local events can contribute to improved acceptance of wind energy projects. Promoting the features of a wind farm that are attractive to tourists (e.g. visitor centre development) is another way of contributing to the optimisation of social acceptance.

Examples of good practice related to proactive communication include:

- Governments and consenting authorities should proactively communicate their own renewable energy objectives through clear policies and targets complemented by robust, holistic strategies, thus setting the context for efficient consenting processes. For example, the **Planning Guidelines for Wind Energy (Ireland)**[7] provided design signals to developers and planners and provided the impetus for the creation of wind energy strategies. The strategies include maps which communicate where wind energy is encouraged, potentially acceptable or unacceptable. These locational signals are a key consideration for consenting. It is vital therefore that the strategy is developed to best practice, incorporating all applicable environmental, social, economic and energy policies and objectives.

- A regular and real dialogue with the local community and municipality from the early stages of the project is also essential to achieve buy-in. It helps to inform the developer while involving the local community, who may have a say in the recommendations for the Environmental Impact Assessment (EIA) or other planning processes. The Canadian Wind Energy Association has produced a useful **good practice guide for community engagement**[8].

- An example of good practice is the **planning phase of the Hitra project** (Norway), where an open dialogue with the municipality and all other local stakeholders was included at the onset. Comments and recommendations were encouraged to reduce the potential for conflicts. The local newspapers were supplied with up-to-date information about the project. All of these endeavours appear to have fostered an improved acceptance. Dialogue with groups opposed to development was secured as well, as it was felt that they could contribute to changing local attitudes and opinions towards the project.

7- The Department of the Environment, Heritage and Local Government, Ireland. Wind Energy Development Guidelines
8- Canada Wind Energy Association, Wind Energy Development Best Practices for Community Engagement and Public Consultation

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Good Practice Highlight

Météo Renouvelable and EnergizAIR – Belgium & EU

This is a good example of how information about renewable energies can be presented in an attractive and appealing way: following television weather forecasts, information is given on the levels of energy produced the previous week from solar and wind generation.

Once a week, the amount of energy saved through the use of a standard solar thermal or produced with a PV installation and the number of equivalent households that have been supplied with electricity from wind farms are presented.

Factors for success:

- The appealing presentation of information on renewable energy production;
- The clear link made between one of the main human experiences of nature (weather) and technologies that are driven by the weather;
- Wide dissemination via the public television channel following weather forecasts (8pm) watched by a large audience (more than 500,000 people every week). Wind farm

2.3 ENVIRONMENTAL IMPACT ASSESSMENT

The Environmental Impact Assessment (EIA) is central to the development of wind energy projects and required under EU legislation; it covers all disciplines (archaeology, air quality, ecology, electromagnetic interference, hydrology, landscape/ visual impact and noise assessment, ornithology and socio-economics, recreation and tourism). Including a socio-economic impact assessment ensures that all the impacts of a wind farm are understood – often demonstrating many positive impacts which would otherwise have not been considered.

Relevant general recommendations include:

- Clear and high quality Environmental Impact Assessment (EIA) standards
- Assessing cumulative impacts
- Considering carbon emissions
- Compatibility of wind farms with other human activities
- Assessing the visual impacts of the wind farm
- Integrating wind turbines in the landscape
- Careful siting and pre-construction assessment with respect to human activities to minimise impacts
- Avoiding, minimising and managing noise impacts
- Considering socio-economic impact assessments
- Include socio-economic criterions while granting the permits

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These general recommendations are supported by specific ones that, combined with clear and high quality EIAs and strict rules around the consenting process and spatial planning, can help in avoiding negative impacts. For example, maps of sensitive areas for biodiversity and natural heritage can be combined to achieve an early locational guidance for wind energy.

Monitoring environmental impacts and planning mitigation measures on a large scale will also help to improve the planning tools developed as a framework around wind farm development.

Examples of good practice related to EIA include:

- Clear and high quality EIA standards. Clarity is important so that developers and other stakeholders know what must be assessed. Quality is important so that the results are less likely to be challenged during the planning process, causing delays, costs, and possible refusal of consent. Examples of such standards are the **Danish**[9] and **Scottish**[10] **EIA standards**

- Due to the developing nature of the offshore wind sector, it is recognised that some final design details may not be available for inclusion in the EIA at the time of application submission (e.g. final turbine size). Given this uncertainty it is accepted that a **'Rochdale envelope'**[11] can be defined, within which an EIA team can assess the variation in final design parameters in which the consenting body can constrain a developer. The EIA and **Habitats Regulation Appraisal**[12] should be undertaken within the envelope, and this information used to progress the Cumulative Impact Assessment (CIA). The development of offshore infrastructure (i.e. cables and onshore substations) will also contribute to the overall Carbon Impact and should be considered within the CIA. While for a new area of research, the **COWRIE guidance**[13] on assessment is recommended.

- **Carbon Impact** - CO_2 emissions from wind farms include CO_2 emissions that occur during production, transportation, erection, operation, dismantling and removal of turbines, foundations and the transmission grid from the existing electricity grid. Emissions reported in peer-reviewed literature have a range of 0.006 to 0.034t CO_2 MWh-1, with indications that the foundations are the component which most affects the environment, particularly the cement used. Assuming a wind farm lifetime of 25 years and a capacity factor of 30%, this equates to emissions of 394 to 8147t CO_2 MW-1. Defensible figures for the specific wind farm should be used wherever possible, but if these are unavailable, carbon dioxide emissions due to the turbine life can be estimated from the turbine capacity.

Good Practice Highlight

Socio-economic Impact

The UK Department of Energy & Climate Change's (DECC) **Overarching National Policy Statement for Energy**[14] (2011) provides strong guidance and states that where a project is "likely to have socio-economic impacts at local or regional levels, the applicant should undertake and include in their application an assessment of these impacts as part of the Environmental Statement".

It states that socio-economic assessments should consider all relevant socio-economic impacts, including the creation of jobs and training opportunities, the provision of local services and infrastructure, the impact on tourism and cumulative effects.

9- Danish Energy Agency, http://www.ens.dk/en-US/supply/Renewable-energy/WindPower/offshore-Wind-Power/Environmental-impacts/Sider/Forside.aspx. **10-** Scottish Government (1999), Planning Advise Note 58 Environmental Impact Assessment. **11-** Infrastructure Planning Commission (2011), Advice Note Nine Rochdale Envelope. **12-** European Commission (2000) MANAGING NATURA 2000 SITES The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC. **13-** COWRIE - Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy. **14-** Department of Energy & Climate Change (2011) Overarching National Policy Statement for Energy

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2.4 CONSULTATION AND COMMUNICATION

Effective, meaningful and early communication between project developers, local communities and other economic actors is essential to the harmonious integration of wind farms in the natural and economic environments in the locality of the wind farm. Proactive communication, providing detailed information on the permitting and consenting procedures, the management (including mitigation and monitoring) of impacts (noise, visual etc.), on local benefits and their equitable distribution, as well as on financial participation possibilities for cooperatives or local authorities in the wind farm, is required to increase social acceptance of a project.

Relevant general recommendations include:

- Promoting the touristic features of the wind farm
- Creating and maintaining up-to-date and complete websites, social media networks and newsletters about the project and its environmental and economic impacts and benefits to the locality
- Avoiding labelling stakeholders that show concerns as NIMBYists
- Raising awareness and communicating with factual information
- Providing detailed information on local benefits
- Organising events around wind energy
- Communicating positively on local initiatives
- Opening the participation in wind energy projects to local financing and equitable profit sharing
- Facilitating the implementation of conditions enabling an equitable distribution of benefits
- Using the profits from wind energy as a leverage for developing other renewable energy projects
- Finding the right balance to secure both community involvement and efficient wind farm development
- Using appealing ways to disseminate a broad positive communication on wind energy

These general recommendations are supported by specific ones. All involved are advised to be mindful that wind energy projects exist within, and not separate from, communities. All actors should aim to establish a common understanding and should communicate factual information to create a fertile ground for acceptance and community involvement. Various means, including websites, social media networks, newsletters and public events can be used to achieve this.

Developers should encourage local participation in projects by promoting opportunities to influence plans and for local financing and equitable profit sharing to achieve buy-in of the local community. Consenting authorities should always communicate their own strategic goals clearly and consistently, and implement a set of transparent and consistent rules as a framework for the consenting process. They should also aim to facilitate the implementation of conditions that would enable an equitable distribution of benefits.

> *"ScottishPower Renewables found the process of developing the guidance both challenging and informative. The easy access to best practice and information from across Europe will be invaluable as we develop our business"*
>
> Martin Mathers
> *Onshore Policy Manager, ScottishPower Renewables*

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Examples of good practice related to positive communications include:

- Developers of projects often find it beneficial to maintain up-to-date and complete websites, social media networks and newsletters about the environmental and economic impacts and benefits of their project to the locality (access to the internet should not be assumed). Some examples of this include **Pindos Energy (Greece), BordGáis Energy (Ireland), SSE Renewables (UK) and IberdrolaRenovables/ScottishPower Renewables (Spain/UK)**. However, in general, much of the information provided by developers is with respect to generic global benefits and constructed wind farms rather than isolating local impacts and benefits of planned or pre-construction projects. Local benefits such as municipal charges, leases, rates, taxes or financial development contributions should be detailed, in particular in areas where scarce municipal funds can be supplemented by wind energy projects.

- **Estinnes Wind Farm (Belgium)** was built in 2010 and utilises the largest onshore wind turbines in the world (7MW, 135m hub height). The proposal to use such large wind turbines was not without risk so the developers worked closely with the community. A scientific approach presented the positives and negatives of using 3MW or 7MW turbines and two separate environmental impact assessments (EIA), which inter alia limited the zone of visual influence, and created trust in the community. Local authorities and political leaders were positively disposed to the project and communicated their support with the community. A developer sponsored rock concert is hosted on the site each summer (Rock'Eole Festival D'Estinnes). Tours of the wind farm are available during the event.

- A complex mediation process facilitated by the **Municipality of San Marco deiCavoti (Italy)** has recently concluded with the consenting of a 12 turbine wind farm in Campania. The original project plan was for 30 turbines. However the process involved a local committee and ended with a revised plan for the formal consenting application. Many European consenting authorities facilitate an informal pre-planning consultation which assists project designers in understanding specific local issues.

- **Mount Rodopi wind farm – Greece**: Mount Rodopi, a pioneering large-scale installation of wind farms in Northern Greece, has resulted in a significant enhancement of local economic and employment prospects, and the enrichment of knowledge-based local skills. The average per capita local income has been increased due to the community benefit scheme implemented, which involves the distribution of 3% of gross energy production income to the local municipalities. This has led to several local investments by the municipality authorities of the rather remote and isolated local communities, which have benefited local citizens.

Good Practice Highlight

Whitelee Wind farm Visitor Centre – UK

The 322MW Whitelee Wind farm in Scotland, one of the largest onshore wind farms in Europe and only 20km from the centre of Glasgow (a city of nearly 600,000 people) provides an excellent opportunity to allow a significant number of people to experience modern, large scale wind energy generation first hand.

A purpose built visitor centre was included as part of the project. With an exhibition hall including bespoke interactive facilities, a classroom, an electric powered bus and over 90km of trails, Whitelee has proved enormously successful in terms of visitor numbers.

Effectiveness:

- Nearly 100,000 people visited in 2010 alone, including several hundred school classes. Education and interpretation is provided by staff from the Glasgow Science Centre, an educational charity that operates a major science centre.
- Public feedback is over 90% positive and "chat" on various blogs is also overwhelmingly supportive.
- As its reputation grows, an increasing number of official government delegations from across the world are coming to Whitelee. Already, visitors from France, China, Mongolia and Thailand have come to learn more.
- Equally importantly, the local community is using Whitelee as a resource. The local primary school in Eaglesham used the wind farm as a case study for a web based video which explores local attitudes to the wind farm.

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2.5 MITIGATION AND MONITORING

Mitigation is integral to the Environmental Impact Assessment (EIA) process and identifies ways in which the impact of the project can be reduced or managed. Monitoring is designed to help understand the effects of the development over a longer period and inform future planning decisions.

Relevant general recommendations include:

Mitigation

- Adopting a Mitigation Hierarchy, where mitigation attempts, in the following order, to:
  1. Avoid negative impacts
  2. Minimise or reduce negative impacts
  3. Repair or restore negatively affected areas
  4. Offset or compensate for unavoidable adverse effects
- Managing mitigation measures globally by public authority

Monitoring

- Monitoring impacts on the environment and sharing knowledge gained to improve understanding of environmental impacts
- Monitoring and evaluating socio-economic impacts to track and understand changes to local communities

Professor Ian Stewart talks to pupils from Eaglesham Primary School about climate change and renewable energy at Whitelee Visitor Centre, March 2011

These general recommendations are supported by specific ones. For example, **in terms of mitigation**, preventing or minimising the impacts of the installation and operation of wind turbines on the environment (habitats, populations and biodiversity) requires clear and high quality Environment Impact Assessment standards.

Based on sound scientific data, a mitigation hierarchy should be closely analysed and implemented in three successive steps:

1. preventing negative effects through relevant spatial planning and targeted location (e.g. micrositing) approaches
2. minimising unavoidable impacts through technical mitigation (e.g. radars) or flexible operating practices
3. repairing any residual effects and restoring negatively affected areas
4. any residual adverse effects should be addressed by compensation or offsetting measures. For example, creating alternative attractive habitats for vulnerable species nearby an affected area has shown promising results. The efficiency of this implementation process must be overseen by a relevant public authority.

These general recommendations are supported by specific ones. For example, **in terms of monitoring**, once clear and high quality Environmental Impact Assessment standards have been set out, monitoring of the impacts of wind farms on the environment must be undertaken in order to develop a common understanding of the real impacts of wind farms. It is important to collate existing information on how flora and fauna will respond to environmental changes over the years to come. If managed rigorously and appropriately, monitoring will facilitate the avoidance or reduction of negative impacts on biodiversity for future wind farms. If monitoring activities are not carried out properly or at all, this could cause significant and lasting damage to the environment.

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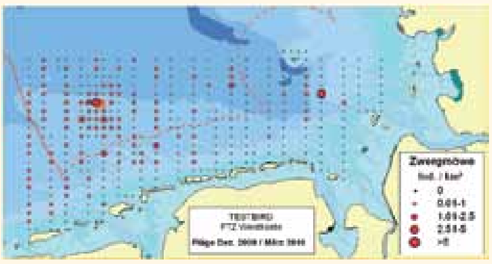
Examples of good practice related to mitigation:

- Minimization and real-time monitoring procedures have been successfully tested in the south of Spain and Portugal. A recent study on avian collision rates at 13 wind farms in Tarifa, Cadiz (Spain) has demonstrated that the use of selective stopping techniques at turbines with the highest mortality rates can help to mitigate the impacts of wind farms on birds with a minimal affect on energy production. The study covered 296 wind turbines before (2006-2007) and after (2008-2009) when selective turbine stopping programs were implemented as a mitigation measure (de Lucas et al. 2011). At the coastal Barão de S. João wind farm in Portugal, radar and observation are used to temporarily shut down turbines when migration flows at turbine blade heights are high (typically in light winds, <5m/s). In the first full year of implementation (2010) the total equivalent shutdown period was 4.3 turbine days, corresponding to production losses of ca2%. There was zero mortality of soaring birds despite >30000 recorded movements through the wind farm area.
- The **mitigation hierarchy** is widely regarded as best practice; its application is required in some legal jurisdictions. Efforts should first be made to prevent or avoid impacts; then to minimise and reduce any unavoidable impacts; and then to repair or restore any unavoidable adverse effects. Any significant residual effects should where possible be addressed via 'offset' in order to achieve 'no net loss'. If an offset is not possible, some other form of mitigation may be required.
- Negative impacts on biodiversity can be avoided through micrositing. Small adjustments to the siting of individual turbines may have a large impact on the incidence of, e.g. bird strikes (Ferrer et al 2012[15]). Many large birds, for example, use 'hangwind' areas where air rises over a ridge, to gain height. Avoiding the immediate area of such hangwind sites by micrositing, even by a few tens of metres, **as proposed for the Hitra wind farm extension in Norway**, may reduce considerably the degree to which flight paths of these species and wind turbines overlap.

Examples of good practice related to monitoring include:

- The Andalusia Environmental Ministry have developed a **protocol for monitoring programs on bird mortality in wind farms in the province of Cadiz (Spain)**. Important results have been obtained of both mortality and success of the corrective measures. The protocol includes tracking tabs for recording incidents on wildlife at wind farms.
- The BACI (before/after-control/impact) approach to monitoring impacts is generally regarded as best practice in this field. This approach to monitoring is currently being implemented at the **Near Shore offshore wind farm** in the Netherlands. While results are not complete, as several years of data are required, the programme provides a detailed example of best practice in the planning and implementation of BACI monitoring techniques at a complex site in environmental monitoring terms.
- The German Federal Government has mandated clear standards for monitoring environmental impact of offshore wind farms in its **Standard for Investigation of the Impacts of Offshore Wind Turbines on the Marine Environment**[16]. These require the approval holder to carry out ecological monitoring before, during, and after the erection of an offshore wind farm. A good example of the development and implementation of the practical application of these standards is given in the publication **Environmental Research at Alpha Ventus (offshore wind farm) – first results**[17]



Distribution of little gulls Hydrocoloelusminutus based on aerial surveys in December 2009 and March 2010. Orange area: Alpha Ventus wind farm. So urce:BundesamtfürSeeschifffahrt und Hydrographie 2007

15- Ecology and Society Vol 17 No 2 Art 1 (2012) Marcus Eichhorn 1, Karin Johst 1, Ralf Seppelt 1 and Martin Drechsler Model-Based Estimation of Collision Risks of Predatory Birds with Wind Turbines.
16- BundesamtfürSeeschifffahrt und Hydrographie (2007) Standard for Investigation of the Impacts of Offshore Wind Turbines on the Marine Environment
17- BundesamtfürSeeschifffahrt und Hydrographie (2010) Environmental Research at Alpha Ventus (offshore wind farm) – first results

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★ While monitoring of environmental impacts is commonplace, very few ESs state that socio-economic impacts will be assessed during the lifetime of the wind farm. One example of good practice in this regard is the **Gwent y Môr** offshore wind farm off the coast of Wales (*http://www.rwe.com*). The SEIA chapter of the ES for this wind farm states that "further tourist attitude surveys will be conducted following the construction of Gwynt y Môr. Such a survey will seek to repeat the method used during the pre-construction survey commissioned by npower renewables to elicit the views of tourist visitors at a representative number of locations around the Liverpool Bay coastline." It is important that socio-economic impacts are monitored so that changes to local communities and economies can be tracked and understood. In Denmark and England, separate studies comprising before and after research were undertaken to assess the impact that the **Horns Rev** offshore wind farm and the **Carland Cross** wind farms respectively were expected to have and actually had on local communities.

ACKNOWLEDGMENTS:
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