Rialtas na hÉireann
Government of Ireland

Draft Revised

Wind Energy Development Guidelines

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Prepared by the Department of Housing, Planning and Local Government

housing.gov.ie

FOREWORD- MINISTER EOGHAN MURPHY T.D.

I am delighted to be publishing these draft Wind Energy Development Guidelines for public consultation in conjunction with my colleague Richard Bruton T.D., Minister for Communications, Climate Action and the Environment, who leads on energy policy.

The review of the Wind Energy Development Guidelines (2006) has been a lengthy process that began with the issuing of initial draft proposals for public consultation in December 2013. This initial consultation resulted in a high level of public engagement and the lessons learned from this initial process are reflected in these draft Guidelines.

Following the 2013 consultation and subsequent detailed engagement between my Department and the Department of Communications, Climate Action and Environment, including at Ministerial level, a “preferred draft approach” to inform and advance the conclusion of the review was announced in June 2017. In line with this “preferred draft approach”, the draft Guidelines now being issued for public consultation primarily focus on addressing a number of key aspects including noise, visual amenity setback, shadow flicker, community consultation obligations, community dividend and grid connections.

From a good practice perspective, it is desirable that local communities are properly engaged in the planning process relating to wind energy proposals. At the same time, it is crucial that the planning system facilitates efforts to meet national and EU renewable energy targets. In this connection, the review aims to strike a better balance between addressing the concerns of local communities in relation to wind farm proposals, whilst maintaining Ireland’s ability to deliver on its binding energy policy obligations, and ensuring that there is greater, and earlier, community engagement by wind farm developers.

As well as providing for enhanced community engagement, it is envisaged that the revised guidelines will provide greater consistency of approach in planning for onshore wind energy development, as well as providing greater certainty and clarity to the planning system, to the wind industry and to local communities.

I would encourage all parties with an interest in this area including developers and communities to have their say on the draft guidelines before the consultation closes on 19 February 2020.

Eoghan Murphy TD, Minister for Housing, Planning and Local Government

FOREWORD- MINISTER RICHARD BRUTON T.D.

How we respond to the challenge of climate disruption will define this generation. The Climate Action Plan was published earlier this year. It sets out our roadmap forward, with actions across every sector of society to ensure we meet our 2030 climate commitments, putting us on a trajectory for net zero emissions by 2050.

Decarbonizing our energy supply is a key pillar of the Plan. It is planned that we will have 5 times the amount of renewables on our grid than we have today (requiring capacity to peak at 95% electricity generation from renewable sources). In the next decade, onshore wind will continue to be our main source of renewable energy.

Such a radical shift away from our current reliance on fossil fuels will require significant changes- to our grid, to the existing infrastructure, to our legislation and regulatory framework. These changes are necessary and crucial, if we are to move to a more sustainable energy system.

These guidelines set out how we deliver on our objectives, in accordance with best practice and in partnership with people living in the local area. Large scale projects can bring benefits to everyone and it’s vital that local communities are centrally involved if we are to be successful in delivering on the scale that is needed.

This consultation gives people the opportunity to offer views on how government, enterprise and local communities can work in tandem to deliver what is crucial infrastructure for the future of the country. I look forward to the outcome of this consultation and I hope we can forge a consensus on the way forward, which will ultimately result in a healthier, cleaner future for us all.

Richard Bruton T.D.

Minister for Communications, Climate Action and the Environment

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CHAPTER 1 INTRODUCTION AND POLICY CONTEXT

1.1 PURPOSE AND STATUS OF GUIDELINES

These Guidelines offer advice to planning authorities on planning for wind energy through the development plan process and in determining applications for planning permission. The guidelines are also intended to ensure a consistency of approach throughout the country in the identification of suitable locations for wind energy development and the treatment of planning applications for wind energy developments. They should also be of assistance to developers and the wider public in considering wind energy development.

The Department originally issued guidelines in September 1996 to planning authorities on wind energy development. Those Guidelines were superseded by the 2006 Guidelines and now these Guidelines supersede the 2006 Guidelines. These Guidelines are one of a series of guidelines aimed at assisting planning authorities in the exercise of their functions.

The Departments of Housing, Planning and Local Government (DHPLG) and Communications, Climate Action and Environment (DCCAE) conducted a targeted review of the Wind Energy Development Guidelines in relation to noise, shadow flicker, visual amenity setback, environmental assessment, consultation obligations and community dividend and grid connections. Accordingly, an Information Note, Review of the Wind Energy Development Guidelines 2006 'Preferred Draft Approach' was published in June 2017. The emerging "preferred draft approach" was outlined to update the general public, stakeholders and planning authorities on the progress made and timetable for conclusion of the Review of the 2006 Guidelines, in the light of the elapse of time since the review commenced in 2013.

In 2017, DHPLG also issued Interim Guidelines for Planning Authorities on Statutory Plans, Renewable Energy and Climate Change under Section 28 of the Planning and Development Act 2000 (as amended) in order to provide guidance on the administrative procedures relating to making, reviewing, varying or amending development plan or local area plan policies or objectives that relate to renewable energy, and in particular, wind energy developments.

This review of the Guidelines has been undertaken to reflect technological developments in the wind energy sector and to strike a balance between the concerns of local communities and the need to invest in indigenous energy projects. There are a number of technical appendices to this document which have been developed to assist planning authorities in relation to noise assessment, monitoring and the setting of planning conditions.

These Guidelines have been issued by the Minister for Housing, Planning and Local Government under Section 28 of the Planning and Development Act, 2000 (as amended).Planning authorities and An Bord Pleanála shall have regard to the Guidelines and are required to apply any *specific planning policy requirements* of the Guidelines in carrying out their functions under section 28(1C).

Specific Planning Policy Requirements- SPPR's

Specific Planning Policy Requirements must be applied by planning authorities and An Bord Pleanála in the performance of their functions.

These Guidelines apply to planning applications and considerations for future wind energy development proposals, including the repowering and renewal of existing wind energy developments.

It should, however be noted that these guidelines relate solely to land use and environmental issues related to on-shore wind energy and do not deal with issues concerning purchasing agreements, matters relating to grid capacity or off-shore wind energy.

Offshore wind energy developments are currently excluded from the provisions of the Planning and Development Act 2000 (as amended). They are, however, subject to the Foreshore Act 1933 (as amended). The Foreshore Act 1933 (as amended) requires that a lease or licence must be obtained from the Minister for Housing, Planning and Local Government for the carrying out of works or placing structures or material on, or for the occupation of or removal of material from, State-owned foreshore, which represents the greater part of the foreshore. Construction of permanent structures on privately owned foreshore also requires the prior permission of the Minister. The Department of Communications, Climate Action and Environment (DCCAE) has prepared the Offshore Renewable Energy Development Plan which can be viewed at

https://www.dccae.gov.ie/en-ie/energy/topics/Renewable-Energy/electricity/offshore/offshore-renewable-energy-development-plan-/Pages/Offshore-Renewable-Energy-Development-Plan.aspx

The DCCAE has also published guidance on the development of offshore renewable energy

https://www.dccae.gov.ie/en-ie/energy/topics/Renewable-Energy/electricity/offshore/offshore-renewable-energy-development-plan-/Pages/Guidance-Documents-for-Developers0517-9406.aspx

In 2014 the European Parliament and the Council of the European Union adopted Directive 2014/89/EU relating to Marine Spatial Planning (MSP), which will try to balance the different demands for using the sea including the need to protect the marine environment. Each Member State must adopt a Marine Spatial Plan by March 2021. Accordingly a National Marine Planning Framework (NMPF) Baseline Report was published on 18 September 2018 and public consultation was undertaken until 14 December 2018. The Framework will, when adopted by both Houses of the Oireachtas, be a key decision making tool for regulatory authorities and policy makers into the future, including decisions on individual consent applications. In addition Article 16 of the Revised Renewable Energy Directive 2018 requires that, by 01 January 2021 Member States shall set up one or more single administrative contact points which will coordinate the entire permit granting process for applicants for permits to build and operate plants and associated transmission and distribution network infrastructures for the production of energy from renewable energy sources.

As such legislative proposals are being drafted to replace the Foreshore Act 1933 and to address the absence of a regulatory framework to regulate offshore renewable energy developments beyond the limits of the foreshore (12 nautical miles). The Marine Planning and Development Management Bill will also provide a coherent mechanism to facilitate and manage development in the exclusive economic zone (EEZ) and on the continental shelf, including for the first time, a comprehensive regime for the regulation of offshore renewable energy.

1.2 POLICY CONTEXT

1.2.1 Climate Change and Renewable Energy

Climate change is one of the biggest global challenges of this century. Its scale and complexity demands a coordinated approach at both national and international levels and Ireland is committed to concerted multilateral action to tackle climate change.

This Review has been undertaken within a wider national and EU energy policy context in line with binding EU and international obligations on Ireland to play its part in tackling both the causes and effects of climate change.

In accordance with the Governance of the Energy Union and Climate Action Regulation, Ireland's first Draft National Energy and Climate Plan (NECP) 2021-2030 was submitted to the European Commission in December 2018. This first draft of the NECP takes into account energy and climate policies developed to date, the levels of demographic and economic growth identified in the

Project 2040 process (discussed below) and includes all of the climate and energy measures set out in the National Development Plan 2018-2027. The final NECP will be submitted to the Commission by December 2019.

Project Ireland 2040 is the Government's overarching policy initiative to make Ireland a better country, informed by the Programme for a Partnership Government 2016, which recognises that economic and social progress go hand in hand. Project Ireland 2040 comprises of the National Planning Framework to 2040 and the National Development Plan 2018-2027.

The National Planning Framework (NPF) 2018 identified the importance of climate change in National Strategic Outcome (NSO) 8, which relates to ensuring a 'Transition to a Low Carbon and Climate Resilient Society'. National Policy Objective 55 seeks to 'Promote renewable energy use and generation at appropriate locations within the built and natural environment to meet national objectives towards achieving a low carbon economy by 2050.'

The associated National Development Plan (NDP) 2018-2027 includes 'climate action' as one of its Strategic Investment Priorities (SIPs). The NPF advises that new energy systems and transmission grids will be necessary for a more distributed, renewables-focused energy generation system, harnessing both the considerable on-shore and off-shore potential from energy sources such as wind, wave and solar and connecting the richest sources of that energy to the major sources of demand.

To ensure Ireland meets its future needs for renewable electricity in a sustainable manner, the Department of Communications, Climate Action and Environment (DCCAE) is currently preparing a revised Renewable Electricity Policy Development Framework (REPDF). The REPDF is intended to guide the development of large scale renewable electricity projects on land. Developing clear national policy that is evidence-based and which facilitates the development of renewable energy on the land area of the state will greatly facilitate the DCCAE delivering upon its core purpose. The REPDF is due to go to public consultation in Quarter 1, 2020.

Following publication of various reports of the UN Intergovernmental Panel on Climate Change (IPCC), all parties of the Oireachtas and the independent Climate Change Advisory Council recognised that Ireland's response to climate change has thus far been insufficient. As such the Joint Committee on Climate Action published a report on 'Climate change: a cross-party consensus for action' in March 2019, taking into account representations from the 2017 Citizen's Assembly Report and other evidence presented to the Committee. The report contains 42 priority recommendations in the area of climate action, grouped in the following key themes: governance; supporting a just transition; citizen and community engagement; education and communication; opportunities; incentivising climate action; energy; agriculture, forestry and peatlands; the built environment; and transport. The Committee's report was unanimously endorsed by the Dáil and the recommendations are being progressed as part of the implementation of the Climate Action Plan.

The Climate Action Plan 2019 is committed to achieving a net zero carbon energy system for Irish society and create a resilient and sustainable country. Decarbonisation is a must if the world is to contain the damage from the impact of greenhouse gas emissions and build resilience for our countries and communities. The far-reaching plan sets out over 180 actions, together with hundreds of sub-actions, that need to be taken at a time when the warning signs are growing, and the time for taking action is rapidly reducing.

At a time when we should be radically reducing our reliance on carbon, Ireland's greenhouse gas emissions have been rising rapidly. The state is currently 85% dependent on fossil fuels and there is a short window of opportunity to reverse this trend and secure a better, healthier, more resilient future for the country. This means changing the way we heat our homes, the way we travel and the way we power our country.

This plan identifies how Ireland will achieve its 2030 targets for carbon emissions, and puts us on a trajectory to achieve net zero carbon emissions by 2050. The Plan embraces every relevant sector: electricity, enterprise, housing, heating, transport, agriculture, waste, and the public sector.

In relation to electricity the key objectives are outlined below:

Electricity

- Increase reliance on renewables from 30% to 70% adding up to 8.2GW of renewable onshore wind energy capacity with some of this delivered by private contracts via corporate power purchase agreements
- Deliver the Renewable Electricity Support Scheme (RESS) which will provide support for renewable electricity projects in Ireland through a series of scheduled, competitive auctions.
- Put in place a coherent support scheme for micro-generation with a price for selling power to the grid
- Open up opportunity for community participation in renewable generation as well as community gain arrangements
- Streamline the consent system, the connection arrangements and the funding supports for the new technologies both onshore and off shore

1.2.2 Safeguarding our Landscape, Natural Heritage and Built Environment

Notwithstanding the clear benefits of promoting wind energy development in the context of tackling climate change, a balance needs to be struck in order to ensure that wind energy development does not materially affect our natural and built environment, as well the amenity of those who inhabit and visit our country. International, European and national legislation and guidance in this regard must be considered when local authorities are preparing their development plans and assessing planning applications relating to wind energy development.

Landscape

Ireland signed and ratified the Council of Europe's European Landscape Convention (ELC) which came into effect on 1 March 2004. It obliges Ireland to implement policy changes and objectives concerning the management, protection and planning of the landscape. The National Landscape Strategy for Ireland 2015-2025 is to be used to ensure compliance with the ELC and to establish principles for protecting and enhancing it while positively managing its change. It is a high level policy framework to achieve balance between the protection, management and planning of the landscape by way of supporting actions. It is proposed to produce a National Landscape Character Assessment and a National Landscape Map for Ireland, which will inform, and be informed by, lower tier landscape character assessments, which should in turn be used in planning policy formulation and decision making.

Article 1.a. of the European Landscape Convention, as included in the Planning and Development (Amendment) Act 2010 states that 'Landscape means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors'. Ireland's National Landscape Strategy advises that the Irish landscape is an integral component of our surroundings and well-being, a visual expression of the diversity of our shared cultural and natural heritage, and intrinsic to our identity as an island nation. The Government recognises the past, present and on-going influences on the landscape from a broad range of sectors and the need to support sustainable landscape change and better promote landscape protection, management and planning.

Pursuant to Part XIII of the Planning and Development Act 2000 (as amended), Landscape Conservation Areas may be designated by local authorities for the purposes of preservation of the landscape and Areas of Special Amenity may be designated for reasons of outstanding natural beauty or special recreational value. Section 10 of the 2000 Act describes the content of development plans, indicating that they should include objectives for, inter alia: "(2) (e) the *preservation of the character of the landscape* [emphasis added] where, and to the extent that, in the opinion of the planning authority, the proper planning and sustainable development of the area requires it, including the preservation of views and prospects and the amenities of places and features of natural beauty or interest”. Tree Preservation Orders are also facilitated under Part XIII of the 2000 Act in the interests of protecting any tree, trees, group of trees or woodlands.

Natural Heritage and Biodiversity

Established in 1971, UNESCO's Man and the Biosphere programme (MAB) is an intergovernmental scientific programme that examines the consequences of human interaction with the environment. The World Network of Biosphere Reserves includes 669 biosphere reserves across 120 countries. Biosphere reserves are UNESCO internationally designated sites of conservation value. The designation aims to integrate the interests of nature conservation, sustainable development, research and education. Ireland is home to two biosphere reserves, namely Killarney National Park and Dublin Bay.

Council Directive (92/43/EEC) on the Conservation of Natural Habitats and of Wild Flora and Fauna (the ‘Habitats Directive’) requires Ireland to propose relevant areas for designation as Special Areas of Conservation for the conservation of listed habitats and species, and to maintain their favourable conservation status. The Habitats Directive was transposed into Irish law by The European Communities (Natural Habitats) Regulations, 1997 (S.I. 94 of 1997).

Council Directive 79/409/EEC on the Conservation of Wild Birds (the ‘Birds Directive’), requires that special measures be taken to conserve the habitats of listed migratory and wetland species in order to ensure their survival and reproduction in their area of distribution. The most suitable areas for these species are classified as Special Protection Areas. Ireland is obliged to “take appropriate steps to avoid pollution or deterioration of habitats or any disturbances affecting the birds”. Only activities that do not have significant effects on birds are acceptable in Special Protection Areas. The Birds Directive also requires the avoidance of pollution or deterioration of habitats generally outside specifically protected sites.

The Habitats and Birds Directives combine to establish the EU wide Natura 2000 ecological network of protected areas. Natura 2000 is a network of core breeding and resting sites for rare and threatened species, and some rare natural habitat types which are protected in their own right. It stretches across all 28 EU countries, both on land and at sea. The Natura 2000 Viewer (http://natura2000.eea.europa.eu/#) is an on-line tool that presents all Natura 2000 sites, provides key information on species and habitats for which each site has been designated, data on their estimated population size, conservation status and allows for various searches. The Habitats Directive does not, a priori, exclude wind energy developments in or adjacent to Natura 2000 sites. These need to be judged on a case by case basis. The European Commission have also produced a helpful guidance document ‘Wind energy developments and NATURA 2000’ http://ec.europa.eu/environment/nature/natura2000/management/docs/Wind_farms.pdf

The European Communities (Birds and Natural Habitats) Regulations 2011 transpose the EU Habitats and Birds Directives into Irish law**.** A listing of Special Areas of Conservation, Special Protection Areas is available on the National Parks and Wildlife Service website:. https://www.npws.ie/protected-sites. The environmental implications of any development likely to have an impact on any SAC or SPA have to be assessed irrespective of the location of the development. In some cases this may require an Appropriate Assessment (see Chapter 4). Planning permission cannot be granted where such an assessment shows that the development would adversely affect the integrity of an SAC or SPA, unless, for example, imperative reasons of overriding public interest (IROPI) can be demonstrated in line with Article 6(4) of the Habitats Directive.

Environmental assessment or environmental impact assessment are procedures that ensures that the environmental effects of certain plans, programmes or projects are assessed before the decisions are made. Consultation with the public is a key feature of environmental impact assessment and environmental assessment procedures.

Strategic Environmental Assessment (SEA) is the process by which environmental considerations are required to be fully integrated into the preparation of plans and programmes and prior to their final adoption. The SEA Directive (2001/42/EC) applies to a number of sectors including agriculture, forestry, fisheries, energy, industry, transport, waste management, water management, telecommunications, tourism and land use planning. This Directive is implemented in Ireland by the European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004 (SI 435/2004) and the Planning and Development (Strategic Environmental Assessment) Regulations 2004 (SI 436/ 2004) as amended by SI 200/2011 and SI 201/2011.

The first EIA Directive was adopted in 1985 (Directive 85/337/EEC) and, following the adoption of amending Directives in 1997, 2003 and 2009, a codified Directive was adopted in 2011 (Directive 2011/92/EU). The EIA Directive is designed to ensure that projects likely to have significant effects on the environment are subject to a comprehensive assessment of environmental effects prior to development consent being given. This Directive requires member states of the EU to carry out assessments of the environmental effects of certain public and private projects before they are allowed to go ahead.

The 2014 EIA Directive (Directive 2014/52/EU), which amended the codified 2011 Directive (2011/92/EU) but did not replace it, entered into force on 15 May 2014. The provisions of the 2014 EIA Directive were transposed into Irish planning legislation on 1st September 2018, with the intention of simplifying the rules for assessing the potential effects of projects on the environment, whilst improving the level of environmental protection. The new approach pays greater attention to threats and challenges that have emerged since the original rules came into force over 30 years ago. This means more attention to areas like resource efficiency, climate change and disaster prevention, which are now better reflected in the assessment process.

EIA provisions in relation to planning consents are currently contained in the Planning and Development Act, 2000, (as amended) (Part X) and in Part 10 of the Planning and Development Regulations, 2001 (as amended). The regulations set thresholds at and above which an EIA is required, however the local authority (or An Bord Pleanála) may require that an Environmental Impact Assessment Report (EIAR) be prepared, even if the development is below the threshold but if it is likely to have a significant effect on the environment.

The Convention on Biological Diversity (the 'Biodiversity Convention'), which entered into force on 29 December 1993, is a multilateral, international and binding treaty with three main goals including: the conservation of biological diversity; the sustainable use of its components; and the fair and equitable sharing of benefits arising from genetic resources. The CBD Strategic Plan for Biodiversity 2011-2020 seeks to integrate biodiversity values to national and local development, planning processes, poverty reduction strategies, national accounting and associated reporting systems by 2020.

In 2011, the EU 2020 Biodiversity Strategy was adopted following recognition that the EU had missed its 2010 target of halting biodiversity loss. The EU strategy has six main targets which focus on: full implementation of EU nature legislation, better protection for ecosystems and more use of green infrastructure; more sustainable agriculture and forestry; more sustainable fisheries; tighter controls of invasive alien species; and a greater contribution to averting global biodiversity loss.

The Convention of Wetlands of International Importance ('Ramsar Convention') is an intergovernmental treaty providing a framework for national action and international cooperation for the conservation and wise use of wetlands. It was adopted in 1971, amended in 1982 and 1987 and was ratified by Ireland in 1985. There are currently 45 RAMSAR sites in Ireland.

The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) guides international cooperation on a range of issues including the conservation of marine biodiversity and ecosystems, the impact of eutrophication and hazardous substances, and monitoring and assessment. It was launched in 1992, following of the merger of the previous Oslo and Paris Conventions (from 1972 and 1974). Several studies of potential impact of off-shore wind energy developments on the marine environment have been initiated under the auspices of this Convention.

The Convention on the Conservation of Migratory Species of Wild Animals (the 'Bonn Convention') entered into force in 1983 and aims to preserve migratory species throughout their natural range. Several agreements signed under this Convention are relevant to the management of conflicts between migrating animals and wind energy developments including the Agreement on the Conservation of Populations of European Bats (EUROBATS) which concerns the protection of all 45 species of bats found in Europe. It entered into force in 1994 and was ratified by Ireland in 1995. Under this agreement, guidelines were published in 2008 (and revised in 2014): Guidelines for consideration of bats in wind farm projects. Revision 2014.

Ireland's 3rd National Biodiversity Action Plan, 2017-2021 sets out actions through which a range of government, civil and private sectors will undertake to achieve Ireland's 'Vision for Biodiversity', and follows on from the work of the first and second National Biodiversity Action Plans. 119 targeted actions are contained in the Plan, underpinned by seven strategic objectives.

Nationally designated conservation areas include Nature Reserves, Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs). Nature Reserves are areas of land, inland water or foreshore areas established for conservation of one or more species, communities, and habitats or for any feature of geological, geomorphological or other natural interest which is provided for by the Minister in accordance with the Wildlife Acts, 1976 and 2000. NHAs are a national designation introduced by the Wildlife (Amendment) Act 2000 to protect natural heritage of national importance. These sites are of significance to wildlife and habitats. pNHAs are sites which have not progressed to NHA status but nonetheless are likely to have ecological value.

In 1969, the International Union for the Conservation of Nature (IUCN) recommended that all governments agree to reserve the term 'National Park' to areas sharing the following characteristics:

- Where one or several ecosystems are not materially altered by human exploitation and occupation; where plant and animal species, geomorphological sites and habitats are of special scientific, educational and recreational interest or which contain a natural landscape of great beauty;
- Where the highest competent authority of the country has taken steps to prevent or eliminate as soon as possible exploitation or occupation in the whole area and to enforce effectively the respect of ecological, geomorphological or aesthetic features which have led to its establishment;
- Where visitors are allowed to enter, under special conditions, for inspirational, educational, cultural and recreational purposes.

There are six designated national parks in Ireland, all of which are State-owned: Ballycroy, Co. Mayo; The Burren, Co. Clare; Connemara, Co. Galway; Glenveagh, Co. Donegal; Killarney, Co. Kerry; and the Wicklow Mountains.

Built Environment

A World Heritage Site is a landmark or area which is selected by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as having cultural, historical, scientific or other form of significance, and is legally protected by international treaties. The sites are judged important to the collective interests of humanity. As of July 2018, a total of 1,092 World Heritage Sites (845 cultural, 209 natural, and 38 mixed properties) exist across 167 countries. There are two designated World Heritage Sites in Ireland, namely Sceilg Mhicíl and Brú na Bóinne. Additional sites have been identified and submitted for consideration to the World Heritage Tentative list 2010 by the Minister of Culture Heritage and the Gaeltacht.

UNESCO's Convention Concerning the Protection of the World Cultural and Natural Heritage was drawn up in 1972 and ratified by Ireland in 1991. This convention notes that the cultural and natural heritage is increasingly threatened with destruction. Each state party to the convention recognises that the duty of ensuring identification, protection, conservation, presentation and transmission to future generations of this heritage belongs primarily to that state.

The Historic Urban Landscape, 2011 - UNESCO's recommendation on the Historic Urban Landscape was adopted on 10 November 2011 by UNESCO's General Conference. The historic urban landscape approach moves beyond the preservation of the physical environment, and focuses on the entire human environment with all of its tangible and intangible qualities. It seeks to increase the sustainability of planning and design interventions by taking into account the existing built environment, intangible heritage, and cultural diversity, socio-economic and environmental factors along with local community values.

The Valletta Treaty (formally the European Convention on the Protection of the Archaeological Heritage (Revised), also known as the Malta Convention) is a multilateral and international legally binding treaty of the Council of Europe. It deals with the protection, preservation and scientific research of archaeological heritage in Europe. The 1992 treaty aims to protect the European archaeological heritage "as a source of European collective memory and as an instrument for historical and scientific study". All remains and objects and any other traces of humankind from past times are considered to be elements of the archaeological heritage.

The Convention for the Protection of the Architectural Heritage of Europe (the 'Granada Convention'), drawn up by the Council of Europe in 1985, was ratified by Ireland in 1997. It provides the basis for our national commitment to the protection of the architectural heritage. The convention is a means of proclaiming conservation principles, including a definition of what is meant by architectural heritage such as monuments, groups of buildings and sites. It seeks to define a European standard of protection for architectural heritage and to create legal obligations that the signatories undertake to implement. It stresses the importance of 'handing down to future generations a system of cultural references'. It relies for its effectiveness on its signatory countries implementing their own national protective regimes.

The Irish National Monuments Service has mapped the locations of recorded monuments nationwide in the Record of Monuments and Places (RMP). The RMP is the statutory instrument of the National Monuments Acts 1930-2004. The interactive map/search facility that provides access to all records of the Archaeological Survey of Ireland (ASI) stored on its national database, is commonly known as the Sites and Monuments Record (SMR).

Local authorities must prepare a Record of Protected Structures, namely a list of structures which it considers to be of special interest from an architectural, historical, archaeological, artistic, cultural, scientific, social or technical perspective, as part of their development plan. Where the local authority considers, taking into account building lines and heights, that a place, area, group of structures or townscape is of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest or value or that the area contributes to the appreciation of protected structures, it may designate an Architectural Conservation Area.

These structures and areas are afforded protection under Part IV of the Planning and Development Act 2000 (as amended) and the Planning and Development Regulations 2001 (as amended). Local authorities must include policies within their development plans to require the impact of proposed developments on protected structures and architectural conservation areas to be assessed.

1.3 SAFEGUARDING AMENITY

The WHO Environmental Noise Guidelines for the European Region (2018) provide guidance on protecting human health from harmful exposure to environmental noise. They set health-based recommendations on long-term average environmental noise exposure of five relevant sources of environmental noise. These sources are: road traffic noise, railway noise, aircraft noise, wind turbine noise and leisure noise.

The Environmental Noise Guidelines aim to support the legislation and policy-making process on local, national and international level. The WHO guideline values are public health-oriented recommendations, based on scientific evidence of the health effects and on an assessment of achievable noise levels.

Compared to previous WHO guidelines on noise, there are five significant developments in the 2018 version:

- stronger evidence of cardiovascular and metabolic effects of environmental noise;
- inclusion of new noise sources, namely wind turbine noise and leisure noise, in addition to noise from transportation (aircraft, rail and road traffic);
- use of a standardized approach to assess the evidence;
- the systematic reviews of evidence define the relationship between noise exposure and risk of health outcome; and
- use of long-term average noise exposure indicators to better predict adverse health outcomes, compared to short-term noise exposure measures.

Directive 2002/49/EC relating to the assessment and management of environmental noise (the Environmental Noise Directive) is the main EU instrument to identify noise pollution levels and to trigger the necessary action both at Member State and at EU level.

To pursue its stated aims, the Environmental Noise Directive focuses on three action areas:

- the determination of exposure to environmental noise
- ensuring that information on environmental noise and its effects is made available to the public
- preventing and reducing environmental noise where necessary and preserving environmental noise quality where it is good

The Directive applies to noise to which humans are exposed, particularly in built-up areas, in public parks or other quiet areas in an agglomeration, in quiet areas in open country, near schools, hospitals and other noise-sensitive buildings and areas.

The Environmental Protection Agency Act 1992, identifies noise as a form of environmental pollution. The Act contains provisions for dealing with noise "which is a nuisance, or would endanger human health or damage property or harm the environment." Section 106 of the Act relates to Regulations for Control of Noise; this section gives the Minister the power to make regulations for the purpose of preventing or limiting noise. This may include imposing noise limits, either exceedance values or emission values, controlling sources of noise and the imposition of charges for noise pollution. Section 107 of the Act relates to the Power of Local Authority or Agency to Prevent or Limit Noise; this section gives powers to Local Authorities or the Environmental Protection Agency to control and limit noise from any premises, process or work.

1.4 SUMMARY

The importance of taking urgent and coordinated action to tackle climate change is clear and the Government is committed to leading the way, as evidenced above.

Notwithstanding the recognition that renewable energy has a significant role to play in tackling climate change, the proper planning and sustainable development of their areas must be taken into account when local authorities prepare their development plans and assess planning applications. In this regard, the impact of wind energy development proposals on the landscape, including the natural and built environment, must be considered along with the legitimate concerns of local communities.

CHAPTER 2 TECHNOLOGY AND WIND ENERGY DEVELOPMENT

2.1 WHAT IS WIND ENERGY AND HOW DOES IT WORK?

The sun heats the earth unevenly and this creates thermal air currents. In order to achieve equal temperatures around the earth, these air pockets move about as global wind. Wind is inexhaustible and renewable and is produced in varying power due to the movement of air between an unevenly heated atmosphere and the irregular surface of the earth. The power of wind allows it exert force and create energy which can be captured and converted to provide electricity. Whilst the use of wind power for commercial production of electricity did not become commonplace until about 30 years ago, the principle behind today's wind turbines are the same as in the windmills and watermills.

The first stage in the wind energy development process is the identification of the most effective locations in terms of wind power. Ireland has one of the greatest wind energy resources in Europe. The Sustainable Energy Authority of Ireland provides an online 'wind mapping system', which identifies wind speeds and directions across the country: http://maps.seai.ie/wind/ . This information should be used by local authorities in identifying areas suitable for wind energy development in the formulation of their development plans and wind energy strategies (see Chapter 3).

The wind atlas can assist all those concerned with the wind planning process and be of great use to developers and policy makers alike. It is currently used by local authorities to help identify areas suitable for wind energy developments. SEAI hopes to increase the usefulness of this atlas to a wider audience, helping to inform the public and educate our children about the nature and extent of Ireland's wind energy resources.

2.2 WHAT ARE WIND ENERGY DEVELOPMENTS AND WIND TURBINES?

Wind turbines are used to convert the wind's kinetic energy to electricity. Wind energy proposals may be for single turbines or for groupings of turbines. A wind energy development is comprised of a group of wind turbines located relatively in the same area which are then interconnected with a medium voltage power collection system together with a communications network. Wind energy development construction consists of turbine foundations, site access roads, power cables and an electrical sub-station; the installation of wind turbines; and the connection of the wind energy development site to the existing electricity grid via overhead lines (involving poles and pylons) or underground cables. The substation compound may include including transformers, circuit breakers and a control building. At the substation, the medium-voltage electrical current is increased in voltage with a transformer for connection to the higher voltage transmission system.

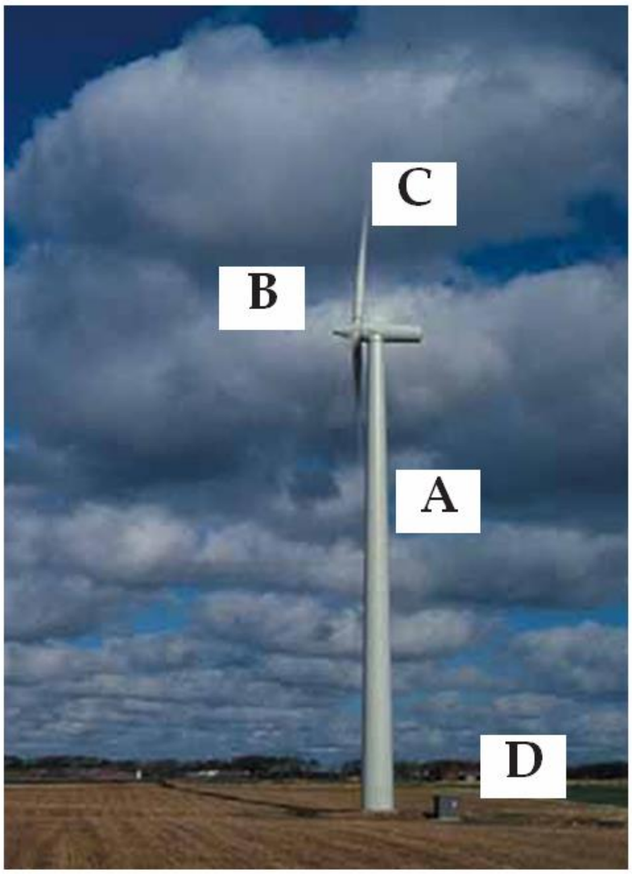

Fig 2.2

Wind turbines consist of a foundation, a tower (A), a nacelle (B) and a rotor (C). The foundation prevents the turbine from falling over. The tower holds up the rotor and a nacelle (or box). The nacelle contains large primary components such as the main axle, gearbox, generator, transformer (which may be housed either inside or alongside the tower as per (D) in the image above) and control system. The rotor is made of the blades and the hub, which holds them in position as they turn. Most commercial wind turbines have three rotor blades on the upwind side of the tower. The rotor either has a horizontal axis, which is the most common type, or a vertical axis:

Horizontal axis turbines: These often have three blades, although this varies in some models. The blades are designed as aerofoils, which use the wind to create lift and turn the rotor. They work in a similar way to aeroplane wings. The turbine rotor is designed to face either directly into or away from the wind. They are designed with a yawing mechanism which aligns them according to the wind direction.

Vertical axis turbines: These rotate around a vertical axis, turning a shaft which is in line with the mast or tower it is mounted on. The rotors can harness wind from any direction. The generator can be located inside the top of the mast, or the shaft can pass down through the inside of the mast to drive a generator located at the base. These turbines place less stress on the tower and base, which means they can be better for roof mounting.

2.3 HOW LARGE ARE WIND TURBINES?

Wind turbines come in many different sizes, depending on the amount of energy that they are required to produce. The larger the turbine, then (generally) the greater the amount of electricity produced.

Commercial energy generation

Currently the highest turbines in Ireland have a tip height of approximately 180-190m, however the height on any individual site will vary depending on the circumstances and the technology available which may change in the future. These guidelines focus mainly on commercial wind turbines, given the significant contribution they can make to meeting renewable energy targets and the potential wider impacts on the local environment and community, however micro-generation can also help to tackle climate change.

Micro-generation

Micro generation is the general term used to refer to generation that is less than 11kW. The DCCAE is currently considering the optimal fuel mix, including the role of micro generation, for Ireland. Micro-wind turbines can often be installed on rooftops or on poles in back gardens, subject to the requirement for planning permission where necessary. Micro-generators reduce the amount of electricity that would otherwise have to be bought from the grid. By installing a micro-generator, home and business owners can take action to address the issues of climate change, rising electricity prices and reliance on fossil fuels. The benefits of micro-generation include lower electricity bills and potential protection against future electricity price rises; less greenhouse gas emissions; reduced reliance on fossil fuels; reduced electrical losses on the network; and improved Building Energy Rating.

Guidance on connecting micro-generation to the electricity network is provided by the SEAI: https://www.seai.ie/resources/publications/Guide-to-Connecting-Micro-generation-to-the-Electricity-Network.pdf.

2.4 WHAT IS THE ANTICIPATED LIFESPAN OF A WIND ENERGY DEVELOPMENT AND WHAT HAPPENS NEXT?

Wind energy developments are expected to have an operational lifespan of approximately 30 years, after which time the site will be reviewed and assessed to determine whether the planning permission may be renewed, or whether the wind energy development may be repowered or otherwise decommissioned.

Renewal involves seeking planning permission to continue using the wind energy development as constructed, beyond the time limit specified in the original planning permission (if such a condition is in place).

Decommissioning entails the dismantling the above ground equipment and then removing it from the site, and the restoration of the land and surrounding areas to their previous condition.

Repowering entails the removal of the existing equipment and seeking planning permission for the installation of new, more efficient wind turbines within the wind energy development site. As existing wind energy developments near the end of their operating lives, applications for repowering are steadily increasing. In some cases, the wind energy developments will be repowered due to rapidly evolving technology and changing financial incentives.

In many cases applicants will seek to install larger turbines when repowering an existing site.

CHAPTER 3 PLANNING FOR WIND ENERGY DEVELOPMENT

3.1 INTRODUCTION

It is important that all development plans (including local area plans and wind energy strategies) incorporate both a statement of the planning authority's policies and objectives in relation to wind energy development and matters it will take into account in assessing planning applications for specific wind energy development proposals.

The development plan must achieve a reasonable balance between responding to overall Government Policy on renewable energy and enabling the wind energy resources of the planning authority's area to be harnessed in a manner that is consistent with proper planning and sustainable development, taking into account the legitimate views of local communities.

The assessment of individual wind energy development proposals needs to be conducted within the context of a "plan-led" approach. This involves identifying areas considered suitable or unsuitable for wind energy development, and those which may be open for consideration for wind energy development. These areas should then be set out in the development plan in order to provide clarity for developers, the planning authority, and the public.

3.2 RELEVANT NATIONAL AND REGIONAL POLICY DOCUMENTS

National Plans, Guidelines and Policy Statements

Important documents to be considered by planning authorities in the context of preparing and adopting strategic policies and objectives in relation to wind energy development in their development plans include all relevant Ministerial planning guidelines and guidance notes. Planning authorities shall, in particular, have regard to the following national plans, policies and strategies when making, reviewing, varying or amending development plan or local area plan policies or objectives that relate to renewable energy, and in particular, wind energy developments:

- The National Renewable Energy Action Plan 2010 (Irish Government submission to the European Commission);
- The Government's Strategy for Renewable Energy 2012 – 2020 (DCENR);
- The Government's White Paper on Energy Policy - Ireland's Transition to a Low Carbon Energy Future 2015-2030 (DCENR);

- The Government's National Mitigation Plan, July 2017 (DCCAE);
- The Government's National Planning Framework and National Development Plan, February 2018 (DHPLG);
- The Government's National Adaptation Framework, January 2018 (DCCAE); and
- The Government's Draft National Energy and Climate Plan 2021-2030 (Irish Government submission to the European Commission, December 2018).
- The All of Government Climate Action Plan, 2019 to tackle climate breakdown

Regional Planning Guidelines and Regional Economic and Spatial Strategies

Many Regional Planning Guidelines and Regional Economic and Spatial Strategies propose coordination between planning authorities in relation to the development of renewable energy. The sieve analysis approach outlined at paragraph 3.6 below could assist regional authorities in developing a common framework within and between regions for the development of wind energy. In addition, local authorities, potential developers of wind energy developments and the general public are advised to consult the documents adopted by the assemblies:

- Eastern and Midlands Regional Assembly: https://emra.ie/
- Southern Regional Assembly: https://www.southernassembly.ie/
- Northern and Western Regional Assembly: https://www.nwra.ie/

3.3 DEVELOPMENT PLANS AND LOCAL AREA PLANS

The development plan is a critical part of translating overall national policy on energy, renewable energy and wind energy in a manner that supports the achievement of Ireland's binding international obligations relating to climate change and renewable energy and takes account of local circumstances. Central and local government need to work together in achieving these targets.

In making or varying a development plan, Sections 12(11) and 13(7) of the Act provide that the members of a local authority shall be restricted to considering the proper planning and sustainable development of the area to which the development plan relates, the statutory obligations of any local authority in the area and any relevant policies or objectives for the time being of the Government or any Minister of the Government.

It is a specific planning policy requirement under Section 28(1C) of the Planning and Development Act 2000 (as amended) that in reviewing, varying or amending development plans, or a local area plan, with policies or objectives that relate to wind energy developments, the relevant planning authority shall:

SPPR 1

1) Ensure that overall national policy on renewable energy as contained in documents such as the Government's '*National Energy and Climate Plan 2021-2030* ', and the '*Climate Action Plan 2019*', is acknowledged and documented in the relevant development plan or local area plan;
2) Indicate how the implementation of the relevant development plan or local area plan over its effective period will contribute to realising overall national targets on renewable energy and climate change mitigation, and in particular wind energy production and the potential wind energy resource (in megawatts) taking into account the 'sieve mapping approach' identified in Table 1 below, in particular the potential contribution of the areas identified as 'acceptable in principle' and 'open for consideration'; and
3) Demonstrate detailed compliance with section 3.4 of these guidelines.

3.4 DEVELOPMENT PLAN – STRATEGIC AIMS AND OBJECTIVES

Following consideration of the strategic context in regional and national terms for wind energy development, and also after full consultation with the appropriate bodies, the development plan should set out the following policies and objectives:

- a positive and supportive statement of the importance of wind energy as a renewable energy source which can play a vital role in achieving national targets in relation to reductions in fossil fuel dependency and therefore greenhouse gas emissions, together with an objective to ensure the security of energy supply;
- objectives to secure the maximum potential from the wind energy resources of the planning authority's area commensurate with supporting development that is consistent with proper planning and sustainable development;
- the identification on development plan maps of the key areas within the planning authority's functional area where there is significant wind energy potential and where, subject to criteria such as design and landscape planning, natural heritage, environmental

and amenity considerations, wind energy development will be acceptable in principle; those areas which may be open to consideration for wind energy development (where relevant) and those areas where wind energy development will generally be discouraged;

- the specific criteria for wind energy development that the planning authority will take into account when considering any wind energy or related[1] proposals in the key areas identified based on the recommended siting and design criteria referred to in these guidelines. and
- the investigation of the potential for relatively small-scale wind energy developments within urban and industrial areas, and for small community-based proposals outside the key areas that are identified as being appropriate for wind energy development. Community ownership of wind energy projects enables local communities to benefit directly from local wind energy resources being developed in their local areas, ensuring long-term income for rural communities.

3.5 CONSULTATION

Planning authorities are required to consult appropriate bodies to ensure that development plan policies have regard to relevant considerations, policies and views (Section 11(3)(c) of Planning and Development Act, 2000 (as amended)).

3.6 STEP-BY-STEP GUIDE TO THE ANALYSIS OF SUITABLE AREAS FOR WIND ENERGY BY THE PLANNING AUTHORITY

In order to assist planning authorities to identify, on development plan maps, key areas where there are good wind energy resources capable of exploitation in a manner consistent with proper planning and sustainable development, a step-by-step approach is proposed. This ordered approach involves a sieve mapping analysis of the key environmental, landscape and technical criteria which must be balanced in order to identify the most suitable location for wind energy development. In carrying out this exercise, it is advised to consult with neighbouring planning authorities to ensure a consistent approach across county boundaries. It would be helpful for potential wind energy developers and the general public if the local authority's approach to wind

[1] These may include energy networks and temporary wind anemometers that measure wind potential.

energy including the sieve mapping analysis could be set out in a wind energy strategy which could be attached as an appendix to the development plan.

Viewshed analysis and GIS can form an integral part of policy formulation, which are particularly useful when identifying the suitability of areas for the deployment of wind energy, given the amount of information and considerations involved in such an analysis. Many of the datasets required in an area-based analysis, such as topographical data, wind speed information and nature and heritage designations are now readily available.

Table 1 **IDENTIFYING SUITABLE LOCATIONS FOR WIND ENERGY DEVELOPMENT IN DEVELOPMENT PLANS**	
Step 1	Assess the areas of wind potential ranging from areas with extensive wind energy resources to lesser wind resources using SEAI's Wind Atlas for Ireland. This wind mapping tool provides detailed information on wind speeds, direction, electricity transmission and distribution networks for specific locations around Ireland at national and county levels. To view the Wind Atlas resource, click here http://maps.seai.ie/wind/. Assistance in this regard can be obtained from the SEAI info@seai.ie.
Step 2	Prepare or utilise an evaluation of the landscape and its sensitivity for wind energy developments. It is recommended that planning authorities contribute towards the protection of landscape designations as relevant. Factors that can inform landscape sensitivity to wind energy development include scenic quality, rarity, uniqueness, natural and cultural heritage and environmental considerations. Special attention is recommended in areas (such as coastal or island areas) where there is higher potential for the occurrence of adverse visual impacts arising from limited assimilative capacity. Some local authorities have prepared landscape characterisation maps, which could support this process. This assessment should take into account the National Landscape Strategy for Ireland 2015-2025 (https://www.chg.gov.ie/heritage/built-heritage/national-landscape-strategy/) and landscape character areas (including Northern Ireland Regional Landscape Character Areas), landscape sensitivity and value areas, high amenity zones, scenic views and prospects and land use objectives relating to landscape protection, National Parks, Special Amenity Order Areas and UNESCO World Heritage Sites. Further information on landscape assessment is provided in Chapter 6 and a methodology for landscape sensitivity mapping is outlined at Appendix 1. The local authority must, within their development plan and/or supporting documents, clarify how the landscape character and sensitivity analysis was undertaken and on what basis the relevant areas have been selected.
Step 3	Prepare an overlay of the wind energy mapping and the landscape evaluation and sensitivity analysis, together with information regarding built and natural

	heritage, archaeological and amenity designations in the Development Plan and existing settlements within the functional area of the local authority. The designation of an area for protection of natural or built heritage or as an amenity area does not automatically preclude wind energy development. However, consideration of any wind energy development in or near these areas must be subject to Ireland's obligations under international, EU and national legislation. When identifying areas which may be either acceptable or open for consideration for wind energy development, existing settlements must be identified and these areas should be excluded as they will be subject to the project-level requirement for a minimum of 500m setback from individual properties as set out later in these Guidelines. This process will identify those areas affected by statutory obligations and will facilitate optimising visual integration into the landscape while at the same time maximising the utilisation of wind energy resources. The process of overlaying wind energy mapping and landscape assessment with the development plan designations and settlements will produce a basis for identifying broadly, the areas where wind energy developments would be 'acceptable in principle', where they would be 'open for consideration', and where they would be 'not normally permissible'.
Step 4	Integrate the areas identified in the above steps with information regarding accessibility to electricity transmission and distribution grids. Details of the electricity transmission and distribution network are provided in SEAI's Wind Atlas for Ireland. In addition, transmission network details are available on EirGrid's Smart Grid Dashboard: http://smartgriddashboard.eirgrid.com/#all/transmission-map. If further network information is required, it is recommended that the planning authority consult with the Transmission System Operator EirGrid) or the Distribution System Operator (ESB Network) as appropriate. In cases where the development is in close proximity to Northern Ireland, the local authority may need to contact SONI. This process will establish, at a general level, areas where wind energy resources are readily capable of development as well as identifying other areas where wind energy resources are capable of being developed but where there is a need for corresponding development of electricity grid infrastructure.

3.7 LANDSCAPE CHARACTER

3.7.1 What is Landscape Character?

Landscape character is the distinct, recognisable and consistent pattern of elements that occur in a particular landscape and how these are perceived. It reflects particular combinations of natural components such as geology, landform, soils, and vegetation with human influences such as land use and human settlement. Cultural perceptions (such as history, social associations and aesthetic values) also play a major role. Understanding a landscape's character is key to ensuring new development can be accommodated successfully within a landscape.

Distinctive regional variations in landscape occur across Ireland and include many areas of outstanding quality that are valued nationally/internationally, including as tourism assets. A Fáilte Ireland survey found that 91% of visitors to Ireland ranked scenery and the natural/unspoilt environment as an important part of a destination in Ireland (Fáilte Ireland, 2012). The Council of Europe's European Landscape Convention, ratified by the Irish Government and effective since 2004, means that the Irish State has acknowledged the contribution that Ireland's landscape makes to people's quality of life, the wide range of land uses that are working to transform the landscape and the importance for all land-users to cooperate in the protection, management and planning of our landscapes.

3.7.2 Landscape Character Assessment

A key component of the sieve mapping process outlined above relies on the undertaking of landscape character assessment and sensitivity analysis. The sensitivity of a landscape is a measure of its ability to accommodate change or intervention, without suffering unacceptable effects to its character. Differing landscapes, based on their sensitivity, have the capacity to absorb different levels of development. In order to fully determine the sensitivity and capacity of a landscape, a Landscape Character Assessment (LCA) is recommended. A Landscape Character Assessment for a geographic area has, in general, three distinct elements: Landscape Types, Landscape Character Areas and Landscape Value and Sensitivity to Development.

Current guidance for Local Planning Authorities (LPAs) on the completion of Landscape Character Assessments in Ireland is provided in draft Guidelines for Planning Authorities on Landscape Assessment (DoEHLG, June 2000). These guidelines aim to provide an approach for local authorities to appraise landscapes in a systematic and consistent way using Landscape Character

Assessment (LCA). The draft guidelines were not finalised or adopted and thus remain a consultation draft with no formal status.

The European Landscape Convention (ELC) obliges Ireland to implement policy changes and objectives concerning the management, protection and planning of the landscape. The National Landscape Strategy for Ireland 2015-2025 is intended to establish principles for protecting and enhancing the landscape while positively managing its change. A key aspect of the National Landscape Strategy is the proposal to produce a National Landscape Character Assessment (NLCA), which would assist with providing a common language and process for preparing landscape character assessments at the county level.

Following completion of the NCLA, a National Landscape Character Map will be prepared using the evidence base to describe and assess distinct landscape character areas at the national scale, ensuring consistency within and between public authority areas and functions. It is also proposed to prepare statutory guidelines on local Landscape Character Assessments, following best international practice, and incorporating Historic Landscape Characterisation, and other appropriate assessment methodologies, for Planning Authorities under Section 28 of the Planning and Development Act 2000 (as amended).

3.7.3 Landscape Character Types, Areas, Value and Sensitivity

Ireland's landscapes can be broadly divided into distinct Landscape Character Types (LCTs). LCTs are distinct types of landscape that are relatively homogeneous in character. They are generic in nature in that they may occur in different areas or different parts of Ireland, but wherever they occur they share broadly similar combinations of geology, topography, drainage patterns, vegetation, historical land use and settlement pattern. For example, drumlins and mountain moorlands are recognised as two distinct LCTs.

It would be beneficial if consistency and cross-working between local authorities could be achieved in order to facilitate local, regional and national character assessments in line with the National Landscape Strategy for Ireland 2015-2025.

Landscape Character Areas (LCAs) are defined by the Heritage Council in its Baseline Audit as "unique, geographically-specific areas of a particular landscape type. Each has its own individual character and identity, even though it shares the same generic characteristics with other areas of the same type". These areas tend to be discrete geographically specific areas often reflecting a particular LCT or group of LCTs. Many of these areas will cross county (or indeed national) boundaries and thus local authorities are encouraged to work together to share information and practice.

The value of particular landscapes is often difficult to define, given the differing perceptions of those who live, work or visit the area. How an individual or community perceive a landscape is informed by how they interact with the landscape. Landscape sensitivity depends on the type, nature and magnitude of the proposed change as well as on the landscape's characteristics. High sensitivity indicates a landscape vulnerable to the change and vice versa. Landscape sensitivity is often used to refer to landscape studies that assesses a landscape's susceptibility to a particular type of development, for example wind energy development.

3.7.4 What do people think about wind energy developments in the landscape?

Local community

The views of the local community are a key consideration in the identification and designation of landscape character types, areas, value and sensitivity. These views are sought when the local authority consults on the draft development plan document, including the proposed landscape character assessment. This exercise will inform the wind energy strategy and policies of the local authority and will provide specific guidance on the locations which may be permissible for wind energy development or those where such development will not generally be permissible. As such local authorities are encouraged to consult widely and effectively in order to inform the emerging approach to wind energy development. Local communities are encouraged to take an active role in this engagement at the appropriate stage.

Tourism, Recreation and Education

The effect of wind energy development on tourism and recreational activities must also be assessed by the local authority in the preparation of their landscape character assessment. In this regard, it is desirable that the relevant national and/or regional tourist authority should be consulted. In many areas in Ireland, tourism and recreation underpin the local economy and can depend to varying degrees on the quality of the environment. Wind energy developments are not incompatible with tourism and leisure interests, but care needs to be taken to ensure that insensitively sited wind energy developments do not impact negatively on tourism potential.

The results of survey work in 2003 indicated that tourism and wind energy can co-exist happily[2]. The SEI survey found that, in general, Irish people are positively disposed towards the development of wind energy developments. However, the survey also indicated that people will

[2] Attitudes towards the Development of Wind Farms in Ireland – Sustainable Energy Ireland, 2003.

not accept wind energy developments everywhere and that special care should be taken to ensure that wind energy developments respond to contextual landscape characteristics.

Fáilte Ireland, in association with the Northern Ireland Tourist Board (NITB), decided in 2012 to survey both domestic and overseas holidaymakers to Ireland to determine their attitudes to wind energy developments[7]. In the study tourists were asked to rate the scenic beauty of five different Irish landscapes namely coastal, mountain, farmland, bogland and urban industrial landscapes and then rate the scenic beauty of each landscape and the potential impact of siting a wind energy development in each landscape.

The Fáilte Ireland study found that coastal areas (91%) followed by mountain moorland (83%) and fertile farmland (81%) were rated as the most scenic. The survey results indicate that although most visitors are broadly positive towards the idea of building more wind energy developments on the island of Ireland, one in seven of those surveyed were negative towards wind energy developments in any context. It is the view of Fáilte Ireland that National Parks and areas of national scenic importance should be avoided for wind energy development. However, the survey results suggest that in other landscapes, the development of wind energy developments can have a positive impact in terms of the visitor's perception of the Irish landscape and of Ireland's commitment to renewable energy. In the ten years since the original SEI study in 2002 visitors attitudes to wind energy developments in Ireland have not changed dramatically, and there is still generally a positive disposition amongst tourists to wind energy developments.

Interestingly those who have not seen a wind energy development on this visit have more negative opinions regarding the theoretical impact of a wind energy development on their sightseeing compared to those who have actually seen one. This suggests there are some negative associations with wind energy developments that in reality do not materialise for those who have seen them.

The educational potential of wind energy developments should also be considered. For example, there may be scope for interpretive centres on alternative energy resources to be located at accessible locations in proximity to some wind energy developments. Long distance walking routes/amenity rights-of-way could be identified and mapped in the Development Plan This would enable an assessment both of the extent to which recreational pursuits can be accommodated and facilitated either within or adjacent to wind energy developments.

3.8 STRATEGIC ENVIRONMENTAL ASSESSMENT AND APPROPRIATE ASSESSMENT OF THE DEVELOPMENT PLAN OR LOCAL AREA PLAN

The local authority will, in the course of their review or preparation of the development plan or local area plan, be required to undertake assessments of the plans in accordance with the SEA, Habitats and Birds Directives. These assessments will need to take account of the draft wind energy policies and strategies, including the sieve mapping process outlined above.

Current guidance on the preparation of Strategic Environmental Assessments can be found on the Department's website:

https://www.housing.gov.ie/sites/default/files/migrated-files/en/Publications/DevelopmentandHousing/Planning/FileDownLoad%2C1616%2Cen.pdf.

The DHPLG intends to publish updated guidance for public consultation in this regard in late 2019.

The National Parks and Wildlife Service (which currently forms part of the Department of Culture, Heritage and the Gaeltacht) provided guidance on the undertaking of Appropriate Assessment of Plans and Projects: https://www.npws.ie/protected-sites/guidance-appropriate-assessment-planning-authorities as part of the Department of Environment, Heritage and Local Government in 2009 (updated in 2010). The DCHG intends to publish updated guidance in this regard in due course.

3.9 MONITORING AND WIND ENERGY DEVELOPMENT

Planning authorities including An Bord Pleanála, should set up systems (where possible, incorporating an online spatial analysis component), to monitor wind energy development (including planning application decisions). This database should be updated regularly and can help to review the degree to which the policies and objectives of the development plan, in addition to the national targets for renewable energy, are being achieved. This database should include the information outlined below relating to approved applications, or the reasons for refusal of a planning application (where applicable), in order to inform the development of future policy and guidance on wind energy development:

- Total number of received, approved and refused applications relating to wind energy development and grid connections;
- Number and height of turbines in each application;

- Geographic coordinates of every turbine and boundaries of wind energy developments;
- Annual output (megawatts) for each applications.

Planning authorities should prepare annual monitoring reports to reflect the requirements of section 10 of the Strategic Environmental Assessment Environmental Report accompanying these guidelines, in order to facilitate monitoring and review of the effectiveness of the guidelines as necessary. These reports shall be submitted to the Department of Housing, Planning and Local Government no later than two months after these guidelines have been in effect for a year and every year thereafter.

CHAPTER 4 SUBMITTING A PLANNING APPLICATION FOR WIND ENERGY DEVELOPMENT

4.1 INTRODUCTION

The purpose of this Chapter is to advise potential applicants, planning authorities and An Bord Pleanála on what should be considered before a planning application for wind energy development is submitted. It includes guidance on pre-planning consultations, grid connections and the requirements in relation to environmental impact assessment. Further information on the general considerations in the assessment of Wind Energy Planning Applications is detailed in Chapter 5.2.

To ensure consistency in information on wind energy developments across the country, planning authorities must ensure an up to date electronic spatial analysis system database is maintained for all permitted and constructed wind energy developments including geographic coordinates of every turbine and boundaries of wind energy developments, which may include a transboundary dimension for wind energy developments straddling the border with Northern Ireland. As outlined in paragraph 3.9 above, refusals of permission relating to wind energy development should also be recorded for monitoring purposes.

Where individual wind turbines are decommissioned, this information shall also be included. Planning authorities shall ensure that such databases are compatible with the Department of Housing, Planning and Local Government's 'myplan.ie' GIS web browser.

4.2 PLANNING AUTHORITY PRE-APPLICATION CONSULTATION[3]

The primary purpose of pre-application consultation by the prospective applicant with the relevant planning authority is to improve the quality of a subsequent application, to avoid the necessity for seeking additional information and in some cases to avoid costs for both applicants and persons making observations in relation to applications likely to be unsuccessful.

[3] Section 247 of the Planning and Development Act, 2000, provides that a person who has interest in land and who intends to make a planning application may enter into consultations with the planning authority in order to discuss any proposed development in relation to the land. A person with no such interest has no statutory entitlement.

Consultation is of value in:

- highlighting development plan objectives on wind energy as referred to in Chapter 3, and
- suggesting need for specialist input as referred to in Chapters 5 and 6.

The requirements of the EIA, Habitats and Birds Directives should be brought to the developer's attention and in particular the fact that section 177V(3) of the Planning and Development Act 2000 (as amended) requires the refusal of permission unless the competent authority has determined that the proposed development would not adversely affect the integrity of a European site, unless it can be demonstrated that there are imperative reasons of overriding public interest (IROPI) and that compensatory measures are secured under either section 177AB or 177AC of the 2000 Act to ensure that the overall coherence of the Natura 2000 network is protected.

To ensure that pre-application consultation is as productive as possible a developer may be invited to submit a minimum level of documentation in advance of the meeting. This might include site location maps, initial description of the development including any initial economic or market factors, sample zones of theoretical visibility, etc.

The developer should be advised by the planning authority that pre-application documentation should also include details of the developer's initial discussions with the electricity transmission operators/distribution grid operators (ESB Networks and EirGrid (or Soni in the case of close proximity to Northern Ireland) as appropriate) so that the developer and the planning authority are aware of the probable and feasible grid connection corridor(s) and any other details that are available with regard to the grid connection, as considered in more detail below.

Additionally, it is strongly recommended that the planning authority consult with the Department of Culture, Heritage and the Gaeltacht at the earliest planning and design stages in relation to wind energy developments that may have a potential impact on the built and natural heritage. Good research and wide consultation by all parties at the site selection stage can avoid unnecessary time delays and expense in considering unsuitable sites.

4.3 COMMUNITY ENGAGEMENT

4.3.1 Consultation Obligations

As set out in Chapter 3 of these Guidelines, all development plans are required to incorporate both a statement of the planning authority's policies and objectives in relation to maximising the potential for wind energy development in pursuance of national targets for renewable energy as well as the detailed considerations to be taken into account in assessing planning applications for specific wind energy development proposals.

In achieving the above, securing community and therefore public acceptance of wind energy developments is an important building block which will in turn depend on proper consultation with and participation by the community in progressing wind energy proposals from concept to approval and ultimately development.

Community consultation is the process through which a developer (in this case a wind energy developer) interacts with the local community enabling them to inform the decision-making processes of a wind energy development project, for example, at the siting and design stage.

The Government's White Paper, Ireland's Transition to a Low Carbon Energy Future (2015) elaborates on the role of all citizens and consumers as energy citizens and outlines the part of communities in the transition to low carbon energy. The Code of Practice for Wind Energy Development in Ireland Guidelines for Community Engagement issued by the Department of Communications, Climate Action and Environment (December 2016) sets out to ensure that wind energy development in Ireland is undertaken in observance with the best industry practices, and with the full engagement of communities around the country.

In addition, the GP WIND – Good Practice Guide (2012), is a valuable resource for both developers and the public concerning the development of wind energy in tandem with community interest. GP Wind was an EU project co-funded by the Intelligent Energy Europe Programme to promote good practice in renewable energy projects and actively involve communities in their planning and implementation.

Further guidance on pre-application public consultation and ongoing engagement is contained in Appendix 2 of these Guidelines.

These Guidelines therefore enable planning authorities to take into account the degree to which the proponents of wind energy projects have meaningfully and properly consulted with the local community and facilitated public participation in developing their proposals. This should ultimately demonstrate the economic benefit of wind energy projects to the community or communities in the vicinity of the relevant wind energy proposal, in the final weighing up of the merits or otherwise of a given proposal.

4.3.2 Public Consultation and Requirement for a Community Report

It is essential that local communities are properly involved in the planning process, as early inclusion improves confidence in the openness and fairness of the planning process. Meaningful community consultation also helps developers:

- to refine the design approach to a project reflecting a broadly based community perspective,
- to explain the potential benefits of a project more clearly to communities,
- to establish relationships with the community, as well as empowering communities to interact with and benefit more fully from projects.

Planning authorities should therefore require developers to engage in active public consultation with the local community in advance of and in addition to the statutory public consultation required as part of the planning application process.

In order to promote the observance of best practice, planning authorities should require applicants to prepare and submit a Community Report with their planning application and a condition on any subsequent planning permission should require developers to carry out the development in accordance with the approved Community Report.

These Guidelines encourage developers to apply the same principles and framework for community engagement, and to act consistently and respectfully in engaging with communities. The community, in turn, has the opportunity to gain a realistic understanding of what to expect from a proposed wind energy development, including its benefits and impacts.

4.3.2.1 Requirements for Community Report

Wind energy developers are therefore now required, in advance of submitting applications for permission, to take active steps to: inform local communities as they begin to develop their proposals; take the views of local communities into account in designing their proposals; demonstrate what practical effect that process of engagement has had; and, set out how the project will perform as a good neighbour in the context of the long-term economic and social development of the community or communities within which it is situated.

The Community Report shall detail the following:

- A map of the proposed project and the communities in the vicinity of the proposal within a radius of up to approximately 10 km of the turbines, depending on the circumstances of the case (see Appendix 2);

- The steps taken by the applicant seeking planning permission for the wind energy development to seek out the views of relevant communities in developing the project (see Appendix 2);
- A summary of the responses received as a result of the engagement process and a statement of any principal design adjustments or modifications undertaken in response to the feedback of the community before the project was submitted for planning permission;
- Proposed details as regards the steps to be taken to ensure that the proposed development will be of enduring economic benefit to the communities concerned, through the negotiation of a form of community investment/ownership, benefit or dividend (see section 5.10 of these Guidelines);
- Demonstrate how the proposed development will adhere to the Code of Practice for Wind Energy Development in Ireland Guidelines for Community Engagement issued by the Department of Communications, Climate Action and Environment (2016) (or any subsequent replacement Code of Practice).

The community report should set out how the developer will thereafter work with the local community on the format for public participation to allow for the free flow of information between the community and the wind energy developer at all stages in the project. Consultation should be meaningful, beginning sufficiently in advance of a submission for planning permission to give the local community an opportunity to comment upon and to have an input into the planning and design of the scheme. To enable the general public to engage with developers, evidence of formal procedures for dealing with queries and complaints must be included in a planning request.

Developers should therefore appoint an individual responsible for liaising with and being the point of contact for the local community from design to planning to construction stages to allow for dialogue and communication and to keep the public informed about the progress of the project.

A condition should be attached to all planning permissions for wind energy developments requiring developers to comply with the community engagement proposals set out in the submitted Community Report for the lifetime of the development.

4.4 PRE-APPLICATION CONSULTATION FOR STRATEGIC INFRASTRUCTURE DEVELOPMENT (SID)

Wind energy development proposals comprising more than 25 turbines or having a total output greater than 50 megawatts may fall under the Strategic Infrastructure Development (SID) provisions of the Planning and Development Act 2000[4] whereby mandatory pre-application consultation with An Bord Pleanála (as opposed to the planning authority) is required. In the event that such a development is deemed by An Bord Pleanála to be SID, following the formal consultation process as set out under section 37B of the Planning and Development Act 2000, then the planning application for same shall be lodged directly with An Bord Pleanála and Environmental Impact Assessment is mandatory[5].

Pre-application consultation with An Bord Pleanála may also address the procedures involved in making a planning application and in considering such an application, as well as what considerations, related to proper planning and sustainable development or the environment, may, in the opinion of the Board, have a bearing on its decision in relation to the application.

4.5 TRANS-EUROPEAN ENERGY NETWORKS (TEN–E) PROJECTS

Pre-application consultation is particularly important where Projects of Common Interest (PCIs) relating to energy infrastructure with a trans-European/cross-border dimension are involved[6].

In this regard the guidance document issued by the EU Commission on 'Streamlining environmental assessment procedures for energy infrastructure Projects of Common Interest (PCIs)' (July 2013) will be especially useful. An Bord Pleanála's 'Manual of Permit Granting Process Procedures for Projects of Common Interest' (September 2014) will also be of relevance for PCI projects. Many of these projects located within Ireland will also fall within SID procedures as set out in the Planning and Development Act 2000 (as amended).

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[4] Refer to Paragraph 1 (Energy Infrastructure) of the Seventh Schedule of the Planning and Development Act 2000, as amended.

[5] For further details on SID proposals and procedures, refer to sections 37A to 37K and the Seventh Schedule of the Planning and Development Act 2000, as amended.

[6] Decision 1364/2006/EC of the European Parliament and the Council lays down guidelines for trans-European energy networks. The Decision lists projects eligible for Community assistance under Council Regulation (EC) No 2236/95 and ranks them in three categories:- projects of common interest (PCI), priority projects and projects of European interest.

4.6 WIND MEASURING MASTS

Whilst the potential location of a wind energy development will be informed by data on wind speeds and directions, it will be necessary to ensure the feasibility of a particular site before detailed work is undertaken. The wind speed at a particular site may be affected by topography, screening (by tall buildings or trees), or even turbulence from existing wind turbines in the area, and therefore in some instances it may be prudent to measure the average wind speed at the site. Planning applications for wind anemometers and measuring masts are generally sought for a limited period only (usually 12 months but might be longer). Permissions should be granted for approximately a two-year period, in consultation with the developer, to allow a wind resource analysis to be carried out.

It would be inadvisable for the planning authority to grant planning permission for a wind measuring mast in an area where there is a presumption against wind energy development in the development plan. In a case where a developer wishes to extend the period of the permission an application must be made to the planning authority to retain the wind measuring mast; otherwise the developer should be required to remove it.

4.7 NEED FOR AN ENVIRONMENTAL IMPACT ASSESSMENT

4.7.1 Mandatory EIA Thresholds

An Environmental Impact Assessment is **mandatory** for proposed wind energy developments that would equal or exceed, as the case may be the following thresholds:

- have more than five turbines, or
- will have a total output greater than 5 megawatts.

In these circumstances, an Environmental Impact Assessment Report (EIAR) must be submitted with the relevant planning application[7] . Proposed wind energy developments below this threshold but which may be likely to have significant effects on the environment may also require

[7] Refer to Section 172(1B) of the Planning and Development Act 2000

an Environmental Impact Assessment[8] and should be screened in this regard (refer to Section 4.7.2 below).

Avoidance, prevention, reduction and , if possible, offsetting of significant adverse impacts on the environment and the consideration of reasonable alternatives are fundamental components of Environmental Impact Assessment, both in terms of legal requirements and best practice. In designing wind energy projects, there is huge potential to avoid or reduce significant adverse environmental effects through site selection to avoid sensitive sites.

If required, an EIAR and planning application for the grid connection must address the direct effects and any short, medium and long-term, permanent and temporary, positive and negative, indirect, secondary, cumulative and transboundary effects of the whole project, i.e. the wind energy development and the grid connection.

The arrangements as outlined above are designed to ensure that the totality of the project i.e. wind energy development and the grid connection, are assessed thoroughly and in an integrated manner as regards EIA in line with the requirements of the EIA Directive.

4.7.2 Sub-EIA Threshold Developments

For proposed wind energy developments below the mandatory thresholds for Environmental Impact Assessment, the planning authority (or An Bord Pleanála on appeal) must consider whether the development would be likely to have significant effects on the environment i.e. a screening determination, unless, on preliminary examination, it can be concluded that there is no real likelihood of such effects arising. Where, based on this preliminary examination, the planning authority (or An Bord Pleanála on appeal) conclude that there is a real likelihood of significant effects on the environment arising from the proposed development, by reference to the selection criteria in Annex III of the EIA Directive as transposed in Schedule 7 to the Planning and Development Regulations, 2001 (as amended), an EIAR must be submitted by the developer and EIA carried out in respect of the project. In this regard, where there is significant and realistic doubt about the likelihood of significant environmental effects, the planning authority (or An Bord Pleanála) may require the developer to submit information specified in Schedule 7A to the 2001 Regulations for the purposes of making its determination.

In the case of sub-threshold development, it is advisable that developers consult with the planning authority regarding the possible need for an EIAR.

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[8] Refer to Articles 103, 109, 120, 123A, Schedule 7 and Schedule 7A of the Planning and Development Regulations 2001, as amended.

The criteria set out in Schedule 7 to the 2001 Regulations must be carefully considered in the determination of whether a proposed development would or would not be likely to have significant environmental effects. These criteria include;

- Characteristics of the proposed development;
- Location of the proposed development and the environmental sensitivity of geographical areas likely to be affected by the proposed development; and
- Types and characteristics of potential impacts.

Regard should also be had to the screening guidance contained in Environmental Impact Assessment (EIA) Guidance for Consent Authorities regarding Sub-threshold Development, issued by the Department in August 2003.

4.7.3 EIA Scoping

The developer can request a written scoping opinion from the planning authority on the information to be contained in the EIAR[9] in the event that EIA is required. This is an opportunity for the planning authority, the developer and the developer's technical advisers to discuss the scope and level of detail of the environmental information to be submitted in the EIAR.

In the event that a corridor approach is considered necessary as referenced above, the scoping process can include discussions on the likely area and location for the grid connection corridor(s) and the likely nature of the connection(s).

The area of the corridor will be determined on a case by case basis, on local geographical and topographical conditions and on the availability and location of potential grid connection.

A guidance document is available on carrying out Environmental Impact Assessments at the following link:

https://www.housing.gov.ie/sites/default/files/publications/files/guidelines_for_planning_authorities_and_an_bord_pleanala_on_carrying_out_eia_-_august_2018.pdf

[9] Refer to section 173(2) of the Planning and Development Act 2000, as amended, and Article 95 of the Planning and Development Regulations 2001, as amended. Other provisions relate to formal scoping with An Bord Pleanála for SID projects, with reference to section 37D of the Planning and Development Act 2000, as amended, and Article 211 of the Planning and Development Regulations 2001, as amended.

4.7.4 Wind Energy Developments and Grid Connections (and other works ancillary to the development of the wind energy development)

Under EU EIA guidance[10], challenges in the EIA process are recognised for projects comprised of different elements which may be permitted at different stages, implemented by different parties and developed over a period of time.

Case law on this issue acknowledges that the requirements of the EIA Directive may be satisfied by multiple consents necessitated by the different stages in delivering a project. It should be noted that the EU courts have also stressed that the purpose of the Directive cannot be circumvented by the splitting of projects.

The Irish Courts have determined the need to assess such projects comprising both the wind energy development element and the subsequent grid connection element, as a single project for EIA purposes[11], and in particular their cumulative effects. This approach is reflected in Recital (22) and Annex II.A, Annex III and Annex IV to the 2011 EIA Directive as revised by the 2014 Directive[12]. In addition, Recital (2), of the 2011 EIA Directive[13] also emphasises that the importance of the effects on the environment should be taken into account at the earliest possible stage in all the technical planning and decision–making process.

In the context of EIA, best practice is that an integrated planning application is made for the whole project (i.e. the wind energy development and the grid connection and any other works which are ancillary to the development of the wind energy development) and that the EIAR submitted with the planning application addresses the cumulative impacts of the whole project.

It is acknowledged that an integrated application is not always possible, because of the distinction between power generation and transmission infrastructure from an energy regulatory framework perspective.

However, in order to ensure that the environmental issues arising in the overall project have been considered in an EIAR, and that neither project splitting nor its perception arises, wind energy development proposals must demonstrate that the effects on the environment of the whole project have been taken into account at the earliest possible stage in the technical

[10] Interpretation of definitions of project categories of Annex I and II of the EIA Directive, European Commission (2015): http://ec.europa.eu/environment/eia/home.htm

[11] O Grianna and others v. An Bord Pleanála [2014] IEHC 632 (High Court Judicial Review)

[12] Directive 2014/52/EU was transposed into Irish law through SI 296-2018- European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018

[13] Recital (2) Directive (2011/92/EU).

planning and decision-making process and that issues arising from cumulative effects have been properly assessed.

The EIAR and planning application(s) for the wind energy development and the grid connection must address the direct effects and any short, medium and long term, permanent and temporary, positive and negative, indirect, secondary cumulative and transboundary effects of the whole project, i.e. the wind energy development and the grid connection.

The planning authority or An Bord Pleanála should, in the granting of permission for a planning application for a wind energy development which includes details of the final grid connection and other ancillary works necessary for the operation of the wind energy development, impose a condition on the planning permission which ensures that the development must be undertaken and maintained as set out in the details submitted with the planning application.

Using a Corridor Approach

Therefore, and for the avoidance of doubt, where EIA applies to a wind energy development (either where mandatory[14] or where a sub-threshold development requires an EIA) and where an integrated wind energy development and grid connection application is not possible, the EIAR[15] shall indicate the most likely corridor(s) of the grid connection, its width and route and the likely nature of the connection in terms of line voltage, whether it will be underground (preferred) or over ground (including details of pole type) and any ancillary equipment (e.g. substations).

In other words, the level of detail provided, within the defined parameters, must be such to enable a proper assessment of the likely significant environmental effects, and necessary mitigation, by the planning authority or An Bord Pleanála.

In general, it is considered that underground grid connections for wind energy projects are the most appropriate environmental and/or engineering solution, particularly in sensitive landscapes where the visual impacts need to be minimised. Therefore, this should be the default approach. However, there may be cases where specific ground conditions would prevent this, e.g. in upland locations where peat stability issues can arise form large-scale excavation.

Where undergrounding is being pursued, proposals should demonstrate that environmental impacts including the following are minimised:

[14] Refer to Class 3(i) of Schedule 5, Part 2 of the Planning and Development Regulations 2001, as amended.
[15] A reference to an EIAR in this chapter should be read as reference to an EIAR, a Natura Impact Statement or both if appropriate.

- Habitat loss as a result of removal of field boundaries and hedgerows (right of way preparation) followed by topsoil stripping (to ensure machinery does not destroy soil structure and drainage properties);
- Short to medium term impacts on the landscape where, for example, hedgerows are encountered;
- Impacts on underground archaeology;
- Impacts on soil structure and drainage;
- Impacts on surface waters as a result of sedimentation.

In some circumstances, there may be more than one corridor option that is feasible and these corridor options and their different grid connection details can be included within the EIAR for the consideration of their different effects, so that the maximum potential adverse impacts of a project have been properly assessed and can be taken into account as part of the decision-making process[16].

In this way, the environmental considerations of the proposed corridor(s) of the grid connection and the likely nature of the grid connection and their cumulative effects, can be considered and evaluated i.e. if the proposal is likely to be over ground or underground, the likely voltage of the connection and, from this, the types of poles and cables that will be required to connect the wind energy development to the grid. Mitigation measures proposed should be adequate to deal with all options including the worst case so as to optimise the effects of the development on the environment.

Planning authorities, or An Bord Pleanála, should secure the most appropriate means of grid connection, considered as part of the planning application and EIAR assessment, by way of a robust planning condition.

Where permission is sought for the wind energy development element of the project, which indicates the probable corridor(s) and likely grid connection details, the permission granted will be for the wind energy development element only, and the grid connection will be subject to a separate planning permission.

In such cases where the applicant is applying for planning permission for the wind energy development but not the grid connection, and in the event that permission is granted for the wind energy development, planning authorities, or An Bord Pleanála, should impose condition(s) that no works on the wind energy development element of the project shall commence without a separate planning permission for the grid connection first being obtained. The works must

[16] This flexible approach to assessment is colloquially known as the 'Rochdale Envelope' approach.

thereafter be undertaken and maintained as set out in the details submitted with the planning application. This requirement will be the subject of amended legislation.

Where planning permission is sought subsequently for the grid connection the planning application will include an EIAR which addresses the cumulative impacts of the final proposed grid connection, and the approved wind energy development.

Consultation with the electricity systems operator

In practical terms, the corridor approach places an onus on the wind energy developer to have early consultation with the relevant electricity system operator (ESB Networks or EirGrid or SONI (in the case of proximity to Northern Ireland) as appropriate) to establish the location of the connection to the national electricity grid. If this is not possible, then the likely corridor alignment(s) to the national electricity grid should be established so that the likely location and format (voltage and underground/over ground, poles/cables etc.) can be determined in sufficient detail to be described and considered in the context of the EIAR.

In certain cases the developer may have to use particular engineering technical expertise to scope out the corridor(s) and the likely nature of the grid connection(s). Where the planning authority or An Bord Pleanála, in considering the application, considers that insufficient information has been given within the EIAR with regard to the proposed corridor and the types of connection, and where such information is necessary to make a decision, it should request such details from the developer by way of additional information.

4.8 APPROPRIATE ASSESSMENT

Under the terms of the EU Habitats and Birds Directives, all applications for permission for wind energy developments must be screened for Appropriate Assessment (AA) by the planning authority or An Bord Pleanála, as relevant, to assess, in view of best scientific knowledge if the proposed project either individually or in combination with other plans or projects is likely to have a significant effect on a European site. The two Directives also require that wind energy developments do not cause any significant damage or disturbance to species of Community interest (i.e. those covered by the Directives) or their key habitats in the broader countryside (i.e. Where the wind energy development itself is located outside of a designated site but is likely to affect the protected species or their habitat ‘throughout their natural range within the EU’ (cf. Article 5 of Birds Directive and Article 12 of Habitats Directive)).

It is vital to assess the requirements for an appropriate assessment at an early stage of the project and to include such an assessment with the planning application. An appropriate assessment must be carried out where it cannot be excluded that the project, individually or in combination with other plans or projects, will have a likely significant effect on a European site[17], and where a Natura Impact Statement (NIS) was not submitted with the planning application, this must be sought by the planning authority/An Bord Pleanála if required.

Similar to considerations set out in respect of EIA in Section 4.7, best practice is that an integrated planning application is made for the whole project (i.e. the wind energy development and the grid connection and any other works which are ancillary to the development of the wind energy development) and that the NIS submitted with the planning application addresses the cumulative impacts of the whole project, in order to avoid project splitting.

Section 177V (3) of the Planning and Development Act 2000 (as amended) requires the refusal of permission unless the competent authority has determined that the proposed development would not adversely affect the integrity of a European site. If it can be concluded on the basis of AA that there will be no adverse effects on the integrity of a Natura 2000 site, the plan or project can proceed to authorisation, where the normal planning or other requirements will apply in reaching a decision to approve or refuse. If adverse effects are likely, or in cases of doubt, the derogation steps of Article 6(4) can be applied, but only in a case in which there are imperative reasons of overriding public interest (IROPI) requiring a project to proceed, there are no less damaging alternative solutions, and compensatory measures have been identified that can be put in place.

Regard should also be had to Appropriate Assessment of Plans and Projects in Ireland Guidance for Planning Authorities, issued by the National Parks and Wildlife Service as part of the Department of Environment, heritage and Local Government in December 2009 (revised in February 2010). NPWS, which now forms part of the Department of Culture, Heritage and the Gaeltacht, intends to publish updated guidance in this regard in due course.

Applicants should be aware that all relevant planning applications must clearly state that a Natura Impact Statement has been submitted as part of the application (including reference to this fact on newspaper planning notices) and that the Natura Impact Statement is available for inspection or purchase at the office of the planning authority – see Planning and Development Regulations 2001 as amended by S.I. No.476 of 2011 Planning and Development (Amendment) (No.3) Regulations, 2011.

[17] Section 177U Planning and Development Act 2000, as amended.

4.9 TECHNICAL CONSIDERATIONS WHICH MAY AFFECT THE SITING OF WIND ENERGY DEVELOPMENT

4.9.1 Proximity to Roads and Railways

Although wind turbines erected in accordance with standard engineering practice are stable structures, best practice indicates that it is advisable to achieve a safety set back from National and Regional roads and railways of a distance equal to the height of the turbine to the tip of the blade plus 10%.

4.9.2 Proximity to Power Lines

Adequate clearance between structures and overhead power lines as specified by the electricity undertaker should be provided. EirGrid's current policy on clearance distances required between turbines and overhead lines can be viewed on their website: http://www.eirgridgroup.com/site-files/library/EirGrid/Wind-Turbine-Clearance-Policy.pdf. They advise that the distance between an overhead transmission line (110kV, 22kV or 400kV) and a commercial wind turbine should not be less than three and a half rotor diameters unless EirGrid have agreed a reduction based on a risk assessment. The minimum clearance for all turbines and overhead transmission lines must be falling distance (measured from the edge of the foundation) plus an additional flashover distance for the relevant voltage.

4.9.3 Interference with Communication Systems

Wind turbines, like all electrical equipment, produce electro- magnetic radiation, and this can interfere with broadcast communications. The interference with broadcast communication can often be overcome by the installation of deflectors or repeaters, however the layout and design of the wind energy development should take into account nearby telecommunications links.

Planning authorities should advise the developer to contact the individual telecommunications providers, both national and local, to inform them of the proposals. A list of the licensed operators is available on the Broadcasting Authority of Ireland website at www.bai.ie. Mobile phone operators should also be advised of the proposed development. Contact details will need to be checked, as the telecommunications market is subject to change and there are new service providers emerging frequently.

In order to determine if there are telecommunications links going through the site, the developer should provide the telecommunications service providers with the site boundary details. This will allow for the mapping of any links in the vicinity of the site at an early stage to inform the site layout design. Where telecommunications service providers have masts in the vicinity of the proposed wind energy development, enquiries should be made about other parties who could be utilising the mast for private telecommunications networks.

Once the layout of the proposed wind energy development has been finalised, the proposed turbine co-ordinates should be issued to all the telecommunications service providers. Where line-of-sight signals are concerned, it is possible to identify potential negative impacts in advance, and design the wind turbine locations to avoid their paths. With regard to point-to-multipoint signals, UHF- and VHF-type signals such as the radio and television services operated by 2RN (on behalf of RTÉ) can occasionally be affected by turbines at some sites. Mitigation measures typically include supplying dwellings with optimised roof-top antennas or satellite reception. It is 2RN's usual practice to require a Protocol to be signed which, effectively, requires the developer to accept total financial responsibility for remedial measures which could be required as a result of potential negative impact of the wind farm on 2RN's network.

4.9.4 Interference with Weather Radar

Wind turbines also have the potential to affect weather radar data. The turbine blades are moving targets which generate a varying Doppler signature which is difficult to remove. In addition, wind turbines can mask the radar signal and produce backscatter. Weather prediction models and operational weather forecasts increasingly depend on national networks of ground-based Doppler weather radars. The effective operation of a national weather radar network is a key tool for the production of accurate warnings of severe weather such as thunderstorms, precipitation (rain, snow, hail) and flooding.

Weather radar data is critical to weather sensing, monitoring, forecasting and warning, and as such consultation, protection and mitigation efforts are important to minimise disruption. The World Meteorological Organisation (WMO), a specialist agency of the United Nations, have produced a Guidance Statement on Weather Radar/Wind Turbine Siting[18] which contains guidelines for mutual proximal operation of weather radars and wind turbines. These guidelines show the potential impact of wind turbines at various ranges from weather radars. Met Éireann currently have two weather radars, one at Dublin Airport and one at Shannon Airport, but are planning to increase the number in the coming years. Developers should consult with Met

[18] contained in the WMO Guide to Meteorological Instruments and Methods of Observations (WMO-No.8)

Éireann at pre-application stage to ensure that any interference with current or approved weather radar installations can be mitigated.

4.9.5 Aircraft Safety

The siting of wind turbines may have implications for the operations of the Communications, Navigation and Surveillance systems used for Air Traffic Control for the separation and safety of aircraft.

Wind turbine siting may also have implications for the flight paths of aircraft. Regard must be had to the Irish Aviation Authority's Obstacles to Aircraft in Flight Order, 2005, (S.I. 215 of 2005), as amended, which specifies the criteria used to determine whether or not any object anywhere in the State is deemed to be an obstacle affecting aircraft operations. Wind turbines or any structure exceeding 90 metres in height are considered obstacles to aerial navigation and need to be shown on aviation charts. They will also need appropriate aviation warning lighting. The Irish Aviation Authority (IAA) should be informed 30 days in advance of the erection of any structure exceeding 45 metres in height under S.I. 215 of 2005. This includes wind monitoring masts which may be exempt from planning permission.

In addition, in order to assure the safety and efficiency of aircraft operations in the vicinity of airports, the International Civil Aviation Organisation (ICAO) has defined a volume of air space above which new objects are not permitted. No part of the wind turbine should penetrate these defined surfaces. If located close to an airport (within 20 km), a wind turbine could interfere with the safe operation of an airport, simply by its presence and height.

Accordingly, wind energy developers should be advised to contact the Irish Aviation Authority (and where relevant the operators of other aerodromes outside the control of IAA) at the pre-planning stage of consultation, with details of locations and proposed heights of turbines, to ensure that the proposed development will not cause difficulties with air navigation safety, including airports, RADAR, and aircraft guidance systems.

The Sustainable Energy Authority of Ireland published a study: “Investigation of the Impact of Wind Turbines on Radar” (2004), which provides relevant information.

4.9.6 Windtake

The question of windtake should be dealt with at scoping stage and/or during pre-application discussions, to ensure that any proposed layout of wind turbines takes into account the development potential of an adjoining site for a similar development.

In general, to ensure optimal performance and to account for turbulence and wake effects, the minimum distances between wind turbines will generally be three times the rotor diameter (=3d) in the crosswind direction and seven times the rotor diameter (=7d) in the prevailing downwind direction. Bearing in mind the requirements for optimal performance, a distance of not less than two rotor blades from adjoining property boundaries will generally be acceptable, unless by written agreement of adjoining landowners to a lesser distance. However, where permission for wind energy development has been granted on an adjacent site, the principle of the minimum separation distances between turbines in crosswind and downwind directions indicated above should be respected.

4.10 HEALTH AND SAFETY

Health and safety issues are generally covered by separate legislation and not by planning legislation however developers of wind energy developments should be aware of the requirements. The Health and Safety Authority (https://www.hsa.ie/eng/) can provide advice and guidance. Further information is available at Appendix 5.

4.11 CONSTRUCTION AND ENVIRONMENTAL MANAGEMENT PLAN

All wind energy developments require a site compound and access arrangements during the construction stage of the project. Typically the compound would include office and welfare facilities, parking, laydown and storage areas and access roads to allow for construction and delivery traffic will be required.

The planning application submission (and in particular the EIAR) must include details of the site compound and access arrangements, including the location and design of the site compound and construction methods, environmental mitigation methods and proposed reinstatement.

Construction Environment Management Plans (CEMPs) are recommended to be prepared in advance of the construction projects and implemented throughout. Such plans are recommended to incorporate relevant mitigation measures which have been integrated into the project and an Environmental Impact Assessment Report or Appropriate Assessment. CEMPs typically provide details of intended construction practice for the proposed development, including:

a) location of the sites and materials compound(s) including area(s) identified for the storage of construction refuse,
b) location of areas for construction site offices and staff facilities,
c) details of site security fencing and hoardings,
d) details of on-site car parking facilities for site workers during the course of construction,
e) details of the timing and routing of construction traffic to and from the construction site and associated directional signage,
f) measures to obviate queuing of construction traffic on the adjoining road network,
g) measures to control noise during construction, in particular noise associated with the transportation of wind turbine components from staging areas at night.
h) measures to prevent the spillage or deposit of clay, rubble or other debris,
i) alternative arrangements to be put in place for pedestrians and vehicles in the case of the closure of any public right of way during the course of site development works,
j) details of appropriate mitigation measures for noise, dust and vibration, and monitoring of such levels,
k) containment of all construction-related fuel and oil within specially constructed bunds to ensure that fuel spillages are fully contained; such bunds shall be roofed to exclude rainwater,
l) disposal of construction/demolition waste (in line with higher level waste management policies) and details of how it is proposed to manage excavated soil,
m) a water and sediment management plan, providing for means to ensure that surface water runoff is controlled such that no silt or other pollutants enter local water courses or drains,
n) details of a water quality monitoring and sampling plan,
o) if peat is encountered - a peat storage, handling and reinstatement management plan,
p) measures adopted during construction to prevent the spread of invasive species (such as Japanese Knotweed),
q) appointment of an ecological clerk of works at site investigation, preparation and construction phases,
r) details of appropriate mitigation measures for lighting specifically designed to minimise impacts to biodiversity including bats.

4.12 WATER FRAMEWORK DIRECTIVE

Under this Directive, local authorities must contribute towards the improvement and protection of existing and potential water resources, subject to exemptions provided for by Article 4 of the Water Framework Directive, and support the implementation of the relevant recommendations and measures as outlined in the relevant River Basin Management Plan. In this regard, planning authorities and developers should take account of relevant and available national guidelines and European guidance publications.

4.13 FLOOD RISK

It is recommended that proposals for development demonstrate compliance with “the Planning System and Flood Risk Management Guidelines for Planning Authorities” (2009) and Circular PL2/14 and include an appropriately detailed Flood Risk Assessment.

Further information on the approach to flood risk management is provided in the Flood Risk Statement that accompanies these Guidelines.

4.14 REASONABLE ALTERNATIVES AND EXISTING INFRASTRUCTURAL ASSETS

It is recommended that environmental assessments address reasonable alternatives for the location of new wind energy developments, and where existing infrastructural assets such as sub-stations, power lines and roads already exist within proposed development areas, then such assets should be considered for sustainable use by the proposed development where the assets have capacity to absorb the new development.

CHAPTER 5 CONSIDERING AN APPLICATION FOR WIND ENERGY DEVELOPMENT

5.1 INTRODUCTION

Wind energy development, like all development, has the potential to impact on the natural and built environment.

The relevant Local Authority Development Plan(s) and Local Area Plan (if relevant) should be consulted in relation to the natural, built and geological heritage, particularly those areas statutorily designated or protected. In addition, the Development Applications Unit of the Department of Culture, Heritage and the Gaeltacht is available for consultation with regard to built and natural heritage aspects of proposed wind energy development, whether at pre-planning or planning application stage.

5.2 GENERAL CONSIDERATIONS IN THE ASSESSMENT OF WIND ENERGY PLANNING APPLICATIONS

Planning authorities are key to implementing national policy regarding the development of alternative and indigenous energy sources and the minimisation of emissions of greenhouse gasses in considering a planning application for wind energy development.

A planning authority may consider some if not all of the following matters:

- Environmental assessments (EIA, AA etc.)
- Community engagement and participation aspects of the proposal
- Grid Connection details
- Geology and ground conditions, including peat stability; and management plans to deal with any potential material impact. Reference should be made to the National Landslide Susceptibility Map to confirm ground conditions are suitable stable for project;
- Site drainage and hydrological effects[19], such as
    - water supply and quality and watercourse crossings;

[19] Site drainage considerations for access roads/tracks, separate in addition to the impact of the actual turbines

    - management plans to deal with any potential material impact on watercourses;
    - the hydrological table;
    - flood risk including mitigation measures;
- Landscape and visual impact assessment, including the size, scale and layout and the degree to which the wind energy project is visible over certain areas and in certain views;
- Visual impact of ancillary development, such as grid connection and access roads;
- Potential impact of the project on natural heritage, to include direct and indirect effects on protected sites or species, on habitats of ecological sensitivity and biodiversity value and ,where necessary, management plans to deal with the satisfactory co-existence of the wind energy development and the particular species/habitat identified;
- Potential impact of the project on the built heritage including archaeological and architectural heritage;
- It is recommended that consideration of carbon emissions balance is demonstrated when the development of wind energy developments requires peat extraction.
- Local environmental impacts including noise, shadow flicker, electromagnetic interference, etc.;
- Adequacy of local access road network to facilitate construction of the project and transportation of large machinery and turbine parts to site, including a traffic management plan;
- Information on any cumulative effects due to other projects, including effects on natural heritage and visual effects;
- Information on the location of quarries to be used or borrow pits proposed during the construction phase and associated remedial works thereafter;
- Disposal or elimination of waste/surplus material from construction/site clearance, particularly significant for peatland sites; and
- Decommissioning considerations.

It would be helpful for potential wind energy developers if planning authorities could provide information on their website to outline the drawings and documents which are likely to be required for submission with the planning application, in order to avoid applications being made invalid.

Planning authorities should advise applicants to ensure that any wireframes and photomontages submitted in support of their application are accurate and verified. Planning authorities, where possible, should utilise spatial analysis tools, including GIS, for in-house assessment and verification of wind energy proposals. The basic models used to assess wind energy development proposals, such as Zones of Visual Influence and Zones of Theoretical Visibility[20] calculations, are now an increasingly standard feature of much spatial analysis software, while integrated links to programmes producing wireframes and photomontages are commonplace. Due to the choice and availability of such proprietary software, these can now be obtained relatively easily and in a cost effective manner. There are also many options available for the use of more specialised Viewshed analysis software.

5.3 NATURAL HERITAGE

Natural heritage refers to habitats and species of flora and fauna. These natural heritage features may be located within sites that have been designated as Special Protection Areas, Special Areas of Conservation, candidate Special Areas of Conservation, Natural Heritage Areas, proposed Natural Heritage Areas, Nature Reserves, Refuges for Flora and Fauna and National Parks.[21] Natural heritage sensitivities identified to date which are particularly relevant to wind energy development relate to impacts on certain habitats, such as peatlands, certain species, particularly birds and bats, and the integrity of sites designated for the purpose of their protection (conservation).

Natural heritage may be impacted by wind energy developments both during the construction and operational phases. These impacts may be either temporary or permanent.

Planning authorities should have full regard to biodiversity considerations in determining applications for wind energy developments. All aspects of the proposal that could, in themselves, or in combination with other proposals, affect the areas' conservation objectives should be identified.

5.3.1 Appropriate Assessment

Where screening for Appropriate Assessment has been carried out (see Chapter 4) and it has been determined that Appropriate Assessment is required, a Natura Impact Statement (NIS)

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[20] It is felt that the title "Zone of Theoretical Visibility" is a more accurate description than "Zone of Visual Influence" – the maps produced are theoretical because they estimate exposure of turbines based upon landform data only and take no account whatsoever of intermittent screening by vegetation or structures. Furthermore, the maps estimate visibility of the turbines in the surrounding landscape and not their "visual influence".

[21] Natural Heritage Areas and proposed Natural Heritage Areas, Nature Reserves and Refuges for Flora and Fauna protect nationally and regionally important habitats, species and geological features. Special Protection Areas and candidate Special Areas of Conservation and Special Areas of Conservation are of international importance, constituting the EU's Natura 2000 Network of protected sites for habitats and species.

must be prepared. Secondly, the competent authority carries out the AA, based on the NIS and any other information it may consider necessary. The AA process encompasses all of the processes covered by Article 6(3) of the Habitats Directive, i.e. the screening process, the NIS, the AA by the competent authority, and the record of decisions made by the competent authority at each stage of the process, up to the point at which Article 6(4) may come into play following a determination that a plan or project may adversely affect the integrity of a Natura 2000 site. The AA must be completed prior to any decision being made to authorise a plan or project.

Planning authorities must ensure that a proposal which is likely to have a significant effect on an SAC or other designated area, is authorised only to the extent that the planning authority is satisfied will not adversely affect the integrity of the area. If necessary, they can seek changes to the development proposed or attach appropriate planning conditions If it can be concluded that there will be no adverse effects on the integrity of a Natura 2000 site, the plan or project can proceed to authorisation, where the normal planning or other requirements will apply in reaching a decision to approve or refuse.

In circumstances where a wind energy project is likely to have an adverse effect on the integrity of a site of international importance for nature conservation (e.g., an SAC or SPA) or in cases where there is some doubt that the integrity of the site might not be safeguarded, the derogation steps of Article 6(4) of the Habitats Directive will apply However permission may only be granted where there are imperative reasons of overriding public interest (IROPI) requiring a project to proceed, there are no less damaging alternative solutions, and compensatory measures have been identified that can be put in place.

5.3.2 Habitats

The National Parks and Wildlife Service (NPWS) within the Department of Culture Heritage and the Gaeltacht have published datasets and survey work as required under Article 17 of the Habitats Directive relating to a number of species across Ireland, namely bogs mires and fens, coastal habitats, dune habitats, forests, freshwater habitats, grasslands, heath and scrub, rocky habitats: (https://www.npws.ie/maps-and-data/habitat-and-species-data/article-17). They have also published datasets on specific habitats including saltmarsh, coastal lagoons, native woodlands, ancient and long-established woodlands, semi-mature grassland, limestone pavements and sand dunes: https://www.npws.ie/maps-and-data/habitat-and-species-data.

Habitats that may be impacted by wind energy developments include peatlands (mainly blanket bog, heaths, flushes and various other wetland habitats including water courses and lakes), sand dune systems, including machair, semi-natural grasslands and woodlands. All are vulnerable, but those located in the uplands are particularly so owing to their location in high rainfall areas and where the growing season is short.

The main potential impacts on habitats that can result in the reduction, or loss, of biodiversity are:

- Direct loss of habitat to the developments' infrastructure, including turbine foundations, buildings, roads, quarries and borrow pits;
- Degradation of habitats through alteration or disturbance, in particular arising from changes to hydrology that may alter the surface or groundwater flows and levels, and drainage patterns critical in peatlands and river headwaters;
- Fragmentation of habitats and increased edge effects; and
- Degradation and loss of habitats outside the development site, especially wetland habitats that may arise from pollution, siltation and erosion originating from within the development site.

5.3.3 Species

The National Parks and Wildlife Service (NPWS) within the Department of Culture Heritage and the Gaeltacht have published datasets and survey work as required under Article 17 of the Habitats Directive relating to a number of species across Ireland, amphibians, arthropods, fish, mammals, molluscs, non-vascular plants, reptiles, vascular plants: https://www.npws.ie/maps-and-data/habitat-and-species-data/article-17. Under Article 12 of the Birds Directive, NPWS have published breeding distribution and ranges: https://www.npws.ie/maps-and-data/habitat-and-species-data/article-12-data. They have also published surveys of specific species including hen harriers, lesser horseshoe bats and kingfishers: https://www.npws.ie/maps-and-data/habitat-and-species-data.

The main potential impacts to birds from wind energy developments have been identified as:

- Disturbance during the construction and operational phases leading to the temporary or permanent displacement of birds from the development site and its environs;
- Collision mortality, although studies have shown this to be low risk;
- Barotrauma effect, the vortices created by turbines are known to cause injury and mortality of bird and bat species. These vortices extend beyond the physical footprint of the turbine;
- Barrier to movement, although studies have indicated that the response by birds to wind energy development may be variable and related to species and/or season; and

- Direct loss or degradation of habitats for breeding, feeding/ foraging and/or roosting purposes, particularly in wetland, woodland and riparian habitats.

Collision risk species include all bird and bats species present in Ireland. The extent to which birds will be impacted by wind energy developments will vary depending on species, season and location, and these impacts may be temporary or permanent.

Those species groups considered to be most at risk are bats, raptors, swans, geese, divers, breeding waders and concentrations of waterfowl. Potential impacts on migratory species and local species movements between breeding, feeding/ foraging and roosting areas require careful consideration.

In addition to information published by the National Parks and Wildlife Service with regard to designated areas and species protection, Birdwatch Ireland (https://birdwatchireland.ie/) provides a useful source of information on Ireland's bird population, including research and survey work and publications. Birdwatch Ireland's Bird Sensitivity Mapping for Wind Energy Developments is available at:

https://www.birdwatchireland.ie/OurWork/PolicyAdvocacy/BirdSensitivityMapping/tabid/1312/Default.aspx

The potential impact on other rare flora, mammals, birds, and amphibians and fish including those listed for protection in the Flora (Protection) Order 2015, would also need to be assessed.

5.4 GROUND CONDITIONS/GEOLOGY

In assessing wind energy developments, the underlying geology is a critical factor. Information on the following issues must be submitted as part of a planning application to enable the planning authority to adequately assess the impact of the proposed wind energy development and any mitigating measures proposed to counter the impacts:

- A geological assessment of the locality;
- A geotechnical assessment of the overburden and bedrock;
- A landslide and slope stability risk assessment for the site for all stages of the project, with proposed mitigation measures where appropriate (this should also consider the possible effects of storage of excavated material);
- Location of the site in relation to any area or site that has been identified by the Geological Survey of Ireland as a geological Natural Heritage Area, a proposed Natural Heritage Area

or as a County Geological Site. (If so, are there any impacts discussed, or mitigation measures proposed);

- Location of the site in relation to areas of significant mineral or aggregate potential;
- An assessment of any potential impacts of the development on groundwater, and
- Details of any borrow-pits proposed on site should be shown on the planning application and details given where blasting is proposed, such as on the avoidance and remediation of land slippage.

Provision must be made for carrying out site-specific geo-technical investigations in order to identify the optimum location for each turbine.

In order to ensure that the above issues have been fully addressed, a developer should consult with the Geological Survey of Ireland and obtain professional advice/source reports from suitably qualified geotechnical engineers, engineering geologists or geologists as appropriate. If upland sites are proposed, the application should be accompanied by a statement from a geologist, a hydro-geologist or an engineer with expertise in soil mechanics.

Peatlands in particular can be damaged by the inappropriate siting of wind energy developments or their associated infrastructures, such as new or improved access roads. The damage is often caused because developments have not taken sufficient account of the underlying hydrology of the peatland. So, whilst the actual amount of peat lost may be small, the damage caused to the natural drainage system of the peat (for instance through drainage ditches, etc.) may have repercussions over a much wider area and can ultimately lead to the deterioration of a more significant area of peatland and other related habitats over time, such as streams and other water courses located down-stream. In considering applications for wind energy developments, planning authorities must ensure that an assessment is made as to whether proposed works are liable to have significant effects on the environment and accordingly they should consider requiring developers to undertake peatland stability assessments when developing project proposals for wind energy developments on peatlands.

It is recommended that consideration of carbon emissions balance is demonstrated when any wind energy development takes place in peatland areas. Peatlands, like forested areas, are also an important carbon store and sink and are, as a result, an important part of Europe's climate change mitigation strategy. Wind energy developments sited on peatlands which hold large stocks of carbon have the potential to greatly increase overall carbon losses which would undermine the expected carbon savings associated with the wind energy developments as well as damage rare habitats of European importance. Impacts on the carbon sequestration processes of an 'active' or growing peatland can also occur if peat growth is arrested due for instance to hydrological changes related to the development. These changes may occur during construction or may develop over and beyond the life-span of the wind energy development.

Further information on developing wind energy developments in peatland areas can be found at Appendix 4.

5.5 ARCHAEOLOGY

Archaeological heritage encompasses designated and unknown archaeological heritage including entries to the Record of Monuments and Places, underwater archaeology, entries to the Northern Ireland Sites and Monuments Record and Northern Ireland Areas of Significant Archaeological Interest and Archaeological Potential. Also encompassed are intervisibility and interrelationships between archaeological heritage within the wider landscape, including cross-border intervisibility and interrelationships.

The potential impact of the proposed wind energy development on the archaeological heritage of the site should be assessed. The assessment should address direct impacts on the integrity and visual amenity of monuments and include appropriate mitigation measures, such as through a desktop study and a field inspection where necessary.

The Framework and Principles for the Protection of the Archaeological Heritage 1999 provides the formal policy and standard approaches to dealing with ground disturbance, development impacts on archaeological heritage with an emphasis on mitigating impact on unknown archaeological sites in peatland locations (including both uncut blanket peats and milled over raised bogs).

5.6 ARCHITECTURAL HERITAGE

Architectural heritage encompasses that which is designated or included within the National Inventory of Architectural Heritage (NIAH), NIAH Historic Gardens and Designed Landscapes, Records of Protected Structures and Northern Ireland's Listed Buildings and Northern Ireland's Historic Parks, Gardens and Demesnes. Also encompassed are intervisibility and interrelationships between architectural heritage within the wider landscape, including cross-border intervisibility and interrelationships.

The Architectural Heritage Guidelines for Planning Authorities 2011 set out the information required for planning applications where architectural heritage considerations are relevant, as well as best practice approaches to avoiding adverse impact on built and architectural heritage.

The planning authority should assess the potential impact of the proposed wind energy development on the architectural heritage of the locality and its landscape context, where relevant. This is particularly necessary in the case of structures included in the Register of Protected Structures.

Where wind energy developments are proposed in proximity to urban settlements, the impact of the proposal on the scale, plan form, topography, views and aspects and relationships of individual sites to each other, need to be considered. An assessment of views and vistas the of historic towns and villages should be undertaken to avoid adverse impact on historic setting and the building out of views of prominent features such as towers or church spires that appear as vertical elements on the profile of an urban landscape.

Where applications may impact upon historic settings and landscapes, the input of a conservation architect is recommended to guide the planning/conservation strategy, the appropriate level of intervention and mitigation measures to avoid adverse impact on built and archaeological heritage.

Proposals to mitigate negative impact on built heritage from development may include a range of measures from short term urgent remedial/protection works or set back to safeguard the setting of a protected structure/monument, landscape mitigation or enhancement of boundaries to provide screening and consideration of long term conservation proposals/benefits. The retention of historic boundaries and field patterns, mature planting and settings and the detail of historic entrances, where possible are also important.

5.7 NOISE FROM WIND ENERGY DEVELOPMENT

This section addresses the requirements relating to new applications for wind energy development. Technical terms are explained in the glossary.

5.7.1 Key Objective

The approach to the assessment and control of noise generated by wind turbines, as required by these Guidelines, seeks to achieve a balance between the protection of the amenity of communities in the vicinity of wind energy developments and meeting Ireland's renewable energy targets in a cost-effective manner while providing security of future supply for the country.

These Guidelines are based on best international practice on wind turbine noise control including the Institute of Acoustics Good Practice Guides[22], WHO Guidelines[23] and a procedure for the assessment of low frequency noise complaints[24]. For the avoidance of doubt the text of these Guidelines and Technical Appendix 1 and 2 set out the requirements in relation to noise limits to apply, the noise assessment and measurement methodology to use and is definitive in all matters of interpretation.

All planning applications for wind energy development will be required to include an acoustic report prepared by a qualified and competent person. Where appropriate this can be incorporated as part of an Environmental Impact Assessment Report.

5.7.2 Sound and Noise

'Sound' can be described in terms of both its loudness and its pitch (or frequency). Sound level (i.e. loudness, measured in decibels/dB) and sound frequency (i.e. pitch, measured in Hertz/Hz) can both be objectively measured using suitable technical equipment. The audible frequency range for humans is considered as being from about 20 Hz to 20 kHz, the upper limit in average adults is often closer to 15–17 kHz.) As illustrated in Figure 1 below, human hearing ranges from approximately 0 dB (the threshold of hearing) to 120 dB (the threshold of pain).

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[22] Institute of Acoustics, A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, May 2013 including Supplementary Guidance Note 1 to 6.

[23] World Health Organization, Environmental Noise Guidelines for the European Union, 2018.

[24] Moorhouse, A., Waddington D. and Adams, M., Procedure for the assessment of low frequency noise complaints, February 2005, Contract no NANR45 to the UK Department for Environment, Food and Rural Affairs (DEFRA)

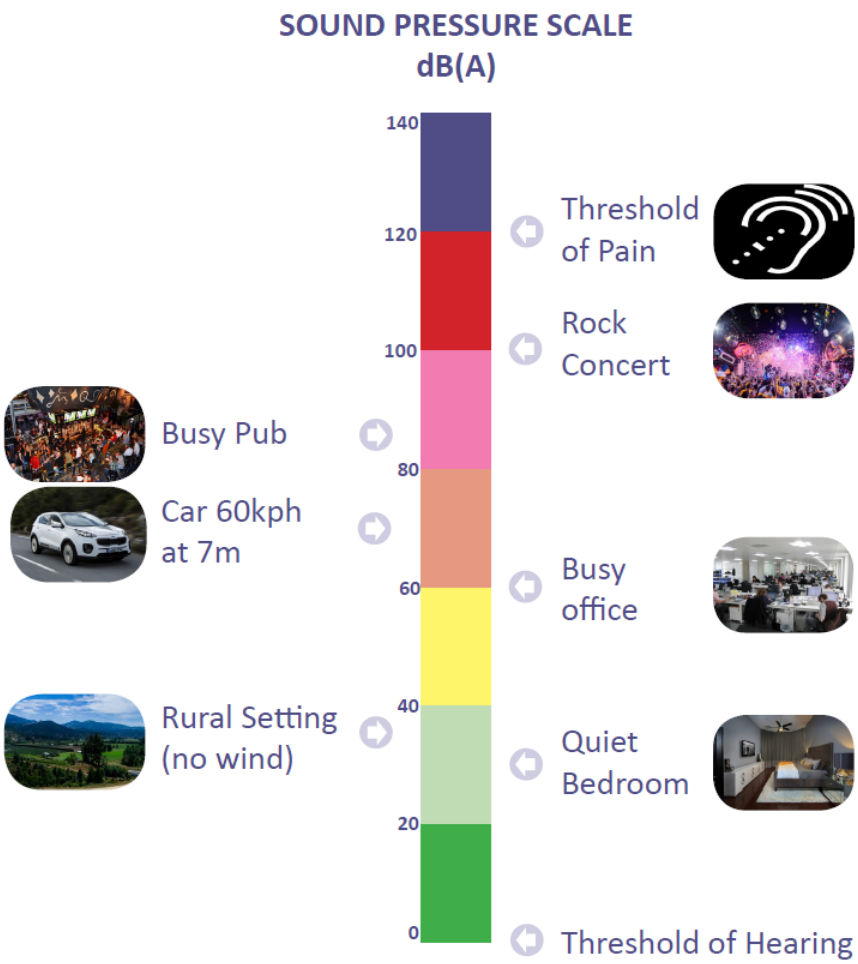

Figure 1 Sound Pressure (dB) Scale and Indicative Noise Levels

A change of 3 dB in sound level is just perceptible under normal circumstances and can result from doubling or halving the number of equal level sound sources. A change of 10 dB corresponds to an approximate doubling of 'perceived' loudness.

'Noise' is essentially unwanted sound experienced by a listener and, given the 'unwanted' component, noise can have a strong subjective aspect.

5.7.3 2006 Wind Energy Development Guidelines approach

The 2006 Wind Energy Development Guidelines were based on the principle that:

'in low noise environments where background noise is less than 30 dB(A), it is recommended that the daytime level of the $L_{A90,\ 10min}$ *of the wind energy development noise be limited to an absolute level within the range of 35-40 dB(A)'.*

The use of a band 35-40 dB(A) lacked clarity and could potentially lead to significant increases in noise levels being set at low background noise level locations.

5.7.4 Preferred Draft Approach

The “preferred draft approach”, announced by DHPCLG and DCCAE on 13th June 2017, proposed noise restriction limits consistent with World Health Organisation Guidelines, proposing a relative rated noise limit of 5dB(A) above existing background noise within the range of 35 to 43dB(A), with 43dB(A) being the maximum noise limit permitted, day or night. The noise limits will apply to outdoor locations at any residential or noise sensitive properties.

The preferred draft approach is based on 5 dB(A) above existing background noise with rating penalties to be applied if certain characteristics arise in the noise emanating from a wind energy development.

The preferred draft approach imposed the lower 35 dB(A) limit as a default until the 5 dB above background relative level exceeds this. This approach would ensure that noise levels from wind energy development are maintained at lower levels than those permitted under the 2006 planning guidelines.

The relative rated noise limit sets two further limitations on the noise level:

1. A rating penalty for certain special audible characteristics (tonal noise and amplitude modulation); and
2. A maximum noise level of 43 dB(A).

The rating scheme for special audible characteristics is discussed in this chapter and is set out in Technical Appendix 1 and imposes penalties of up to 11 dB(A) on noise with tonal and amplitude modulation characteristics, in addition to a fixed threshold for low frequency noise.

The maximum noise level of 43 dB(A) is imposed to ensure that the noise exposure at residential or noise sensitive locations is consistent with the World Health Organisation recommendation for wind turbine noise. Consideration of the cumulative impacts of wind turbines requires: when noise levels resulting from other existing and approved wind turbines are taken into account, the cumulative impact shall not exceed:

(1) Background noise levels[25] by more than 5 dB(A) within the range 35-43 dB(A), or

(2) 43 dB(A).

both measured as $L_{90,10\ min}$ outdoors at specified noise sensitive locations

5.7.5 World Health Organisation Environmental Noise Guidelines

At the request of EU Member States, the WHO Regional Office for Europe has developed Environmental Noise Guidelines for the European Region (WHO 2018). These guidelines provide policy guidance to Member States that is compatible with the noise indicators used in the EU's Environmental Noise Directive (END)[26]. The guidelines provide recommendations for protecting human health from exposure to environmental noise originating from transportation, leisure and wind turbine sources.

These guidelines state: '*the number of people exposed* (to wind turbine noise) *is far lower than for many other sources of noise (such as road traffic). Therefore, the GDG* (WHO Guideline Development Group) *estimated the burden on health from exposure to wind turbine noise at the population level to be low, concluding that any benefit from specifically reducing population exposure to wind turbine noise in all situations remains unclear. Nevertheless, proper public involvement, communication and consultation of affected citizens living in the vicinity of wind turbines during the planning stage of future installations is expected to be beneficial as part of health and environmental impact assessments. In relation to possible harms associated with the implementation of the recommendation, the GDG underlined the importance of wind energy for the development of renewable energy policies'* (p. 84).

The WHO Regional Office for Europe developed the guidelines at the request of the Member States to provide '*robust public health advice, which is essential to drive policy action that will protect communities from the adverse effects of noise'* (p. vii).

The WHO Guidelines 2018 states that: '*that evidence on health effects from wind turbine noise (apart from annoyance) is either absent or rated low/very low quality*' (p. 84). None of the health studies examined by the WHO found a statistically significant association between exposure to wind turbine noise and the prevalence of hypertension or self-reported cardiovascular disease.

[25] Where an existing or approved development pre-dates the application for a wind farm development, the cumulative impact from all existing and approved developments must be considered at the noise sensitive locations in the assessment of the proposed wind farm. The background noise includes the ambient noise at the measurement location, excluding existing or approved wind turbine noise, but including other existing and approved noise sources (see Glossary definition).
[26] Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise.

The WHO recommendation for wind turbine noise is therefore based on annoyance criteria, i.e. noise affecting the general amenity of a resident or other noise sensitive occupier near to the development.

The WHO recommendation is 'conditional', indicating that '*There is less certainty of its efficacy owing to lower quality of evidence of a net benefit……meaning there may be circumstances or settings in which it will not apply*,' (p.23).

Noise control, based on annoyance dose response curves, is recommended by the WHO as the primary metric for wind turbine noise exposure. The methodology and standards set out in the 'preferred draft approach' have been reviewed to ensure that the requirements set out in these Guidelines are consistent with the 2018 WHO Guidelines.

5.7.6 Wind Energy Development Noise

5.7.6.1 Wind Turbine Noise

Unlike other sources of noise, a key characteristic of wind turbine noise is that its level changes with wind speed due to the fact that the turbine power output is also directly related to wind speed.

Natural wind sound increases continuously with increasing wind speed, whereas wind turbine noise from modern pitch regulated turbines reaches a plateau at rated (full) power. The nature of wind turbine noise means that it can only be assessed in windy conditions and in some cases the wind turbine noise is at or below the natural (background) sound levels. This distinguishes it from other types of commercially and industrially generated noise which is normally assessed in calm or low wind conditions.

Because wind turbine noise varies with wind speed, specific measurement and analysis methods are needed to assess noise from either proposed or operational wind energy developments.

Good acoustical design and careful siting of turbines is essential to ensure that there is no significant noise impact at 'noise sensitive locations' (which are defined in section 5.7.7 below). Noise output from modern wind turbines can be controlled to mitigate noise problems, albeit with a reduction in turbine power output. An appropriate balance must be achieved between facilitating power generation and mitigating against the noise impact on nearby noise sensitive locations.

Sources of wind turbine noise

There are distinct types of noise sources associated with the operation of wind turbines;

- a mechanical component created by the operation of mechanical elements in the hub and nacelle such as the generator, and
- an aerodynamic component caused by turbine blades passing through the air and wind moving around the turbine tower.

A third potential source of noise from a wind energy development is noise associated with ancillary equipment such as electrical sub-stations co-located with the wind energy development.

Wind turbine and ancillary equipment noise can include special audible characteristics such as tonal noise, amplitude modulation and low frequency components.

5.7.6.2 Mechanical noise

In general, wind turbines themselves produce very little noise when not turning. Some noise is produced from yaw motors (as they rotate the turbine to face into the wind), blade pitch actuators, brakes, and hydraulic pumps in the nacelle. In some cases, mechanical related noise can be tonal in nature. Improvements in gearbox design and noise control techniques have resulted in significant reductions in mechanical noise generation. Modern direct drive turbines have limited high-speed mechanical components and therefore mechanical noise levels and tonal noise components are greatly reduced.

5.7.6.3 Aerodynamic noise

Aerodynamic noise created as a result of the interaction between wind and turbine blades is generally the dominant noise source experienced from wind turbines. Modern wind turbine blades begin to rotate and generate electricity at hub height wind speeds of around 3 to 4 metres per second, a speed referred to as the 'cut-in' wind speed. Maximum power output is generally reached at hub height wind speeds of around 10 metres per second, a speed referred to as 'rated wind speed'.

From cut-in wind speeds the noise level generally increases with wind speed and power output but differs in level depending on the type of turbine used. The two main types of turbine in use are pitch controlled and stall regulated turbines. The aerodynamic noise from a stall regulated turbine continues to increase with wind speed but a pitch regulated turbine's noise level generally reaches a maximum level at rated power and remains constant or may decrease slightly as wind speed continues to increase. Virtually all large wind turbines being commercially produced are pitch controlled.

Some early wind turbine designs had turbine blades which were downwind of the tower (see Section 2.2). As the blades passed on the downwind side of the tower significant turbulence caused loud low frequency and infrasonic noise on a consistent basis. Modern wind turbines have the blades upwind of the tower. This has effectively eliminated continuous infrasound elements from wind turbine noise during normal operation.

5.7.6.4 Other Noise Sources

Wind energy developments can include electrical equipment such as transformers in sub-stations and other ancillary equipment within the boundary of the wind energy development site which can also contribute to noise emissions. These components have the potential to generate tonal noise in particular and must be considered in combination with the wind turbine noise. Any tonal noise penalty arising from these sources will be considered as part of the overall noise assessment set out in Technical Appendix 1.

5.7.6.5 Special Audible Characteristics

Wind turbine noise containing special audible characteristics (tonal, infrasonic, low frequency and amplitude modulation components) are frequently perceived to be more intrusive than broadband noise. There is no evidence that wind turbines generate perceptible infrasound. There is normally no excessive tonal or low frequency element in the noise from a wind turbine. The characteristic sound close to a wind turbine could be described by the listener as a regular ‘swish’ which decreases rapidly with distance. However, under some running conditions wind turbines can generate special audible characteristics in the form of amplitude modulation, tonal and low frequency noise at distances of hundreds of metres from the turbine.

Under adverse conditions at a distance from the turbine ‘whoomphing’ or ‘thumping’ type noise can dominate the noise from a wind turbine. This periodic fluctuation comes from changes in the amplitude (dB) level of the noise and is related to the rotational speed of the turbine. It is referred to as ‘amplitude modulation’. Such noise can cause annoyance at lower levels than noises without such characteristics. While amplitude modulation can occur over extended periods it tends to vary in intensity, adding to the annoyance.

The assessment of tonal, low frequency and amplitude modulation characteristics require specific measurement techniques. Full assessment for these types of noise is addressed in Technical Appendix 1 to these Guidelines including how such elements in the noise are penalised.

5.7.7 What is a Noise Sensitive Location?

The limits regarding noise levels and special audible characteristics will be applied to all noise sensitive locations. For the avoidance of doubt the limits will be interpreted as L_{A90} measured at outdoor locations and adjusted for special audible characteristics, within the curtilage[27] of noise sensitive locations.

A noise sensitive location is defined, in the case of wind energy development, as any location in which the inhabitants may be disturbed by noise from the wind energy development. This incorporates a dwelling, house, hotel or hostel, health building (providing patient services), nursing/retirement home, educational establishment, place of worship or entertainment, or other facility which may justifiably require for its proper use the absence of noise at levels likely to cause significant effects. This definition may include protected wildlife areas[28], areas of particular scenic quality or special recreational amenity importance designated in the Development Plan.

Noise sensitive locations may include dwellings with an interest in the development of the wind energy development including where the wind energy development is developed as part of a community scheme or with community involvement through an equity share. In such cases the Relative Rated Noise Limit may be increased by agreement between all relevant parties in the impacted noise sensitive locations. Notwithstanding this the RRNL[29] may not exceed 43 dB(A) which is the upper limit set by these Guidelines consistent with the WHO Environmental Noise Guidelines for the European Region (WHO, 2018) metric for impacting human health.

Documentary evidence of the agreement must be provided in writing with the planning application. It is recommended that any such agreement is registered with the title/ deeds of the property. The annual noise monitoring and reporting completed in accordance with section 2.6 and 2.7 of Technical Appendix 2 must demonstrate compliance with the maximum noise level

[27] The curtilage of a domestic dwelling house for the purposes of these draft guidelines is defined as the land immediately surrounding a dwelling house which is used for purposes incidental to the enjoyment of the dwelling house as such and excludes for example any open fields beyond the immediate surrounds of the dwelling. In the case of buildings associated with other noise sensitive properties the curtilage would be the area in the immediate surrounds of the relevant buildings.

[28] Areas protected under Irish or European legislation (see Glossary).

[29] Relative Rated Noise Limit, see Section 5.7.11 for definition.

permitted at that Noise Sensitive Location. Separate noise monitoring shall be carried out for each property the subject of an interest agreement in order to provide full disclosure of wind turbine noise levels to the occupiers of the property for the duration of operation of the wind energy development.

5.7.8 Impact of Separation Distance on Noise Levels

In general noise levels decrease with increasing distance from the turbine. WHO (2018) states, however: 'there is no clear evidence on an acceptable and uniform distance between wind turbines and residential areas, as the sound propagation depends on many aspects of the wind turbine construction and installation' and concludes 'using distance to a wind farm as a proxy for noise from wind turbines in health studies is associated with high uncertainty' (p. 85).

Separation distance alone cannot be relied upon as a mechanism to accurately control noise levels. This is due to a variety of factors which are not directly related to distance but which can affect the transmission of noise, including:

- topography (line of sight has a significant impact on noise propagation);
- ground absorption;
- directionality of the source;
- wind speed and direction; and
- atmospheric conditions.

[Separately see Chapter 6 in relation to the use of a separation distance for visual amenity purposes.]

5.7.9 Control of Noise

In Ireland, under the 2006 guidelines, the determination of background noise levels and limits was typically carried out using the ETSU-R-97 [30] methodology. The Assessment and Rating of Noise from Wind Farms - ETSU-R-97 (ETSU 1996) was the first detailed planning guidance for the

[30] The Energy Technology Support Unit was part of the UK Department of Trade and Industry and funded research to develop the report on wind farm noise.

assessment of noise from wind energy developments and set a noise limit relative to background noise levels. It was written prior to the development of multi-MW turbine design.

The Institute of Acoustics[31] has published a 'Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (IoA 2013). Subsequently the IoA published guidance on a 'Method for Rating Amplitude Modulation in Wind Turbine Noise' (IoA 2016).

These Guidelines adapt the 2013 approach to the IoA application of ETSU-R-97, along with international standards and guidance on tonal noise and low frequency noise, for wind energy developments in Ireland. Detailed guidance is set out in Technical Appendices 1 and 2 which form part of these Guidelines.

5.7.10 The L_{den} Indicator

The L_{den} indicator is calculated as the A-weighted average sound pressure level, with a 10 dB penalty added to the night time (23:00–07:00) level, a 5 dB penalty is added to the evening (19:00–23:00) level and no penalty added to the daytime (07:00–19:00) level. The penalties are introduced to account for people's extra sensitivity to noise during the evening and night periods. Wind turbine noise assessment will be based on the L_{den} indicator which is defined in the Environmental Noise Directive (2002/49/EC) and used by WHO in drafting the 2018 guidelines.

L_{den}

Annualised A-weighted L_{eq} sound pressure level, with a 10 dB penalty added to the night time (23:00–07:00) level, a 5 dB penalty is added to the evening (19:00–23:00) level and no penalty added to the daytime (07:00–19:00) level

Following the IoA Guidance wind turbine noise is determined using the L_{A90} index to minimise the influence of transient noise sources which are not related to the measured wind turbine noise

[31] The Institute of Acoustics is the UK's professional body for those working in acoustics, noise and vibration. It is a nominated body of the Engineering Council, offering registration at Chartered and Incorporated Engineer levels. The Institute has some 3000 members worldwide with approximately 150 members in the Irish Branch.

levels. For the purposes of these guidelines $L_{A90,\ 10\ min}$ will be relied upon for describing the noise from wind turbines, with the conversion factor of L_{A90} = LAeq - 2dB being deemed appropriate for converting L_{Aeq} levels to L_{A90} for noise modelling purposes where required.

L_{A90} Coversion Factor

L_{A90} = LAeq - 2dB

5.7.10.1 Relative Noise Limit versus Fixed Noise Limit

An important element in the control of noise from wind energy developments is a maximum allowed external noise limit, which can take the form of either a relative noise limit or a fixed noise limit. A relative noise limit is based on an increase relative to background noise levels. A fixed noise limit is a specific limit regardless of changes in the background level, such as those applied by the EPA for licenced sites. A fixed limit can have the effect of permitting significant increases in noise levels where existing background noise levels are low.

However, a noise limit that is relative to the background noise level, while increasing noise levels, is limited to a slight or moderate change in areas with low background noise levels. This is the preferred option, taking into account international best practice. A relative noise limit can however result in wind turbine levels exceeding the WHO recommendation. The limit proposed in these guidelines is a combination of relative and fixed values to provide a balance facilitating wind energy development while controlling noise emissions.

The margin of increase over background noise levels can be set in the following context. A 3 dB(A) change is just perceptible under normal circumstances. The Environmental Noise Directive (END) requires noise 'bands' to be calculated in 5 dB intervals and most health-related studies are based on 5 dB intervals.

Ideally developments should be carried out without increasing background noise levels. Where a development serves a specific national policy, international best practice regarding relative noise limits is to restrict the increase above the existing background noise level. Internationally a 5dB increase over background noise levels is regarded as a reasonable balance in protecting amenities.

The EU END and the WHO Guidelines recognise that noise occurring in the evening and night time periods can be more annoying than noise during the day by imposing a 5 dB(A) penalty for noise occurring in the evening period and 10 dB(A) penalty for noise occurring at night. Using these penalties provides a temporal 'rating' based on the time at which the noise arises.

The change from $L_{night, outside}$ to L_{den} as the appropriate noise indicator for wind turbine noise by the WHO means that night time noise is the determining factor due to the 10 dB(A) night time penalty imposed in the calculation of the indicator. The most appropriate method of control, to avoid doubling up on penalties, is to set limits based on the night time background noise level and adjust accordingly for the day and evening periods.

5.7.10.2 Combined Noise Limits- Relative Rated Noise Limit

It is vital that through careful design, technological advancements and operational practice that the development of new wind energy projects ensures the control of noise levels and special audible characteristics. In order to provide the maximum level of protection for sensitive locations, in addition to a relative maximum allowed external noise limit as set out above, a rating system is used to provide additional control in the form of penalties for specific noise characteristics, where relevant.

The principle of a 5 dB(A) increase above background levels has been regarded as good practice and has been adopted for wind turbine noise in ETSU-R-97 and other standards for relative noise limits for many years. These Guidelines provide for a Relative Rated Noise Limit (RRNL) of 5 dB(A) above the existing background noise level, within upper and lower fixed limits, as the most appropriate method to control noise impacts from wind energy developments.

The background noise includes the ambient noise at the measurement location, excluding existing or approved wind turbine noise, but including other existing and approved noise sources (see Glossary definition).

The upper fixed limit prevents escalating noise levels at higher wind speeds. The lower fixed limit permits wind energy development at lower wind speeds. The intermediate band permits operation at an internationally acceptable increase over background noise levels. This combination of fixed and relative noise limits provides a sustainable approach while controlling wind turbine noise levels.

A noise limit of this type provides the appropriate protection by:

- providing a consistent level of protection for noise sensitive locations at low background sound levels,
- allowing wind turbines to operate with effective noise control at intermediate wind speeds,
- limiting noise emissions at high wind speeds due to a fixed maximum noise limit, and
- incentivising the use of best available noise control techniques in wind energy development design.

5.7.11 What limit must be complied with?

Best available techniques must be used in selecting and implementing measures to predict and minimise the noise impact of wind energy developments. While wind energy development noise may be audible, the noise limits of these guidelines are intended to protect amenity at noise sensitive locations. The noise limits will apply to outdoor locations at any residential or noise sensitive properties.

A Relative Rated Noise Limit (RRNL) in the range of 35 – 43 dB(A) shall apply, while not exceeding the background noise level by more than 5dB(A) with an upper limit of 43 dB(A). The background noise level is determined by the measured L_{A90} (in the absence of wind turbine noise[32]) during the background noise measurement period. The rated wind turbine noise level ($L_{A\ rated,\ 10\ min}$) is determined by the measured noise level attributable to or related to the wind energy development plus any rating penalties for special audible characteristics.

[32] Planning applications for wind energy development must determine background noise levels 'in the absence of wind turbine noise'. This may require such measures as switching off turbines or using correction techniques to exclude existing nearby wind turbine noise. The methodology for determining background noise levels shall be provided in the planning application.

Relative Rated Noise Limit (RRNL)

Relative rated noise levels (LA rated, 10min) resulting from wind energy development and taking into account the cumulative impact of noise levels resulting from other existing and approved wind energy developments shall not exceed:

(1) Background noise levels by more than 5 dB(A) within the range 35-43 dB(A), or

(2) 43 dB(A).

both measured as $L_{90,10\ min}$ outdoors at specified noise sensitive locations.

At noise sensitive locations where existing background noise levels are measured at less than 30 dB, a maximum 35 dB(A) noise limit will be strictly imposed at lower wind speeds. For the purpose of these guidelines noise levels shall be calculated to an accuracy of one decimal place and rounded to the nearest integer value, e.g. 32.4 = 32 and 32.5 = 33, etc.

The methodology used for determining background noise levels shall comply with Section 5.2 of the IoA GPG and details provided in the planning application. Planning applications for wind energy development must therefore determine background noise levels in the absence of existing or approved wind turbines. This may require such measures as switching off turbines or using correction techniques to exclude existing or approved wind turbine noise sources. However, for the avoidance of doubt, the noise levels associated with all other existing and approved natural and anthropogenic noise sources in the study area shall constitute the background noise

The rating mechanism is described in detail in Technical Appendix 1 and can result in the addition of penalties of up to 11 dB to the measured noise level.

Figure 2 shows the background noise level (green line), prior to the wind energy development construction, the Relative Rated Noise Limit (RRNL) (red line) set at planning stage and a curve of measured wind energy development noise post construction (blue line). The background noise and wind energy development noise curves are constructed in accordance with the IoA Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise as modified in Technical Appendix 1 based on the background noise measurement period levels. At low wind speeds the background noise level is low so the limit of 35 dB(A) applies up to a wind speed of 7 m/s wherethe limit is set at 5 dB above background noise levels. At wind speeds above 11 m/s background noise continues to increase but the noise limit from wind turbines is limited to 43 dB(A).

The critical noise level to ensure consistency with the WHO conditional recommendation will be at night time. It may be possible to operate a wind farm at higher noise levels during the day period, subject to compliance with the RRNL. Background noise shall be determined during the night time period and set at the measured level for night time. The RRNL shall then be calculated based on the background noise for the appropriate period. Additional limits can be set at background plus 5 dB(A) for the evening period and the backgroundlevel plus 10 dB(A) for the day period as set out in Technical Appendix 1.

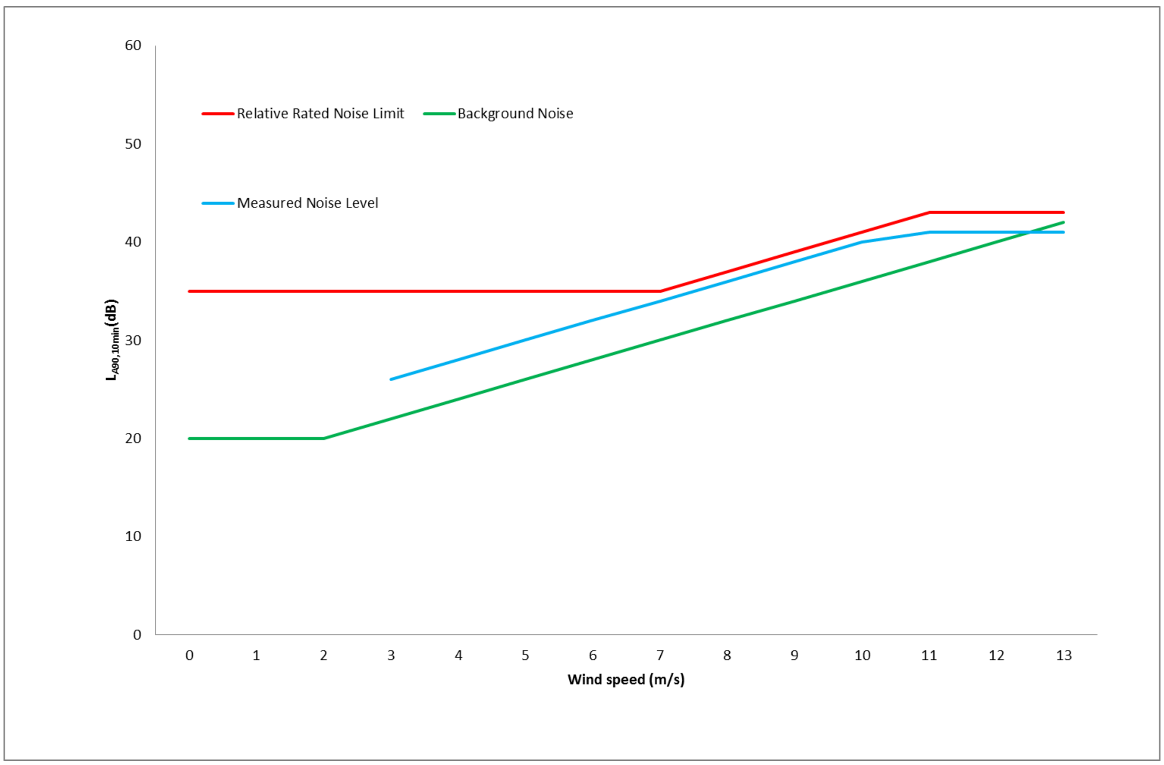

Figure 2 Rated Relative Noise Limit

The maximum noise level permitted at a noise sensitive location under these guidelines is 43 dB(A). The relative rated noise limit will be 35 dB(A) at lower wind speeds increasing to the maximum noise level permitted. The actual noise level arising at a noise sensitive location, for the majority of the time, will be lower than the maximum permitted of 43 dB(A) due to variations in weather conditions.

Recent long term studies on wind energy developments in County Wexford[33] have confirmed that the long term noise emissions from wind energy developments measured at nearby noise sensitive locations are lower than the maximum predicted. The long term measured noise levels were lower than the WHO guideline level in those studies.

An additional factor is the rating of the noise. The RRNL includes a rating for tonal and amplitude modulation components. The inclusion of a rating for special audible characteristics provides a more conservative approach than the WHO Guidelines.

5.7.12 Requirements at Pre-Application and Application Stage

Planning authorities will require that noise modelling of the wind energy development project carried out by the applicant in advance of and submitted with the planning application will test and demonstrate compliance with these limits including any presence of such special audible characteristics. In addition to the wind turbines, this assessment should include details of any transformers, sub-stations or any other ancillary equipment. The planning application for a wind energy development shall include a noise assessment which, when carried out in accordance with these Guidelines, identifies a reasonably foreseeable worst-case scenario.

In order to meet the specified noise limits at design stage, the developer must make allowance for any potential special audible characteristics and ensure that through a combination of separation distance and operational control, including automatic wind turbine shut off, this limit can be achieved. Where penalties for special audible characteristics need to be applied to measured noise levels by the developer in their design, as specified in these Guidelines, the noise modelling predictions submitted with the planning application must take account of this and achieve the RRNL.

Regarding post-completion compliance monitoring the IoA GPG states that:

'*Unless there is any particular requirement to measure day-time noise levels (i.e. complaint during these periods) it may be useful to filter out all data except that measured between 2300 and 0400 when competing noise (including early morning birdsong and traffic) would be at a minimum. Evening measurements may also be sufficiently unaffected by spurious sources, depending on the background noise character of the locality.'*

[33] Available from https://www.wexfordcoco.ie/news/2017/07/14/wind-farms-noise-report (10th October 2019)

This is in line with current experience which indicates that the night period is in most cases the only time that wind turbine (in the absence of special audible characteristics) noise dominates. The guidelines will have the effect of further reducing wind turbine noise, making it harder to isolate for post completion measurements.

Compliance noise measurements submitted by the developer to the planning authority must therefore be based on the rated level, inclusive of any penalties. This will have a direct impact on how far any new turbine must be located from a noise sensitive location.

In a situation where more than one wind energy development is approved or where a wind energy development already exists in an area, the cumulative impact from all operating and approved wind energy developments must be considered at the noise sensitive locations in the assessment of the proposed wind energy development(s). This prevents a situation where each of two wind energy developments may individually meet prescribed noise levels but cumulatively exceed the limit at a noise sensitive location. For the avoidance of doubt;

- Background noise levels must be determined 'in the absence of existing or approved wind turbines'. This may require such measures as switching off turbines or using correction techniques to exclude existing wind turbine noise sources. The methodology used for determining background noise levels shall be in compliance with Section 5.2 of the IoA GPG and the details provided in the planning application.

- The noise level attributable to an existing wind energy development shall be either the existing noise limit under a grant of planning, or where no limit has been applied, appropriate monitoring and/ or prediction will be required as part of the developer's assessment for their planning application.

Applicants shall submit documentary evidence that the type(s) of turbines proposed will use Best Available Technology (BAT)[34] and current engineering practice in terms of avoidance of noise generation and suppression of any noise nuisance. BAT requires the developer to reduce, minimise or prevent emissions from occurring. This may involve the application of a single technique or a combination of techniques including turbine specification/design, turbine separation from noise sensitive locations and/or operational controls. The developer shall provide a list all such techniques proposed with the planning application. Technique(s) employed must comply with BAT and must be capable of complying with the noise limits set out in these guidelines. Planning authorities will take reasonable steps to seek such evidence from the applicant where it is insufficient.

[34] BAT is defined in Section 5(1) of the EPA Act 1992 as amended http://www.epa.ie/licensing/info/bref/

Applicants shall also submit the following with the application:

1. A proposed noise monitoring and control procedure for the construction phase.
2. A clear statement that the wind energy development shall not exceed the predicted $L_{A\ rated}$ levels stated in the noise report.
3. A proposed detailed methodology for a post completion noise survey in accordance with the IoA GPG Supplementary Guidance Note 5: Post Completion Measurements for each turbine to be commenced within four weeks of commissioning of any turbine or group of turbines.
4. A map showing the noise monitoring locations for the ongoing operation phase of the wind energy development along with a detailed proposed noise monitoring and reporting procedure.
5. A proposal for a documented complaints handling procedure.

5.7.13 Wind Energy Development Noise Conditions Monitoring and Modelling

These Guidelines draw from best international practice and noise criteria including WHO (2018). The WHO (2018) noise criterion L_{den} was chosen to capture levels that 'occur over a longer period of time, i.e. an annualised level. WHO (2018) states 'Moreover, most health outcomes considered in these guidelines are expected to occur as a result of long-term exposure.'(p. 9)

In accordance with the Environmental Noise Directive and the WHO approach of an annualised limit, the Relative Rated Noise Limit (RRNL) applies over the whole year. Separate limits for shorter periods do not apply. Applying the RRNL to the annualised background noise level provides a more proportional level of protection consistent with WHO (2018).

When calculating the RRNL, in accordance with the requirements of Technical Appendix 1, data for the appropriate baseline noise monitoring period shall be considered in determining noise limits based on background noise levels plus 5 dB(A), within the specified range, as an average over the entire measurement period.

Detailed guidance on how to apply the RRNL is set out in Technical Appendix 1. Suggested wording for planning conditions is included in Technical Appendix 2.

These Guidelines are designed to ensure that noise from wind energy developments are compatible with the WHO Environmental Noise Guidelines for the European Region (WHO, 2018). A report analysing wind turbine noise and long-term wind data has concluded that average noise levels are lower than rated power levels[35]. Guidance on monitoring and modelling of wind energy development noise is set out in the Technical Appendices to these Guidelines.

Wind energy development noise is measured in 10-minute intervals and varies considerably depending on wind speeds. The noise modelling methodology predicts long term average A-weighted sound pressure levels, at full power output, under meteorological conditions favourable to propagation, i.e. down wind or under a well-developed moderate ground-based temperature inversion, which can occur at night. Statistically these worst-case conditions do not arise all of the time and may not coincide with the turbines operating at full power output.

5.7.14 Noise Monitoring

The Department of Communications, Climate Action and the Environment, in conjunction with Local Authorities and the Environmental Protection Agency (EPA) will ensure that there is a robust noise monitoring framework in place. This framework will build on existing structures and powers of the local authorities and the EPA to investigate noise complaints with the EPA providing a supporting and advisory role to local authorities through the Network for Ireland's Environmental Compliance and Enforcement (NIECE) network as well as utilising its powers of independent oversight where appropriate. Furthermore, enhanced cooperation between local authorities with the potential of a regional approach to resources may be developed over time in consultation with the EPA and DHPLG and DCCAE, as part of a wider policy of regional approaches to environmental protection. Consideration will be given to establishing an approach based on existing arrangements which currently operate in other areas of environmental protection, in order to maximise the efficient use of resources. This will establish a fair and consistent methodology to ensure constructed wind energy development projects meet the strict new noise limits including special audible characteristics penalties.

As an essential element of this second step, planning authorities should impose planning conditions in relation to noise limits and special audible characteristics in line with these Guidelines where planning permission is granted. Local authorities will enforce planning conditions with the potential for technical support and advice from the Environmental Protection Agency, as appropriate. Planning authorities will undertake or arrange for their own independent noise monitoring to be carried out as part of their investigations of wind energy developments as required, using the existing and any future support structures available as outlined above.

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[35] RPS Report MGE0713RP0001F01 Draft Wind Energy Guidelines – Wind Turbine Noise Analysis

The planning authority or An Bord Pleanála should impose conditions on a grant of planning permission for a wind energy development to ensure that the development is constructed, operated and decommissioned in accordance with the submitted noise impact assessment; including relative rated noise limits identified in respect of each noise sensitive/monitoring location, any necessary mitigation measures and details of monitoring and compliance.

As detailed in Technical Appendix 2, such planning conditions should specify that where a complaint is made by a member of the public that the relevant planning condition limits on noise are not being complied with in an operational wind energy development, and where the planning authority has satisfied itself that the condition is not being complied with, then, having been notified by the planning authority of its interim determination, the relevant wind turbine(s) must be taken out of operation by the operator until such time as the operator has demonstrated to the satisfaction of the relevant planning authority that noise reduction measures have been completed and any other steps that the authority requires have been taken to ensure compliance. The planning authority may then approve a testing programme to demonstrate compliance, subject to which the turbine(s) may be returned to operational service.

Detailed technical guidance in relation to noise assessment, monitoring and the drafting of planning conditions to assist planning authorities and developers in this regard is set out in Technical Appendix 1 and 2.

5.7.15 Good Practice for Wind Energy Development Guidelines.

To ensure that the general public has maximum confidence in the reliability of the design and modelling to accurately predict the noise impacts from wind energy development projects in relation to the construction and operation phase, the "Good Practice for Wind Energy Development Guidelines"[36], issued by the Department of Communications, Climate Action and Environment (December 2016), are intended to ensure that wind energy development in Ireland is undertaken in observance with the best industry practices, and with the full engagement of communities around the country. The Code of Practice provides that there is an effective complaints procedure put in place by wind energy development operators in relation to all aspects of wind energy development projects, where members of the public can bring any concerns they have about operational difficulties, including noise nuisance, to the attention of the wind energy development operator.

The Code of Practice sets out a number of practical steps that wind energy development promoters must comply with in engaging with communities. It is critical that developers and

[36] http://www.dccae.gov.ie/documents/Code%20of%20Practice%20community%20engagment.pdf

operators of wind energy developments adhere to the guidelines set out in the Code of Practice and the provisions set out therein for the management of complaints, including noise complaints, by the wind energy development operator.

While signing up to the Code of Practice has thus far been on a voluntary basis, new planning applications for wind developments under these Guidelines will be required to comply with the Code of Practice and demonstrate annual compliance with its provisions. For the avoidance of doubt, the Code of Practice is not a substitute for planning obligations or other legal requirements imposed on wind energy developers.

Furthermore, wind industry initiatives around community engagement together with the community requirements that the Department of Communications, Climate Action and Environment has developed as part of the new Renewable Electricity Support Scheme[37] should augment the community centred approach set out in the Good Practice Guidelines and within these Guidelines. It is expected that these measures will significantly strengthen the protection of communities affected by wind energy developments and specifically in relation to wind energy development noise.

5.7.16 Construction and Decommissioning Noise Control

Noise arising during the construction phase and decommissioning and reinstatement of wind energy development sites are similar in nature. The range and scale of the equipment required are broadly similar along with the conditions and hours of operation. The noise control measures adopted for both of these phases in the development can therefore be considered as one.

Conditions relating to noise levels will be attached to planning permissions for wind energy developments to protect the amenity of nearby noise sensitive locations. A draft Construction and Environmental Management Plan shall be submitted with a planning application for a wind energy development project. The draft Construction and Environmental Management Plan shall (inter alia) include specific proposals for noise control for construction work necessitated by safety, weather or turbine transportation conditions that must be completed outside the normal working day period.

Further guidance in relation to the control of noise during both the construction and decommission phase are set out in Technical Appendix 2.

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[37] Communities are being designed into the fabric of the new Renewable Electricity Support Scheme which will be characterised by increased community participation in, and ownership of, renewable electricity projects. See: https://www.dccae.gov.ie/documents/RESS%20Design%20Paper.pdf

5.8 SHADOW FLICKER

5.8.1 Background

Wind turbines, like other tall structures, can cast long shadows when the sun is low in the sky. The effect known as “shadow flicker” occurs where the rotating blades of a wind turbine cast a moving shadow which, if it passes over a window in a nearby house or other property results in a rapid change or flicker in the incoming sunlight. This effect will occur only for a short period during a given day and only under specific concurrent circumstances, namely when:

- the sun is shining and is at a low angle (after dawn and before sunset), and
- there is sufficient direct sunlight to cause shadows (cloud, mist, fog or air pollution could limit solar energy levels), and
- a turbine is directly between the sun and the affected property, and within a distance that the shadow has not diminished below perceptible levels, and
- there is enough wind energy to ensure that the turbine blades are moving.

Generally only properties within 130 degrees either side of north, relative to the turbines, can be affected at these latitudes in the UK and Ireland- turbines do not cast long shadows on their southern side.

The time period in which a neighbouring property may be affected by shadow flicker is completely predictable from the relative locations of the wind turbine and the property. Modern wind turbines have the facility to measure sunlight levels and to reduce or stop turbine rotation if the conditions that would lead to shadow flicker at any neighbouring property occur. With careful site design and appropriate mitigation, and most critically the use of appropriate equipment and computer software, no existing dwelling or other affected property (e.g. existing work places or schools) should experience shadow flicker. The relevant planning authority or An Bord Pleanála should require that the applicant shall provide evidence as part of the planning application that shadow flicker control mechanisms will be in place for the operational duration of the wind energy development project.

5.8.2 Shadow Flicker Control

Computational models can be used to accurately predict the strength and duration of potential shadow flicker during daylight hours for every day of the year. A Shadow Flicker Study detailing the outcome of computational modelling for the potential for shadow flicker from the development should accompany all planning applications for wind energy development.

If a suitable shadow flicker prediction model indicates that there is potential for shadow flicker to occur at any particular dwelling or other potentially affected property, then a review of site design involving the possible relocation of one or more turbines to explore the possibility of eliminating the occurrence of potential flicker is required. Following such a review, if shadow flicker is not eliminated for any dwelling or other potentially affected property then clearly specified measures which provide for automated turbine shut down to eliminate shadow flicker should be required as a condition of a grant of permission.

The planning authority or An Bord Pleanála should impose condition(s) to ensure that no existing dwelling or other affected property will experience shadow flicker as a result of the wind energy development subject of the planning application and the wind energy development shall be installed and operated in accordance with the shadow flicker study submitted to accompany the planning application, including any mitigation measures required.

5.9 ENVIRONMENTAL (INCLUDING ECOLOGICAL) CONSIDERATIONS AND THE DESIGN PROCESS

As part of any EIA, environmental considerations (including environmental constraints and opportunities- and mapping of these factors) are recommended to be integrated into the design process for individual projects at site selection, layout and configuration stages in order to help to prevent or mitigate environmental impact. Site-specific field data will be required to identify the most appropriate sites and layouts.

Were no mitigation to be applied, environmental constraints could limit wind energy development. Examples of environmental constraints include:

- residential development and other sensitive uses,
- amenities,
- other infrastructure,
- ecologically-designated sites,
- protected habitats and species,
- ecological connectivity,
- designated geological heritage sites,
- areas where soil/subsoil/geology are less stable,
- peatlands,

- areas of mineral/aggregate potential, surface and ground waters,
- Water Framework Directive requirements including Register of Protected Areas,
- flood risk, noise emissions from wind energy developments,
- carbon emissions from peat extraction,
- archaeological and architectural heritage and its context (including intervisibility and interrelationships between monuments and structures within the wider landscape),
- capacity of road networks to accommodate construction traffic,
- waste generation from construction and decommissioning,
- landscape designations and limited visual assimilative capacity for developments in marine and island areas.

Opportunities for the development of wind energy have the potential to facilitate the wind energy development with increased environmental benefits and/or with reduced adverse environmental effects. Such opportunities include higher wind speeds, closer proximity to the Irish transmission grid, availability of grid connection, accessibility and reduced concentrations of environmental constraints.

Stage 1 – Site Selection

- Environmental constraints should contribute towards the identification of possible suitable wind energy development site options.

- Consultation with local communities and opportunities are also likely to influence the identification of suitable sites.

Stage 2 – Internal Site Layout

- Buffers and set-backs from relevant features should inform the selection of suitable areas within the site as appropriate.

- Environmental constraints should assist in the identification of possible internal site layout options.

- Consultation with local communities and maximising the wind resource potential of the site are also likely to influence layout options.

Layout includes location of turbines, access routes, separation distances/spacing, clustering, turbine height and number of turbines.

5.10 COMMUNITY INVESTMENT AND DIVIDEND

The Government's White Paper, Ireland's Transition to a Low Carbon Energy Future (2015), sets out a vision for transforming Ireland's fossil fuel-based energy sector into a clean, low carbon system where there will be a focus on citizens and communities as active participants in energy generation.

The Programme for Partnership Government (2016) further affirms the importance of community participation in renewable energy and energy efficiency projects. Collectively the potential benefits of community energy projects are in both the local and national interest.

The Code of Practice for Wind Energy Development in Ireland Guidelines for Community Engagement issued by the Department of Communications, Climate Action and Environment (December 2016) sets out to ensure that wind energy development in Ireland is undertaken in observance with the best industry practices, and with the full engagement of communities around the country.

Applicants for wind energy developments are required to adhere to this Code of Practice and to engage with the local community and submit a Community Report with their planning application (as set out in Chapter 4 of these Guidelines). The Community Report must set out the means by which the developer intends to provide an opportunity for the local community to benefit from the development, whether by facilitating community investment/ownership in the project or by other types of benefits/dividends, or a combination of the two.

Models to support community participation will be implemented as part of the new Renewable Electricity Support Scheme (RESS) that is being developed by the Department of Communications, Climate Action and Environment and due to open in late 2019. Communities are being designed into the fabric of the RESS and its design will be characterised by increased community participation in, and ownership of, renewable electricity projects. Specific policies and support measures under the RESS will include financial support for community-led projects; a mandatory Community Benefit Fund with contributions set at €2/MWh for all RES-E generation produced and seeking support via RESS auctions; a National Community Benefits Register; mandatory investment opportunities for communities and citizens; a separate 'community' category in the RESS auction; project supports providing independent financial, legal, technical and project advice. DCCAE will work with the Commission for Regulation of Utilities (CRU) to identify measures to support Community-led projects through the grid connection process; and with industry representative groups and community representatives on the model.

5.10.1 Community Investment and Ownership

Local ownership and part-ownership, across the scale of energy generation can have a real and lasting impact on rural communities, supporting employment and securing sources of income. Though the ownership structure of an energy generation development is not a material consideration influencing acceptability of a project in planning terms, net socio-economic benefits such as employment, supply chain opportunities, associated business and local revenue streams and community benefit arrangements are relevant material considerations in determining planning applications for renewable energy projects.

There is an opportunity for communities to bring forward their own renewable and low carbon energy generating proposals. Indeed there are many community-led initiatives which are developing to bring forward such schemes. Community supported generation can extend the benefits of renewable energy to households in the form of cheaper energy, revenue streams and employment with the additional benefit of profits generated by the investment being retained within the local community.

The DCCAE's RESS scheme outlined above will promote and assist the development of community-led projects and shared ownership in developer-led projects.

Wind energy development projects which operate on a merchant basis or outside of the RESS should similarly ensure that they put in place measures to ensure that there are substantial benefits for the local community that have a similar effect to the community provisions that DCCAE has put in place to underpin the RESS.

Together industry initiatives on community engagement, the RESS provisions, the Good Practice Guidelines and these Guidelines place a strong emphasis on placing community benefits at the core of future wind energy development.

5.10.2 Community Benefit/Dividend

Wind energy developers should also take steps to ensure that the proposed development will be of enduring economic or social benefit to the communities concerned, whether or not the community plays any role in the ownership of the project. Benefits delivered in this way can provide local improvements that respond to the needs or aspirations of the community and in many cases, can be delivered efficiently as part of the development and construction process. These opportunities often grow out of discussions with the community and in relation to the nature and scale of the proposed development. The earlier these conversations begin, the greater the opportunity for benefits to be identified and delivered effectively.

This could, for example, include the establishment of a Community Benefit Fund, which is mandatory in RESS, resourced through community participation with an appropriate share of the revenue stream from the project and dispersed with appropriate governance, administration and accountability arrangements through a suitable local organisation or representative group.

Governance Arrangements

Developers should ensure funds are set up in a way which will support and promote local decision making. There are a number of different models and approaches. Developers, communities and others involved in the process need to be prepared to be flexible so as to find the best solution for their local area, including considering how to align funding from renewables developments by other developers in order to maximise local benefit.

Decision making on awards or spend should be vested with a group mandated for that purpose and there must be an emphasis on setting up effective governance and administration arrangements from the outset. Where a new legal entity is established to hold and manage the fund, there will be a level of administrative work around processing the fund, fulfilling legal requirements, ensuring it is resourced and demonstrating accountability. Where an existing community structure or vehicle is used, that body must be aware of the additional work required to administer the fund. Where the fund is managed through a third party or directly by a developer, the administration will be undertaken by that third party or developer, while all decision making should be kept local. For all of these options, it is essential that conflict of interest is avoided.

It is suggested that this should involve a local development vehicle, for example the Local Community Development Committees (LCDC) established under the Local Government Act 2014 (as amended), however it could also involve a more informal community council arrangement. It is important that the developer and the local authority provide assistance to the local community in identifying the most suitable governance and administration arrangement for their particular circumstances. This may involve capacity building and providing training, through the community liaison group structure set up during the community engagement process.

Types of Benefit/Dividend

Community benefit may encompass a range of measures that a project can bring to those living in its hinterland. For the majority of projects, this is associated with the level of economic benefit, widely defined, that a project brings to a community. Whether in the form of wider socio-economic community benefits such as local jobs and training opportunities, improved infrastructure resulting from the development, monetary payments to the community usually provided via an annual cash sum (often referred to as a Community Benefit Fund, which may provide grant funding), or other benefits which involve more direct funding of community projects, such as contributions in kind to local projects, assets and facilities (which could involve measures to promote energy efficiency or a local energy discount scheme), it is important that community benefit is a core component of future wind energy developments.

While the precise benefit will likely be a function of the scale and financial benefit of the project to the project promoters, the impact of the project on the local communities and their expectations regarding the nature of the community benefit, it is essential that the developer offers a form of community benefit that provides for a tangible long-term dividend to the community.

Whilst planning authorities will not generally be directly involved in the negotiation between the applicant and the local community, they should provide assistance where possible in terms of identifying possible types of community benefit which might be promoted.

Whether or not the project is operating under RESS, all projects should, unless other means of community benefit are expressly preferred by the local community, provide a Community Benefit Fund, using the RESS contribution of €2/MWh as a benchmark. All projects should also take part in the National Community Benefits Register. Wind energy developers must be open and transparent in providing information on how the benefit was calculated and allocated.

Such grant or direct funding could involve the funding of projects such as retrofitting of local community facilities i.e. community centres, clubhouses, dressing rooms, schools etc. in order to contribute towards energy efficiency, reduced energy costs and carbon footprint in such facilities or other energy saving measures such as district heating systems.

Examples of the principles and criteria established for existing community funds operating in Ireland include the following:

- Bord na Mona Wind Farms Community Gain Scheme Charter: http://www.bordnamona.ie/wp-content/uploads/2017/09/Wind-Farms-Community-Gain-Scheme-Charter.pdf

- ESB/Galetech Energy/Greencoat and Enercon Wind Farm Community Funds: http://www.windfarmcommunityfunds.ie/wp-content/uploads/2014/11/2019-Wind-Farm-Community-Fund-Guidelines-FINAL.pdf

In considering the planning application, the planning authority will take into account the degree to which the proponents of wind energy projects have meaningfully and properly consulted with and facilitated public participation in developing and refining their proposals. Projects should reflect broadly-based community perspectives, should explain the potential benefits of a project and should seek to establish relationships with the community on a long-term basis. Planning authorities are advised that in arriving at a decision on a given development proposal, they may evaluate the Community Report and place appropriate weighting on its adequacy and content alongside the broader site specific and energy policy factors detailed elsewhere in these Guidelines. The planning authority or An Bord Pleanála should impose condition(s) to ensure that any community investment/benefit/dividend proposed in the Community Report submitted to accompany the planning application is secured.

5.11 DECOMMISSIONING AND RESTORATION

The decommissioning and post operational restoration of a wind energy development once electricity ceases to be generated must be assessed during the initial design phase of the development and outlined at the planning stage, ensuring that decommissioning of infrastructure and the restoration of habitats is achievable and practical once the development has ceased operating... Issues to be addressed include restorative measures, the removal of above ground structures and equipment, landscaping and/or reseeding roads. It may be appropriate to allow tracks to remain, e.g., as part of a walking route after decommissioning.

It is good practice to include an outline Decommissioning and Restoration Plan (DRP) in the Environmental Report. However, as there would commonly be 25-30 years between construction and decommissioning of a wind energy development, the outline DRP should be sufficiently flexible. The draft DRP should at least consider the main infrastructure on the site and the likely aims of the restoration process.

The developer should review the DRP at least every 10 years throughout the lifetime of the development, and more frequently should the need arise. This is to ensure that site conditions, maintenance requirements and unexpected events do not compromise the objectives of the DRP. For example, unexpected impacts may arise during/following construction that affects the initial objectives of the DRP. Consultation with the statutory bodies should be considered at these review stages, as appropriate.

CHAPTER 6 CONSIDERING AN APPLICATION FOR WIND ENERGY DEVELOPMENT- AESTHETIC CONSIDERATIONS IN THE SITING AND DESIGN

6.1 INTRODUCTION

The primary purpose of this chapter is to provide clear national policy and guidance to planning authorities, wind energy developers and the wider community on appropriate approaches to the siting and design of wind energy development projects. There are two main areas of focus in this regard, namely the broad landscape design parameters which should be considered in determining the suitability of a particular location for wind energy development, and the siting of wind energy developments in relation to individual properties, including any setback from those properties which may be specified.

6.2 HOW SHOULD THE IMPACT OF WIND ENERGY DEVEOPMENT ON LANDSCAPE CHARACTER BE ASSESSED?

The first consideration in the siting of wind energy developments is the sieve mapping process outlined in Chapter 3 above, which takes account of landscape character assessment in the identification within the local authority development plan of areas which are 'acceptable in principle' for wind energy development, where they would be 'open for consideration', and where they would be 'not normally permissible'. On the assumption that the location chosen for the wind energy development is either 'acceptable in principle' or 'open for consideration', the guidance below is intended to provide indicative and general advice which may assist developers and the local authority in considering the most appropriate location, design and layout for the development, taking into account the type of setting.

The guidance does not suggest that wind energy developments are appropriate or inappropriate in any given situation. These questions can be informed and/or qualified by the values people attach to landscape and by evaluating their sensitivity through the sieve analysis described in Chapter 3 on the development plan process, or otherwise at a strategic and/or project specific level.

The highest standards of siting and design for a wind energy development, as presented in this chapter, should be expected where the sensitivity of the landscape is high and the locations from where it is viewed are critical. Where a wind energy development is close to and visible from an area of high sensitivity, it should be designed to achieve similar standards as viewed from key viewpoints in that area. Particular landscapes of very high sensitivity may not be appropriate for wind energy development

Wind turbines are often located in elevated exposed locations to optimise exposure to the wind resource, and their size and appearance mean that all wind turbine development will be prominent within the landscape. Careful consideration of positioning and layout of a wind turbine can greatly influence its appearance and any potential effects on landscape character and visual amenity. Since wind turbines cannot be hidden (without compromising their exposure to the wind resource), careful site selection as well as choice of wind turbine type and layout is the most effective way of minimising landscape and visual impacts. The layout and design of wind turbines should be informed by landscape and visual impact assessment.

Landscape and Visual Impact Assessments (LVIAs) should be prepared by the developer and submitted with the planning application (forming part of the EIAR) in order to help to identify the effects of new developments on views and on the landscape itself. These effects can be quite different. Some developments can have visual effects but none on landscape character and some vice versa. A depth of analysis and understanding of these two interrelated aspects is required to produce a successful LVIA. Details of the tools required for landscape and visual impact assessment of wind energy development proposals is provided in Appendix 3.

6.3 BROAD LANDSCAPE DESIGN PARAMETERS

The first part of this section deals with the general principle of landscape siting and design of wind energy development. It comprises a series of line diagrams that are conceptually illustrative of typical problems and solutions as viewed from a fixed idealised location. These diagrams are presented under the following headings:

- Siting
- Spatial extent and scale
- Cumulative effect
- Spacing of turbines (regular, irregular, graduated)
- Layout of turbines (single line, staggered line, clustered, grid)
- Height of turbines (tall, medium, short)

The second part of this section considers how these principles can be best applied within different types of landscapes. Guidance is also given in relation to associated development, including substation compounds, access tracks and fencing.

While many issues in relation to wind energy development can be assessed in quantitative terms, aesthetic considerations are more subjective and qualitative. They represent, nevertheless, some of the most critical issues in relation to wind energy development, and can be discussed with reasonable objectivity.

Considering wind energy development in respect of the following concepts can be helpful in the creative and critical analysis of aesthetic issues in relation to wind energy developments, and can help in achieving reasonable objectivity on the subject:

- Conventional visual aesthetic, such as compositional balance and harmony, rhythm, positive tension, aesthetic order and clarity, and including perception of wind energy developments as sculptural elements in the landscape.
- Positive association, where, for example, a wind energy development relates thematically to modern structures in terms of form, function and/or operation, perhaps even affirming an identity in a given landscape.
- Symbolism, whereby a wind energy development represents or is a public sign for technological efficiency, progress, environmental cleanliness and utility.

These concepts provide the conceptual basis necessary for practical guidance on the relationship of wind energy developments to typical landscapes and landscape characteristics and can be applied to key landscape siting and design issues.

6.4 SITING OF WIND ENERGY DEVELOPMENTS

6.4.1 Location

The elevation and position of a wind energy development in the context of the character and feature of the landscape. Issues to be addressed include:

- Consideration of lower ground, where feasible, may be necessary in sensitive landscapes, but otherwise location on ridges and hilltops may be visually acceptable;
- Consideration of prominent landcover and structures, or features to which a wind energy development can provide a visual counterbalance;
- Management of visual exposure from viewing locations in respect of the sectional profile, striving in so far as is practicable; to achieve full turbine exposure from sensitive key

viewpoints, as the perception of complete turbines is more aesthetically pleasing than stunted turbines;

- Taking advantage of the possibility of a relationship between a wind energy development and, say, an urban settlement; and
- Avoiding the creation of visual confusion and spatial dominance where landscapes are already cluttered, but take advantage of a moderate amount of visual absorption that might be provided by existing structures and/or infrastructure.

6.4.2 Topographic Profile

A wind energy development should be located so as to optimise the aesthetic qualities of the surrounding landscape and those of the wind energy development itself. It should, therefore, respond to topographic profile, achieving visual balance and accentuation of landform.

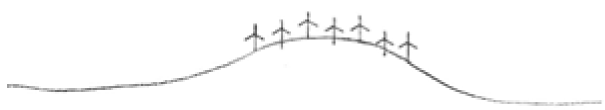
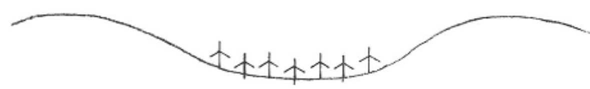
	

Fig 1: *Wind energy development located on a peak.*	Fig 2: *Wind energy development located in saddle between peaks- framing and, thus, accentuation achieved.*

6.4.3 Sectional Profile

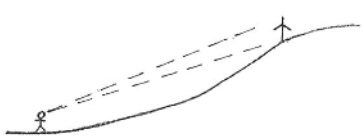


Fig 3: *Wind energy development located above a concave slope, providing full visual exposure.*	Fig 4: *Wind energy development located above and behind convex slope, partially screening turbines from view.*	Fig 5: *Wind energy development partially screened behind crest where screening visually stunts towers.*

6.4.4 Composite Relationships

Large entities contiguous to a wind energy development may or may not result in visual balance. In diagram below, a forest stands in profile, creating a visual counterbalance to the wind energy development. This assumes the typical practice of replanting commercial plantations after harvesting.

Fig 6: *Wind energy development in visual harmony with forest.*

Large entities such as power lines and towers, agricultural buildings, houses and roads may create a context that visually absorbs a wind energy development, especially in farmland (visual absorption capacity), though in more sensitive upland situations this could result in visual confusion. However, visual complexity as well as image and/or thematic association with industrial structures, for example, can help to assimilate a wind energy development where it becomes just one more element in the landscape.

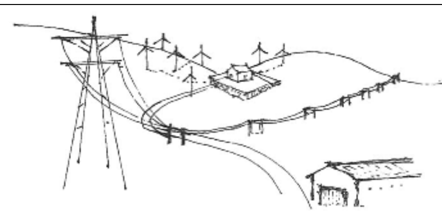


Fig 7: *Wind energy development located in a landscape of complex visual composition resulting in visual confusion.*

Where the wind energy development is relatively close and above a small urban node, it should respect the scale of its setting and avoid spatial dominance.

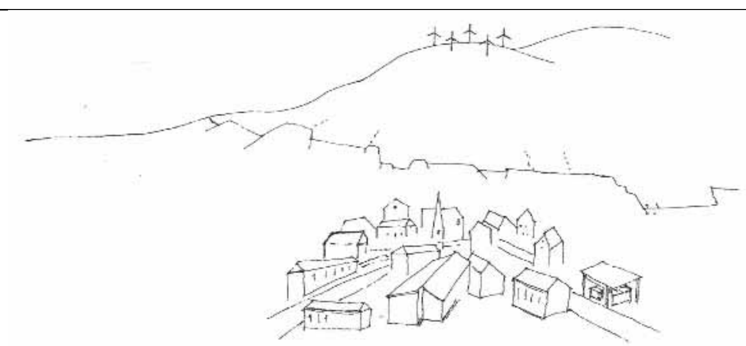


Fig 8: *Wind energy development located contiguous to an urban centre.*

6.5 SPATIAL EXTENT AND SCALE

Spatial extent is the area covered by a wind energy development, reflecting the number of turbines involved and their spacing.

The spatial extent of a wind energy development should be balanced and in scale with its landscape context. This involves consideration of the perceived size (extent and height) of landform, landcover and structures relative to the wind energy development.

Many turbines viewed at close proximity in a spatially enclosed area, such as hilly mountain moorland or farmland area will be large while a few turbines on open moorland will be regarded as small.[38]

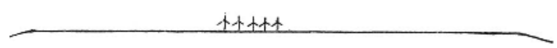
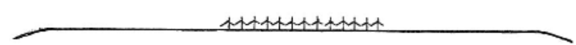
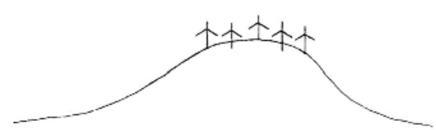
	

Fig 9: *Wind energy development is too limited in spatial extent relative to the scale of its panoramic setting.*	Fig 10: *Spatial extent of wind energy development is more appropriate regarding the scale of its panoramic setting.*

	
Fig 11: *Wind energy development is too spatially extensive relative to the scale of the hill.*	Fig 12: *Spatial extent of wind energy development is more appropriate relative to the scale of the hill.*

6.6 CUMULATIVE EFFECT

Cumulative effect is the perceived effect on the landscape of two or more wind energy developments visible from any one place.

[38] The term 'size' is deliberately avoided here as it is usually used within the industry to indicate the capacity of turbines to generate electricity (measured in megawatts).

- A landscape of complex landform and landcover provides a greater possibility of screening for more than one wind energy development.
- Similarity in the siting and design approach is preferred where a number of wind energy developments are located in the same landscape character area, particularly within the same viewshed. However, an alternative approach where a particular aesthetic effect is sought may be acceptable.
- Different wind energy developments can appear as a single collective unit if located near each other.
- It is preferable to avoid locating turbines where they can be seen one behind another, when viewed from highly sensitive key viewpoints (for example, viewing points along walking or scenic routes, or from designated views or prospects), as this results in visual stacking and, thus, confusion. This may not be critical, however, where the wind energy development to the rear is in the distant background.

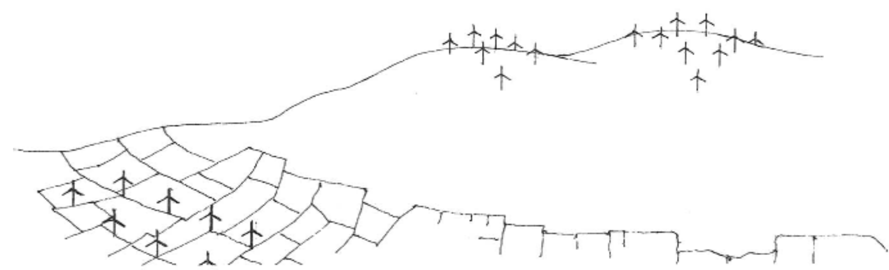


Fig 13: *Wind energy developments dissimilar in terms of spatial extent, spacing and layout in different landscape types but within the same viewshed.*

Wind energy developments within relatively close proximity to one another, while in different landscape character contexts, may be so close as to be within the same visual unit and, therefore, should involve the same siting and design approach.

6.7 SPACING

Spacing concerns the position of turbines relative to one another and the gaps between turbines.

- Regular spacing is more appropriate for wind energy developments in landscapes of clear and orderly landcover pattern or unenclosed flat landscapes.

- Irregular spacing is more appropriate in landscapes of varied landcover pattern or hilly and/or rugged landscapes.
- Graduated spacing of turbines is acceptable for wind energy developments where accentuation of a landscape feature or the creation of a sense of climax is sought.
- Generally, spacing should be of a uniform type in any given wind energy development, rather than a mixture.
- Some flexibility in spacing should be integral to a planning permission to allow for necessary on-site fine-tune adjustment of turbine placing due to such considerations as geological support for foundation or archaeological remains, etc. (see paragraph 7.5 and 7.6).

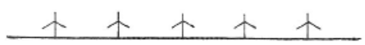
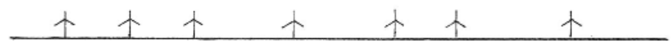
	

Fig 14*: Wind energy development with regular spacing of turbines– a simple and obvious rhythm.*	Fig 15: *Wind energy development with irregular spacing of turbines – no obvious rhythm, i.e. non-repetitive.*

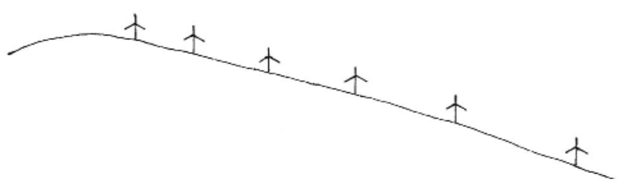


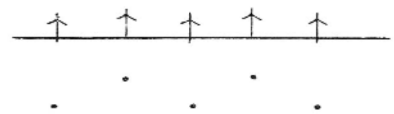
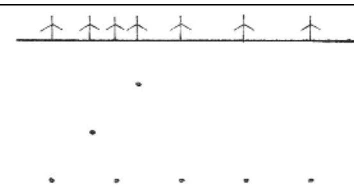
Fig 16: *Wind energy development with graduated spacing on a hillside- attractive in terms of accentuation of ascent and sense of climax.*

6.8 LAYOUT

Layout concerns the position of turbines, providing the overall form or configuration of the wind energy development and its perceived density or complexity.

- Generally, layout should be of a uniform type, whether a single line, staggered line, splayed line, random or grid, rather than a mixture;
- The creation of a "visual stacking" effect from a sensitive viewpoint should be avoided;
- A circular / oval cluster or linear layout would be appropriate on hilltops;

- A linear or staggered linear layout would be appropriate close to a road or other such linear features; and
- A random or grid layout would be appropriate on a vast open landscape.

		
Fig 17: *Plan and view of single line layout.*	Fig 18: *Plan and view of staggered line layout.*	Fig 19: *Plan and view of splayed linear layout.*

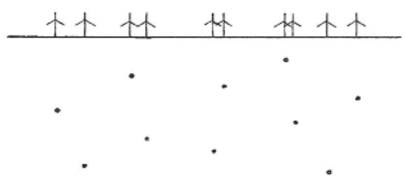
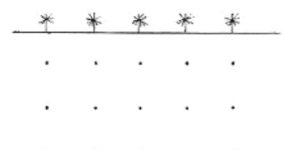
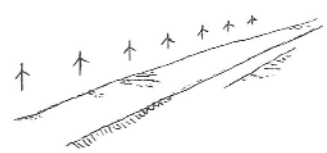
	

Fig 20: *Plan and view of random layout.*	Fig 21: *Plan and view of grid layout.*

	
Fig 22: *View of linear layout on a peak.*	Fig 23: *View of linear layout in response to a road, shoreline or cliff.*

6.9 HEIGHT

Height relates to the full extent of turbines, comprising tower, nacelle and maximum blade length in an upright position. Height involves both the actual height and/or perceived height relative to topography. It includes the profile of the wind energy development as a whole, whether even or uneven. Different possibilities are acceptable, depending on context.

- Turbine height is critical in landscapes of relatively small scale, or comprising features and structures such as houses, and must be carefully considered so as to achieve visual balance and not to visually dominate.
- A wind energy development comprising two distinct turbine heights may be acceptable provided the resulting composition is carefully considered, so as to achieve an aesthetic effect. This situation may result from the combination of an old and a new wind energy development or where certain turbines would be critically visible from a sensitive viewpoint. Other than the height difference, the wind energy developments in the same viewshed should relate with regard to their main design features and colour.
- Where possible, the perception from more sensitive viewpoints, of turbine blade sets cutting the horizon should be avoided.
- A skewed profile where one or more turbines are perceived to run at an angle relative to the horizon is acceptable in landscapes which are not of high sensitivity or where some aesthetic effect can be demonstrated.

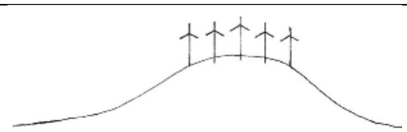
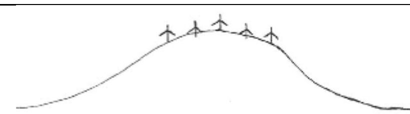
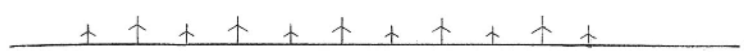
	

Fig 24: *Turbines are too high relative to the scale of the hill – this results in spatial dominance.*	**Fig 25:** *Turbines are too short (squat) relative to the scale of the hill - this results in visual irritation.*

	
Fig 26: *Height of turbines is appropriate.*	**Fig 27:** *Wind energy development comprising turbines of two distinct heights used to aesthetic effect - careful spacing and simplicity of layout achieve a successful solution. Alternative sequences and rhythms may also be appropriate.*

6.10 LANDSCAPE CHARACTER TYPES AS A BASIS FOR GUIDELINES

Landscape character types (LCT's) provide a useful basis for practical application of siting and design guidelines in relation to wind energy development and can be incorporated into the planled approach discussed in Chapter 3.

Six landscape character types have been selected to represent most situations where wind energy development is concerned:

- Mountain moorland
- Hilly and flat farmland
- Flat peatland
- Transitional marginal land
- Urban / industrial
- Coast

It is, however, common that a wind energy development is located in one landscape character type but is visible from another, for example, where the site comprises an unenclosed moorland ridge standing above a broad flat farmland. In such an instance, the entire visual unit should be taken into consideration. It will be necessary to decide whether the moorland ridge or the farmland might more strongly influence the approach.

The guidance on the siting and design possibilities in each of the landscape character types is proactively indicative of how wind energy developments best fit different landscapes and is necessarily independent of the issue of sensitivity, that is, of whether wind energy developments are appropriate in a given location. Thus, one might ably demonstrate how a proposed wind energy development could fit aesthetically into the landscape while recognising its inappropriateness due, for instance, to a critical heritage designation.

It should also be emphasised that actual realisation of preferred solutions as depicted in these guidelines is not always feasible due to the variations of a particular landscape type and the different viewing possibilities for each.

6.10.1 Mountain and Moorland

Key characteristics of this landscape are:

- Peaked, ridged or rolling mountains and upland with steep sides or gently formed valleys;

- Generally unenclosed;
- Landcover comprising blanket bog, a mottling of heather, wild grasses and some rush in wet flushes; and
- A landscape type of relative remoteness and often comprising pristine, unspoilt and remote landscapes.

Given exposure and smoothness of terrain, these landscapes are often sought for wind energy development. The exposure of mountains and the preference for wind energy developments to be located at high elevations result in high visibility.

Mountain moorland may be inappropriate for wind energy development for reasons of natural heritage and the fact that some of these landscapes are of rare scenic quality and/or support some of the last wilderness areas of relatively pristine, unspoilt and remote landscapes.

However, many examples of these landscapes should be open for consideration subject to appropriate design and landscape siting to minimise adverse impact and optimise aesthetic effect.

Siting and design guidance for mountain moorland

Location

It may be acceptable to locate wind energy developments on ridges and peaks. They may also be appropriate, in certain instances, in a saddle between two peaks where they will be partially contained or “framed”. A third acceptable location is lower down on sweeping mountainsides.

Spatial extent

Given the typical extensive areas of continuous unenclosed ground, larger wind energy developments can generally be accommodated because they correspond in terms of scale. However the spatial extent of a wind energy development would need to be reduced where a suggestion of smaller scale is provided by nearby landscape features.

1(a) Large wind energy development with random layout, irregular spacing and high turbines- this siting and design option is appropriate given the scale of this landscape.

1(b) Wind energy development with many turbines of medium height – this can be inappropriate. The spatial extent of a wind energy development can be reduced by using taller turbines. This may be a preferable solution in some situations.

1(c) Wind energy development with relatively few and tall turbines.

Spacing

All spacing options are usually acceptable. Where a wind energy development is clearly visible on a crest or ridge there is considerable scope to vary the rhythm, though on simple ridges, regular spacing may be more appropriate. On sweeping and continuously even areas of mountain moorland or upland plateaux regular spacing may be most desirable.

Layout

All layout options are usually acceptable. However, the best solutions would either be a random layout, and clustered where located on hills and ridges (fig 1(a)), or a grid layout on sweeping and continuously even areas of moorland or plateaux (fig 1(b)). Where a wind energy development is close to a linear element, such as a river, road or long escarpment, a corresponding linear layout or staggered line might be most desirable.

1(d) A wind energy development with a grid layout with tall turbines – the rhythmic grid layout is appropriate to the open expanse of moorland, especially when it relates to the geometric blocks of conifers.

Height

There would generally be no height restrictions on mountain moorlands as the scale of landscape is so great. However, shorter turbines may be more appropriate where they are located on small peaks and outcrops in order to maintain an appropriate scale. Profile, whether even or uneven, is dependent on topography: the more rugged and undulating (e.g., knolls and crags) the more uneven it will be. The profile of the wind energy development should not necessarily run in parallel to that of the topography.

1(e) Cumulative effect involving two wind energy developments – this situation would possibly be acceptable due to the similar siting and design approach adopted for each wind energy development

Cumulative effect

The open expanse of such landscapes can absorb a number of wind energy developments, depending on their proximity. The cumulative impact will also depend on the actual visual complexity of landform, whether steeply rolling, undulating or gently sweeping. The more varied and undulating an area is topographically, the greater its ability to absorb and screen wind energy developments. The aesthetic effect of wind energy developments in these landscapes is acceptable where each one is discrete, standing in relative isolation.

6.10.2 Hilly and Flat Farmland

Key characteristics of this landscape are:

- Intensively managed farmland, whether flat, undulating or hilly;
- A patchwork of fields delineated by hedgerows varying in size;
- Farmsteads and houses are scattered throughout, as well as occasional villages and towns;
- Roads, and telegraph and power lines and poles are significant components; and
- A working and inhabited landscape type.

The essential key here is one of rational order and simplicity, as well as respect for scale and human activities. The predominance of field pattern introduces an organised patchwork landcover structure that not only prompts a similar response in the siting and design of wind energy developments, but also provides a spatial structure and rhythm. Although hilly and flat farmland type is usually not highly sensitive in terms of scenery, due regard must be given to houses, farmsteads and centres of population.

Siting and design guidance for hilly and flat farmland

Location

Location on ridges and plateaux is preferred, not only to maximise exposure, but also to ensure a reasonable distance from dwellings. Sufficient distance should be maintained from farmsteads, houses and centres of population in order to ensure that wind energy developments do not visually dominate them. Elevated locations are also more likely to achieve optimum aesthetic effect. Turbines perceived as being in close proximity to, or overlapping other landscape elements, such as buildings, roads and power or telegraph poles and lines may result in visual clutter and confusion. While in practice this can be tolerated, in highly sensitive landscapes every attempt should be made to avoid it.

Spatial extent

This can be expected to be quite limited in response to the scale of fields and such topographic features as hills and knolls. Sufficient distance from buildings, most likely to be critical at lower elevations, must be established in order to avoid dominance by the wind energy development.

2(a) Wind energy development of large spatial extent – this example is inappropriate given the scale of this landscape.

2(b) Wind energy development of small spatial extent – this example is appropriate given the scale of this landscape.

2(c) Wind energy development with random layout - this response is inappropriate given the patchwork field pattern of this landscape.

2(d) Wind energy development with grid layout - this response involving any form of linear layout and regular spacing is appropriate given the patchwork field pattern of this landscape.

2(e) Small wind energy development with regular linear layout - the rhythmic order is more appropriate to this landscape due to the order created by the field pattern.

Spacing

The optimum spacing pattern is likely to be regular, responding to the underlying pattern field pattern. The fields comprising the site might provide the structure for spacing of turbines. However, this may not always be the case and a balance will have to be struck between adequate spacing to achieve operability and a correspondence to field pattern.

Layout

The optimum layout is linear, and staggered linear on ridges (which are elongated) and hilltops (which are peaked), but a clustered layout would also be appropriate on a hilltop. Where a wind energy development is functionally possible on a flat landscape a grid layout would be aesthetically acceptable.

Height

Turbines should relate in terms of scale to landscape elements and will therefore tend not to be tall. However, an exception to this would be where they are on a high ridge or hilltop of relatively large scale. The more undulating the topography the greater the acceptability of an uneven profile, provided it does not result in significant visual confusion and conflict.

2(f) Small wind energy development located close to modern farm buildings - a thematic association is established involving modern materials and construction. Careful consideration needs to be given to tall turbines in this landscape given the potential proximity of houses.

Cumulative effect

It is important that wind energy development is never perceived to visually dominate. However, given that these landscapes comprise hedgerows and often hills, and that views across the landscape will likely be intermittent and partially obscured, visibility of two or more wind energy developments is usually acceptable.

2(g) Cumulative effect caused by two wind energy developments - although similar in siting and design, the open and full exposure of both developments might be excessive given the fact that it involves an inhabited landscape.

6.10.3 Flat Peatland

Key characteristics of this landscape are:

- Landscapes of this type comprise a vast planar extent of peatland and have significant potential for future wind energy development;

- In their relatively undisturbed and naturalistic state the wet bogs comprise a landcover mostly of heather, wild grasses and bog cotton, as well as patches of coniferous plantation;
- Some of these bogs have been harvested for peat and may comprise long parallel ridges of stacked milled peat and deep drains;
- Evidence of human habitation is sparse;
- Roads tend to run in straight lines over considerable distances, followed by electricity and/or telephone lines; and
- This landscape type is horizontal, open, extensive and also characterised by a sense of remoteness.

The preferred approach here is one of large-scale response. The vast visual openness with few, if any, dominant geometric elements provides a certain freedom in the siting and design of wind energy developments.

Siting and design guidance for flat peatland

Location

Wind energy developments can be placed almost anywhere in these landscapes from an aesthetic point of view. They are probably best located away from roadsides allowing a reasonable sense of separation. However, the possibility of driving through a wind energy development closely straddling a road could prove an exciting experience.

3(a) Random layout - the random spacing is not entirely appropriate to the simplicity of this landscape.

3(b) Staggered linear layout - the rhythmic spacing and layout as well as even profile of turbines create a composition appropriate to the simplicity of this landscape and corresponding to the peat harvesting ridges.

3(c) Grid layout - the rhythmic and regular layout create a composition appropriate to the simplicity of this landscape.

Spatial extent

The vast scale of this landscape type allows for a correspondingly large spatial extent for wind energy developments.

Spacing

Regular spacing is generally preferred, especially in areas of mechanically harvested peat ridges.

Layout

In open expanses, a wind energy development layout with depth, preferably comprising a grid, is more appropriate than a simple linear layout. However, where a wind energy development is located close to feature such as a river, road or escarpment, a linear or staggered linear layout would also be appropriate.

Height

Aesthetically, tall turbines would be most appropriate. In any case, in terms of viability they are likely to be necessary given the relatively low wind speeds available. An even profile would be preferred.

Cumulative effect

The openness of vista across these landscapes will result in a clear visibility of other wind energy developments in the area. Given that the wind energy developments are likely to be extensive and high, it is important that they are not perceived to crowd and dominate the flat landscape. More than one wind energy development might be acceptable in the distant background provided it was only faintly visible under normal atmospheric conditions.

Further details in relation to Best Practice for Wind Energy Development in Peatlands are outlined in Appendix 4.

3(d) Cumulative effect of two wind energy developments - this is acceptable where the wind energy developments are limited in spatial extent and are located at great distance apart.

6.10.4 Transitional Marginal Landscapes

Key characteristics of this landscape are:

- Comprises something of both mountain moorland and farmland, thus involving a mix of small fields, tight hedgerows and shelterbelts;
- May include relatively rugged and rocky terrain, and thus a reasonable degree of spatial enclosure;
- Higher ground tends to be wet and boggy. Lower areas are usually cultivated and managed as fields;
- Houses and farmsteads are usually fairly common; and
- This landscape type bridges the organised and intensively managed farmland and the more naturalistic moorland;

The essential key here is one of respect for scale and human activities. These landscapes are often relatively small-scale due to spatial enclosure provided by hills and wind energy developments should respond sensitively to this intimacy. These landscapes are also visually complex due to diverse landform and landcover, as well as houses and power and telegraph poles and lines. Wind energy developments should avoid adding to such complexity due to the risk of creating visual confusion and conflict.

Siting and design guidance for transitional marginal landscapes

Location

As wind energy developments, for reasons of commercial viability, will typically be located on ridges and peaks, a clear visual separation will be achieved from the complexity of lower ground. However, wind energy developments might also be located at lower levels in extensive areas of this landscape type, where they will be perceived against a relatively complex backdrop. In these situations it is important to minimise visual confusion such as the crossing by blade sets of skylines, buildings, utility lines and varied landcover.

Spatial extent

Wind energy developments in these landscapes should be relatively small in terms of spatial extent. It is important that they do not dominate but achieve a balance with their surrounds, especially considering that small fields and houses are prevalent.

4(a) Wind energy development with regular spacing and linear layout - may not be appropriate due to the undulation of land form as well as limited field pattern.

4(b) Wind energy development with irregular spacing and random layout - is more appropriate given the relative undulation of the setting.

4(c) Large wind energy development straddling two landscape character types within the same visual unit - this creates a visual ambivalence and, thus, negative tension between the two character types involved.

Spacing

All options are possible, depending on the actual landscape characteristics. However, irregular spacing is likely to be most appropriate, given the complexity of landform and land cover typical of these landscapes, and the absence of extensive swaths of fields of regular and rectilinear pattern.

Layout

The likely location of wind energy developments on ridges suggests a linear or staggered linear layout whereas on broader hilltops they could be linear or clustered. Grid layouts are less likely to succeed aesthetically unless there is an open continuity of similar landcover.

Height

In small-scaled enclosed areas, short turbines are preferred in order to avoid their spatial dominance and to ensure visual balance. However where the upper ground is relatively open and visually extensive, taller turbines may be more appropriate. In terms of perceived height, the profile can be even or uneven, depending on the profile and visual complexity of the terrain involved. The more rugged and undulating, the greater the acceptability of an uneven profile provided it does not result in significant visual confusion and conflict.

Cumulative effect

This would have to be evaluated on a case-by-case basis, but great caution should be exercised. The spatial enclosure often found in transitional marginal landscapes is likely to preclude the possibility of seeing another wind energy development. However, should two or more wind energy developments be visible within a confined setting a critically adverse effect might result, depending on turbine height and wind energy development extent and proximity.

6.10.5 Urban and Industrial

Key characteristics of this landscape are:

- a predominance of urban complexity, industrial buildings, infrastructure or a combination of these; and
- that it is intensively altered and dominated by structures.

The essential key here is one of rational order and simplicity. Wind energy developments can thematically complement the contemporary technology expression of these landscapes and visually relate to their functional nature.

Siting and design guidance for urban and industrial areas

Location

A wind energy development can be placed sufficiently close to the structures concerned in order to establish a visual relationship but sufficiently distant to ensure a certain autonomy. The wind energy development should appear as a distinct and discrete entity.

Spatial extent

This should be determined by the spatial extent and height of the existing structures making up the urban and/or industrial context. Generally, therefore, it is likely to be relatively limited.

5(a) Large wind energy development with random layout contiguous to town that can be inappropriate - although an association is achieved between the wind energy development and urban structures as well as infrastructural elements; the wind energy development spatially dominates the hill and town.

5(b) Small wind energy development with regular layout contiguous to town. Regarding its spatial extent, this wind energy development is appropriate to the scale of the hill and town and a thematic association is created with the existing telecommunication towers in terms of technological image.

5(c) Wind energy development contiguous to industrial buildings with random layout - visual disharmony is created.

5(d) Wind energy development with staggered linear layout contiguous to industrial buildings – rhythmic spacing is appropriate to the industrial and technological image of the context.

Spacing

Regular spacing will usually provide the greatest possibility of visual integration. A graded spacing, however, could be used to aesthetic effect, depending on how it was composed in relation to the built context.

Layout

In order to achieve simplicity, a single line or staggered line will most likely be the preferred approach. In the case of an extensive urban and/or industrial complex a slightly deeper plan might be acceptable.

Height

Where only a very small wind energy development is involved, tall turbines could create a dramatic contrast with existing structures. Otherwise, turbines should be selected so as not to visually overpower existing structures. An even profile would typically be preferred in order to ensure simplicity and reduce the likelihood of visual confusion, but an uneven profile may be acceptable depending on contextual relationships.

Cumulative effect

In urban areas there is little or no tolerance of more than one wind energy development due to the likely sense of clutter and possible feeling of dominance.

5(e) Wind energy development located in harmonious visual relationship to a town and rural buildings - white turbines relate to the colour of the buildings of the urban centre as well as to the houses and farmsteads scattered across the countryside.

6.10.6 Coastal Zone

Key characteristics of this landscape are:

- Beaches, dunes, rocks, promontories and/or cliffs;
- High rocky crags may have scrub, heather, bracken and gorse as land cover, whereas flatter areas are more likely to comprise farmland;
- Seashores can also include harbours, hamlets, villages and towns and some of these may have developed into seaside holiday resorts; and

- This landscape type involves openness, nature and recreation and thus may be sensitive. Coastal landscapes identified through sensitivity analysis, as being of rare scenic quality may not be appropriate for wind energy development.

The essential key here is one of simplicity and rational order. The juncture of land and sea is extremely attractive to the eye. Its linearity or, perhaps more likely, curvilinearity creates a strong aesthetic contrast with the planar quality of the sea in geometric terms. Both are, nevertheless, essentially simple and elemental. Rather than inhibiting the introduction of a wind energy development, the associations and symbolism of the seashore challenge the wind energy development design to achieve aesthetic excellence. The simplicity of many coastlines prompts a corresponding simplicity regarding the introduction of wind energy developments.

Visual Impacts

Special attention is recommended in areas (such as coastal or island areas) where there is higher potential for the occurrence of adverse visual impacts arising from limited assimilative capacity.

Siting and design guidance for coastal areas

Location

Wind energy developments should be set back from the sea and clearly located on solid ground. They are suited to low beach shorelines as well as rocky promontories.

Spatial extent

This depends on the length of shoreline. In order to achieve simplicity, a wind energy development should not extend beyond one particular kind of shore. Accordingly, it should physically relate to a beach or a rocky promontory but not bridge the two.

Spacing

Regular turbine spacing would be most appropriate in order to achieve a serenity and composure that reflect those of the sea. A promontory could be used to achieve a dramatic aesthetic effect using graded spacing with the gradual tightening occurring seawards.

6(a) Wind energy development with irregular spacing and linear layout on coastal promontory - visual disorder is created by variation in spacing and hub height (wind energy development profile) which is inappropriate to the simplicity of the landscape / seascape context.

6(b) Wind energy development with regular spacing and linear layout on coastal promontory - the simplicity and rhythm created by rhythmic spacing and level profile are appropriate to the simplicity of the landscape / seascape context.

Layout

Wind energy developments should reflect the linearity of the shore by a corresponding linear or staggered linear layout. However, on a headland with a peak or hill, a clustered layout might be used to crown and thus accentuate the feature.

6(c) Wind energy development with the irregularity of spacing is disjointed and creates visual disharmony on this simple curving coastline.

6(d) Wind energy development with simplicity involving regular spacing, a linear layout and level profile is usually preferable.

6(e) Graduated spacing and linear layout on coastal promontory - the increasingly closer spacing of turbines draws emphasis to the tip of the promontory and its connection to the sea.

6(f) Clustered layout on end of promontory - this layout too accentuates and celebrates the end of the promontory and its interface with the sea.

Height

Turbines can generally be tall, especially close to and parallel to beaches. More caution might be necessary in regard to promontories where the scale of the projecting land mass should be considered. The profile should be even in response to the flatness of the sea.

Cumulative effect

Generally along any length of shoreline one wind energy development can be visible in the fore or middle ground. A second one may be acceptable in the far distant background, provided it is only dimly visible under normal atmospheric conditions in order to preserve the spatial, scenic and thematic integrity of the shore. The principle objective is to ensure that multiple wind energy developments are not visible in close proximity from any one seaside location due to their generally sensitive nature.

6.11 LANDSCAPE IMPACT OF WIND ENERGY DEVELOPMENT CONSTRUCTION

The process of construction can result in adverse landscape and visual impact due to, for example, temporary structures and materials on site, alterations to drainage, dust, ground compaction, excavation, road construction, soil erosion and mineral leaching, as well as traffic movement. To help alleviate these impacts, the following practices should be adhered to as closely as possible:

- Site offices, workers' hut and toilets, materials and site compound should ideally be sited so as to minimise visual exposure, bearing in mind operational effectiveness from a construction and site management perspective, and landscape conditions. They should be removed when the wind energy development is constructed;
- Construction traffic and machinery movement should be confined as much as is practicable to the roads and tracks that are part of the long-term development in order to minimise unnecessary compaction;
- Where temporary earth works are required, ground and vegetation should be reinstated as soon as possible;
- The site should be kept tidy and construction rubbish should be neatly contained;
- Cement trucks should not be washed on site where there is a risk of run-off and damage to flora and watercourses;
- The spread of dust on surrounding vegetation should be minimised - where heavy and visible in sensitive landscapes it should be removed by spraying with water after construction is complete;
- The dispensing of fuel and oil tanks should be confined to one bounded location in order to minimise the risk of damage by spillage; and
- Where possible, after construction is completed, vegetation should be reinstated on banks and margins of roads that are constructed to accommodate the passage of construction machinery and trucks. This is especially critical where cut and fill has been required.

6.12 LANDSCAPE IMPACTS OF ASSOCIATED DEVELOPMENT

The elements associated with wind energy developments other than turbines include the roads and tracks, power poles and lines, the control building, the wind measuring mast and the compound. Individually and collectively, these elements should be considered, located and designed to respect the character of surrounding landscape.

6.12.1 Control Building and Substation Compound

- A high standard of design should be applied to all structures associated with the substation, and should not only take account of its function but also of its aesthetic quality, in order to minimise any sense of intrusion.

- The development should incorporate colour harmony and adequate screening of the control building and substation compound. Should the surrounding landscape include trees and/or shrubs, such material can be used for screening. In sensitive landscapes, consideration should be given to screening the control buildings and compound by earth berms as well as re-sodding with local vegetation in order to mitigate their visual impact.

- The control building, where practicable, should be located in a dip or a hollow but away from ecologically sensitive areas or features. In the case of coastal locations it should not be located on promontories, unless comprising a special design appropriate to the setting.

- Control buildings should be designed to respect the character of buildings typically found in the surrounding landscape.

- Urban/industrial contexts could also accommodate building design, which corresponds more specifically to the contiguous building(s).

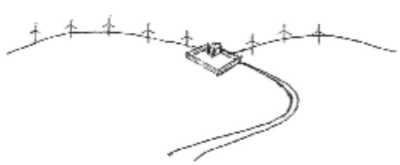
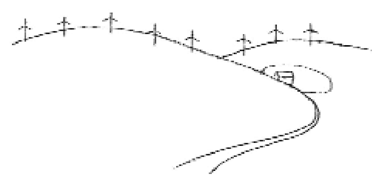
	

Fig 28*: Visually exposed control building and angular compound draw attention to the wind energy development while creating visual disharmony.*	Fig 29: *Screened/partially screened control building and rounded shape of compound is more sympathetic to the landscape.*

6.12.2 Fencing

- Fencing should be limited to the substation compound area.
- Chain link is preferred over palisade fencing as it is more transparent.
- Fencing should not encompass the entire wind energy development, as this would unnecessarily compromise access to the countryside as well as the sense of simplicity intrinsic to the aesthetic quality of turbines. Extensive areas of fenced ground would also limit grazing which could result in variations in the colour of vegetation.

- Temporary fencing (e.g., electric fencing) may be required to keep grazing animals off bare soils while vegetation cover re-establishes or scraghs root in.
- Consideration should be given on Mountain Moorland hilltops to creating a curvilinear shape for the compound as defined by fencing, as the more conventional rectilinear shape may jar with the openness and sense of the open natural setting.

6.12.3 Connection to Electricity Providers

- Power line connections between turbines and from turbines to the control building and from the compound to the national grid should be underground, except where specific ground conditions would prevent this.
- Power lines should be interred alongside turbine access roads in order to minimise spatial extent of soil/hydrological and vegetation damage/ disturbance.

6.12.4 Roads/Tracks

The impact of access routes on landscape can be minimised by sensitive routing and design.

- The number and extent of roads/tracks serving the site should be kept to a minimum. Access routes should utilise existing roads where possible.
- Access roads/tracks should relate to key characteristics of landscape, e.g., the roads should not follow a straight line up a Mountain Moorland slope directly to the wind energy development, but rather a diagonal line following the contours. Sensitive areas such as archaeological sites should be avoided as far as possible while important features such as streams should be properly bridged or culverted.
- The colour of road material should be such as to minimise contrast with the surrounding landcover. Crushed stone sourced locally is preferable.
- Access tracks should be properly landscaped immediately following completion of works and damage to existing hedgerows from transporting the turbines should be made good.
- Cut and fill required for road construction should be roughly balanced in order to minimise the need for soil removal from the site. Surfaces resulting from cut and fill should consist of material that is conducive to the successful re- establishment of local vegetation.
- Disturbed soil, whether cut banks or deposited soil, should be re-seeded or re-sodded to match surrounding conditions in sensitive landscapes. Re-sodding is essential on upland and lowland peatlands, and all other upland sites, as re- seeding is likely to be

unsuccessful and exposed peat is liable to erode. Non-development site vegetation should not be introduced on semi-natural sites such as peatlands.

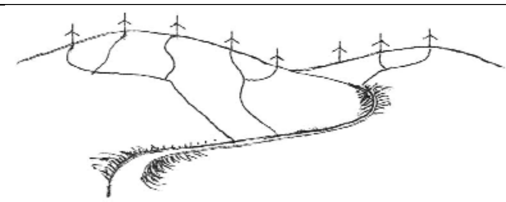


Fig 30: *Unnecessary tracks create visual confusion in Mountain Moorland. Deep cutting and high banks of fill for roads have a scarring effect on mountainsides, and act as drainage channels thus resulting in hydrological impacts on adjacent areas/habitats and possibly initiating erosion due to concentrating water flows.*

6.13 TURBINE COLOUR

The colour and surface finish of wind turbines influences the visual impact of a wind energy development. In most Irish landscapes, white, off-white or light grey are generally the most appropriate colours, but other natural colouring may be acceptable depending on the circumstances. For example, two-tone colouring, with a natural colour at the base of the turbine surmounted by white, off-white or light grey, can be effective.

Turbines should as far as possible appear as a positive element within a landscape. Consequently, dark grey or metallic colours can appear negative or relate to industrial elements, whereas white is expressive of an image of cleanliness and efficiency associated with wind energy. Matt non-reflective finishes should be used on all turbine components.

6.14 TURBINE MAINTENANCE

Regular maintenance of turbines is important in the context of the general visual amenity of the wind energy development. In this regard:

- Rotors should be kept rotating and counter rotation of blade sets should be avoided. Any malfunctioning turbines should be repaired or removed, together with ancillary structures or any other scrap material, ideally within a maximum six- month period.
- Nacelles and towers should be kept clear of leakage from internal fluids.

6.15 TURBINE TRANSFORMERS

Given that they are relatively small and their visual impact is localized, turbine transformers can be located either within the tower, partially underground or adjacent to the tower. Where exposed in more sensitive locations, screening can be provided using earth mounding and/or vegetation, as appropriate to the surrounds. Where visually exposed, transformers can be painted to suit the backdrop. Decisions regarding the location of transformers should be informed by health and safety criteria.

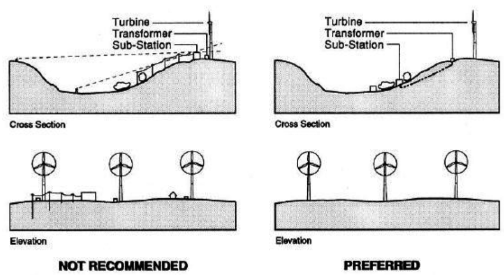


Fig 31: *Visibility of turbine transformers and sub-stations.*

6.16 LANDSCAPE IMPACT OF WIND ENERGY DEVELOPMENT OPERATION AND DECOMMISSIONING

The operability of turbines should be carefully monitored electronically so as to minimise the duration of a static non- functioning blade set, as otherwise visual disharmony could result.

Decommissioning should involve the removal of all of the above- ground elements of the wind energy development and making good of the site, with the possible exception of roads and tracks where some further use can be found for them and this is approved by the planning authority. Foundation pads can be covered with local soil and left for natural re-vegetation, although they should be re-sodded in highly exposed locations.

6.17 ESTIMATION OF THE LIKELY DEGREE OF IMPACT ON LANDSCAPE

Estimation of impact upon landscape is reached using both quantitative and qualitative factors. It comprises the following four parts:

- Landscape sensitivity (ranging from very low sensitivity to very high sensitivity) – relates to the acceptability of change to the landscape. The assessment is based on common sense, observation and professional knowledge.
- Visual presence of the wind energy development (ranging from minimal presence to highly dominant) – relates to how visually dominant the wind energy development is on the landscape, but is not synonymous with or indicative of adverse impact. This criteria can be assessed by examining photomontages of the proposed wind energy development, taking into account such factors as viewing distance, screening, the spatial structure of the landscape and visual absorption capacity.
- Aesthetic impact of the wind energy development on its landscape context (ranging from major positive impact to major adverse impact) - relates to the aesthetic relationship of the wind energy development to its context. Does the proposed wind energy development fit in well with the character of the landscape as recommended in these Guidelines, achieving an overall positive aesthetic relationship with its context?
- Significance of the impact (ranging from insignificant to major) – a statement used to summarise the overall impact of the wind energy development and determined by the previously assessed landscape sensitivity, visual presence and aesthetic impact. This factor is not applied where the aesthetic impact has been deemed to be positive.

TABLE 1: MATRIX SUMMARISING LANDSCAPE CHARACTER BASED RECOMMENDATIONS

	Location	Spatial Extent	Cumulative Effect	Spacing	Layout	Height
Mountain Moorland	Ridge and saddles are generally acceptable.	Tend towards large, depending on scale of actual context.	Acceptable, depending on topography as well as siting and design of wind energy developments involved.	Any spacing may be acceptable, but regular spacing may be best on a simple ridge or on broad sweeping areas.	Any layout may be acceptable, but random or clustered may be best on ridges and hilltops, respectively, and grid on broad sweeping areas.	Any height.
Hills and Flat Farmland	Anywhere.	Generally limited to small wind energy developments.	Acceptable depending on appropriate siting and design.	Regular.	Linear and staggered linear layout on ridges and clustered on hilltops.	Medium typically preferred but tall may be acceptable.
Flat Peatland	Anywhere.	Large.	A second wind energy development may be acceptable only at a very great distance with minimal visual presence.	Regular.	Generally a layout with depth, i.e. a grid, unless following a linear feature, where a linear or staggered linear layout may be acceptable.	Tall.
Transitional Marginal Land	Ridges and hilltops are preferred.	Generally small relative to scale of context and do not bridge two different land covers, e.g. moorland and field areas.	Generally not acceptable unless the visual presence of the second wind energy development is negligible.	All options possibly acceptable.	Linear or staggered linear layout on ridges and clustered on hilltops.	Generally medium and short. A varied profile is acceptable in undulating landscape.
Urban/ Industrial	Close to but distinct from contiguous structures.	Tend towards small – relate in scale to height and spatial extent of contiguous structures.	Minimal tolerance.	Regular spacing is preferred. Graded spacing may be acceptable where composed relative to existing structures.	Linear or staggered linear is preferred. A grid may be acceptable contiguous to larger structures.	Short enough so as not to over-power existing buildings. A few tall turbines may be successful relative to the scale of existing buildings.
Coastal Type	Set back from water.	Do not cross over between beaches and rocky promontories.	A second wind energy development may be acceptable only at a very great distance with minimal visual presence.	Regular is most appropriate. Graded spacing may be acceptable on promontories.	Linear, especially along beaches. A cluster may be acceptable on promontories.	Tall may be acceptable, especially along beaches. Profile should be even.

6.18 SITTING IN RELATION TO INDIVIDUAL PROPERTIES ('SETABACK')

In the public consultation exercises leading up to the publication of this revised document, the issue of increased mandatory setback distances was cited by many respondents as being important. On the other hand, many in the energy sector highlighted that mandatory setback distances determine (and thereby reduce) the scope to develop terrestrial wind energy projects necessary to meet existing and binding EU and global commitments as regards renewable energy generation.

In broad terms, Ireland must double the level of output from the wind energy sector to meet its targets, which can be achieved, on-land through a combination of both upgrading existing wind energy development sites with newer more efficient turbines and developing new projects.

Development of additional renewable sources such as solar photo-voltaic, off-shore wind and wave energy capacity in the future may be necessary to meet emerging international commitments on climate change in a post 2030 scenario as part of the broader international push to decarbonise at a strategic level. Therefore, Ireland needs to maximise every resource at its disposal at present to transition to a low and ultimately carbon-free society towards the middle of this century.

Because of historical development in Ireland and rural settlement patterns in particular, introducing of large non-noise related mandatory setbacks for wind energy developments would effectively rule out very large swathes of the country for such developments or would push such development into environmentally sensitive upland and wilderness areas that can be otherwise inappropriate for development.

On the other hand, a reasonable degree of separation or setback between wind turbines and surrounding developments and communities, while not normally necessary as a noise mitigation measure due to technological advancements in noise abatement and the development of quieter turbines(see Chapter 5 for details of noise considerations) , setbacks can nevertheless be an effective tool in blending such developments into the pre-existing contexts, given their increasing visual scale particularly during the past decade.

6.18.1 Appropriate Setback Distance to apply

The potential for visual disturbance can be considered as dependent on the scale of the proposed turbine and the associated distance. Thus a setback which is the function of size of the turbine should be key to setting the appropriate setback. Taking account of the various factors outlined above, a setback distance for visual amenity purposes of 4 times the tip height should apply between a wind turbine and the nearest point of the curtilage of any residential property in the vicinity of the proposed development, subject to a mandatory minimum setback of 500 metres.

This setback requirement is also subject to the need to comply with the strict noise limits laid down in Chapter 5 of these Guidelines, the enforcement of which will serve to ensure that wind energy projects operate in accordance with the highest international and World Health Organisation advice in order to protect the amenity of the communities in which they are situated.

It is a specific planning policy requirement of these Guidelines under Section 28(1C) of the Planning and Development Act 2000, as amended, that, in both their development planning and management functions, planning authorities shall not apply a setback distance that ***exceeds*** these requirements.

SPPR 2

With the exception of applications where reduced setback requirements have been agreed with relevant owner(s) as outlined at 6.18.2 below, planning authorities and An Bord Pleanála (where relevant), shall, in undertaking their development planning and development management functions, ensure that a setback distance for visual amenity purposes of 4 times the tip height of the relevant wind turbine shall apply between each wind turbine and the nearest point of the curtilage of any residential property in the vicinity of the proposed development, subject to a mandatory minimum setback of 500 metres from that residential property. Some discretion applies to planning authorities when agreeing separation distances for small scale wind energy developments generating energy primarily for onsite usage.

The planning authority or An Bord Pleanála (where relevant), shall not apply a setback distance that exceeds these requirements for visual amenity purposes.

[39]

6.18.2 Exceptions to the mandatory minimum setbacks

[39] The curtilage of a domestic dwelling house for the purposes of these draft guidelines is defined as the land immediately surrounding a dwelling house which is used for purposes incidental to the enjoyment of the dwelling house as such and excludes for example any open fields beyond the immediate surrounds of the dwelling. In the case of buildings associated with other noise sensitive properties the curtilage would be the area in the immediate surrounds of the relevant buildings.

An exception may be provided for a lower setback requirement from existing or permitted dwellings or other sensitive properties to new turbines where the owner(s) and occupier(s) of the relevant property or properties are agreeable to same but the noise requirements of these Guidelines must be capable of being complied with in all cases. In such exceptional reduced setback situations, the relevant parties must provide written confirmation to the satisfaction of the planning authority that they have agreed to a reduced setback and have no objection to the proposed wind energy development.

It is also important to note that determining setback distance is but one component requiring consideration in determining the appropriateness of a particular project to a given area that must also take account of wider considerations outlined elsewhere in the Guidelines and the contents of this Chapter.

CHAPTER 7 PLANNING CONDITIONS

7.1 INTRODUCTION

The preparation of an adequately researched and sufficiently detailed planning application should reduce the need for an extensive list of planning conditions and any further time required for processing consequent compliance submissions. The importance of pre-application discussions between the applicant and the planning authority in advance of lodging an application cannot be overemphasised (see Chapters 3 and 4).

Some planning authorities have devised standard conditions and reasons for use in relation to different types of applications. This practice is useful in the interests of consistency. The following criteria should apply to all planning conditions, namely, is the condition:

- Necessary?
- Relevant to the development to be permitted?
- Precise?
- Reasonable?
- Enforceable?

In addition to establishing the suitability of planning conditions, it is important to ensure that the reason for attaching each condition is clear and unambiguous and that the developer fully understands what is required. The particular circumstances of each proposed development will need to be carefully considered in drafting conditions and deciding which conditions are necessary and appropriate.

Matters that may be appropriately dealt with by the inclusion of conditions on a planning permission for wind energy development are detailed below. The list and accompanying explanation is included for guidance only and is not exhaustive:

- Siting, design, and layout
- Community Engagement
- Community Dividends/ Benefits
- Flexibility in turbines location
- Flora, fauna and habitats
- Archaeology
- Noise, including construction noise
- Environmental impact: Mitigation/ Compensatory measures
- Environmental monitoring
- Construction phase

- Borrow pits and quarrying
- Roads and access routes
- Ancillary structures and equipment
- Connection to electricity distributors
- Site management issues
- Shadow flicker
- Electromagnetic interference
- Aeronautical safety
- Windtake
- Development contributions
- Wind measuring masts
- Decommissioning and reinstatement
- Time limits

7.2 SITING, DESIGN AND LAYOUT

Conditions which result in changes to siting, spatial extent layout, spacing, height, profile and colour of turbines need to be approached with care particularly where the wind energy application has been the subject of detailed pre planning discussion and an agreed design solution for a particular landscape proposed. The need for such conditions may arise through input from prescribed bodies or third party representations. The need to “modify” a layout will need to be balanced against the impact that that condition may have on the design of a particular wind energy project or the implications that the revised sitting may have for other planning considerations.

7.3 COMMUNITY ENGAGEMENT

A condition should be attached to all planning permissions for wind energy developments requiring developers to adhere to the submitted community report which sets out how the development will comply with the Code of Practice for Wind Energy Development in Ireland Guidelines for Community Engagement issued by the Department of Communications, Climate Action and Environment (December 2016).

7.4 COMMUNITY DIVIDEND/BENEFITS

The planning authority or An Bord Pleanála shall impose condition(s) to ensure that any community investment/benefit/dividend proposed in the Community Report submitted to accompany the planning application is secured.

7.5 FLEXIBILITY IN TURBINE LOCATION

As the precise location of turbines may need to be modified in the course of development due to matters such as the wind regime, ground conditions, or heritage concerns, etc., it may be helpful as referred to in paragraph 6.7 in the design of a layout and in framing conditions to allow for a degree of flexibility in the final siting of turbines. Where this flexibility is agreed upon details of final specification should be submitted to and agreed in writing with the planning authority prior to commencement of development.

7.6 ARCHAEOLOGY

Conditions on wind energy developments within close proximity to recorded monuments and sites may include the following:

- Funding by the applicant of archaeological assessment, geophysical survey, archaeological testing, archaeological excavation and/or monitoring within the area covered by the permission;
- Preservation of all or part of the archaeological remains (in situ or by record) in the area covered by the permission;
- Relocation of the position of turbine(s) in order to minimise the impact on the archaeological heritage and/or create buffer zones;
- Temporary fencing-off of archaeological monuments during construction, repairing and decommissioning in order to protect and preserve the monuments; and
- Other appropriate archaeological mitigation measures that may be deemed necessary.

7.7 NOISE, INCLUDING CONSTRUCTION NOISE

Conditions relating to the control and management of noise emissions from wind turbines are attached to planning permissions for wind energy development so as to protect the amenity of noise sensitive locations. Appropriate conditions in this context are set out in broad terms in Technical Appendix 2.

7.8 ENVIRONMENTAL IMPACT: MITIGATION/COMPENSATORY MEASURES

Mitigation/compensatory measures specified or stipulated in the EIAR are designed to prevent or limit the environmental impacts of the development. They are measures that must be implemented and this should be reflected in the phraseology of the EIAR. If there is room for doubt over whether the EIAR makes the mitigation/ compensatory measure obligatory or not, this should be clarified or reinforced by a planning condition, or clarification should be sought at an earlier stage by the planning authority. A condition in relation to monitoring the implementation of mitigation measures specified in the EIAR should also be considered.

7.9 ENVIRONMENTAL MONITORING

Effective monitoring is necessary to provide evidence of compliance with planning conditions addressing issues such as noise limits or biodiversity considerations.

On the other hand, broader environmental monitoring conditions should be avoided, apart from where specific requirements in relation to environmental matters are part of the planning permission.

It is recommended that planning applications shall specify who the appropriate contact person would be (including hours of contact) to deal with any complaints or issues that might arise during both the construction and operation stages of a wind energy development. Further details on Monitoring and Appropriate Noise Control Post Construction will be contained in Technical Appendix 2.

An agreed monitoring/management programme, funded by the developer, can provide reassurance for both the planning authority and any concerned third parties that these conditions are being observed in the day-to-day operation of the wind energy development, and that in the event of a breach, appropriate remedial action will be taken. Such a programme would be particularly relevant in the initial operating period of the development, within the first 2 years, possibly with provision for further monitoring if the problem persists. The environmental monitoring can be carried out either by agreed independent specialists, or by the planning authority at the developer's expense.

7.10 CONSTRUCTION PHASE

It may be necessary in particular circumstances to attach conditions with regard to the following matters arising during the construction stage of the wind energy project:

- Hours of construction;
- Monitoring and supervision of construction phase by qualified and experienced geo-technical engineer(s) and/or by qualified and experienced ecologist(s), where deemed necessary;
- Construction traffic movements, including vehicle types and routes in relation to removal of excavated material, and importation of materials, turbine parts and equipment,
- Ground disturbance during construction;
- Management and treatment of rock and soil excavated during construction work;
- Storage and transfer of material, including use of bunded storage areas for use during construction and operational phases to avoid any pollution of surface or ground waters;
- Impacts on surface and groundwater drainage;
- Reinstatement of the site where construction works result in ground disturbance/surface damage or erosion; and
- Removal of ancillary construction equipment including site offices, portakabins and portable toilets.

7.11 BORROW PITS AND QUARRYING

Conditions may be required in relation to the excavation of rock and soil, and the development and location of borrow pits associated with wind energy development proposals. Conditions may also address the issues of avoidance and remediation of land slippage, where appropriate. Where land slippage occurs the local authority should be notified and all works suspended until the matter is rectified.

7.12 ROADS AND ACCESS TRACKS

Conditions may be necessary in relation to design, width, surface materials, construction details, silt traps, associated earthworks (such as cutting or embankments), and routing of tracks within the site, not only to minimise visibility, but also with regard to erosion and minimising impact on habitat.

7.13 ANCILLARY STRUCTURES AND EQUIPMENT

Ideally, matters regarding associated structures and equipment should be considered at pre-planning application stage as part of an overall design solution for the site and subsequently included in the planning application. Where that does not happen, conditions may need to address siting, design and finishes of ancillary structures including sub-stations, transformers and service buildings. In general, conditions requiring the location of transformers within turbines or outside the tower base should be informed by the landscape evaluation and the health and safety criteria. Fencing should be kept to a minimum but may be necessary in relation to storage of materials and security. Where fencing is required, conditions may be necessary to address issues regarding routing, rights of way and finish.

7.14 CONNECTION TO ELECTRICITY DISTRIBUTORS

A condition should be attached to all planning permissions which involve a wind energy development which requires EIA or AA, but does not include the grid connection as part of the application, to ensure that no works shall commence on the wind energy development until a separate planning permission for the grid connection has been obtained.

A condition should also be attached to all planning permissions for the grid connection, which should specify the nature of the connection (i.e. underground/ over ground/ a combination of the two) as outlined in the planning application submission.

7.15 SITE MANAGEMENT ISSUES

Appropriate conditions in relation to site management issues may address the operation and maintenance of equipment and turbines, repair/replacement/ removal of non-operational turbines and overall good site maintenance and management procedures.

7.16 SHADOW FLICKER

A condition should be attached to all planning permissions for wind energy development to ensure that there will be no shadow flicker at any existing nearby dwelling or other relevant existing affected sensitive property and that the necessary measures outlined in the shadow flicker assessment submitted with the application, such as turbine shut down during the associated time periods, should be taken by the wind energy developer or operator to eliminate the shadow flicker.

7.17 ELECTROMAGNETIC INTERFERENCE

Conditions regarding measures to be taken to minimise interference with the transmission of radio and television signals, air and sea transport communications and other transmissions systems in the area may be necessary. Where electromagnetic interference is difficult to predict, conditions may require the developer to consult with the service provider concerned and undertake remedial works to rectify any interference caused.

7.18 AERONAUTICAL SAFETY

Conditions regarding lighting of structures, submission of coordinates of the turbines positions, as constructed, and/or other appropriate conditions should be included, where advised by the Irish Aviation Authority or other relevant bodies.

7.19 WINDTAKE

Conditions with regard to windtake could be included to ensure that wind turbines are located in a manner that respects the development potential of an adjoining site for a similar development. Where such conditions apply they should generally allow a distance from adjoining site boundaries of not less than two rotor blades having regard to the wind resource at the site, save with the written agreement of the adjoining landowner(s). This issue is more appropriately addressed before an application is made (see paragraph 4.9.6).

7.20 DEVELOPMENT CONTRIBUTIONS

General contributions: In general, any condition requiring the payment of a development contribution that a planning authority may attach to a permission for wind energy development should be clear from the Development Contribution Scheme, or Supplementary Development Contribution Scheme, drawn up under section 48 or 49 of the 2000 Act. No appeal may be brought in relation to a condition requiring a contribution to be paid in accordance with a development contribution scheme except on the basis that the terms of the scheme were not properly applied or, in the case of a supplementary development contribution scheme, on the basis that the applicant considers the public infrastructure service or project the subject of the supplementary scheme will not benefit the development. It should be noted that where a Development Contribution Scheme makes no provision for payment of contributions in respect of wind energy development, or in respect of a class or description of development which includes wind energy development the planning authority may consider it appropriate to require payment of a special contribution as outlined.

Special contributions: The additional traffic - particularly in terms of heavy goods vehicles generated during the construction phase of a wind energy development - may necessitate additional expenditure by the planning authority on the surrounding road network or local infrastructure.

Where such specific exceptional costs not covered by the general contribution scheme are incurred by the local authority in respect of public infrastructure and facilities that benefit the proposed development, a condition requiring the payment of a special development contribution may be imposed under Section 48 (2)(c) of the Planning and Development Act, 2000 (as amended). In such a case, the planning condition should specify the particular works carried out, or proposed to be carried out, by the local authority to which the special contribution relates (Section 48). Unlike contributions levied under a general scheme, an appeal may be brought in relation to a condition requiring payment of a special contribution.

7.21 DECOMMISSIONING AND REINSTATEMENT

A condition may be attached to secure a Decommissioning and Restoration Plan (DRP), following on from the outline document submitted with the application. Given the time lag between construction and decommissioning of a wind energy development, the DRP should be sufficiently flexible and the scope for review mechanisms must be built in to require the plan to be re-assessed at least every 10 years throughout the lifetime of the development, and more frequently should the need arise. This is to ensure that site conditions, maintenance requirements and unexpected events do not compromise the objectives of the DRP. For example, unexpected impacts may arise during/following construction that affects the initial objectives of the DRP. Consultation with the statutory bodies should be considered at these review stages, as appropriate.

Conditions requiring the lodgement of financial bonds have been used in the past to ensure that decommissioning will take place in a responsible manner. However, the use of long-term bonds to secure satisfactory reinstatement of the site upon cessation of the project puts an unreasonable burden on developers given the long time span involved in wind energy developments and is also difficult to enforce. The recycling value of the turbine components, particularly copper and steel, should more than adequately cover the financial costs of the decommissioning. Accordingly, the use of a long-term bond is not recommended.

7.22 TIME LIMITS

Having regard to the statutory provisions regarding the life of a planning permission, conditions should not require that a development be commenced or finished by a certain date.

Conditions that limit the life of a wind energy development to a particular time period have been included in the past in order to enable the planning authority to reassess the operation or re-equipping of the wind energy development in the light of circumstances prevailing at the time. The discretion on the particular time limit for an individual application will rest with the planning authority, taking into account the specific technology being used. However, current technology would suggest that a time limit of approximately 30 years is reasonable. The condition should also require the equipment to be removed where it is no longer required or operational.

Where the renewal of an existing wind energy development is sought, this will require a further planning application to be submitted.

In the case of repowering, where the developer seeks to amend the scale, nature and location of the turbines, a new planning application will also be required.

Planning authorities may grant permission for a duration longer than 5 years to implement the permission if it is considered appropriate, for example, to ensure that the permission does not expire before a grid connection is granted. It is, however, the responsibility of the applicants in the first instance to request such longer durations in appropriate circumstances.

CHAPTER 8 ENVIRONMENTAL ASSESSMENT OF THE GUIDELINES

As part of the preparation of the Guidelines a number of environment assessments have been carried out including a Strategic Environmental Assessment (SEA), an Appropriate Assessment (AA) and also a screening exercise in relation to the potential requirement for a Strategic Flood Risk Appraisal (SFRA).

8.1 STRATEGIC ENVIRONMENTAL ASSESSMENT

Strategic Environmental Assessment (SEA) is being undertaken alongside the preparation of the Guidelines.

SEA is the formal, systematic evaluation of the likely significant environmental effects of implementing a plan or programme before a decision is made to adopt it. The requirement for SEA is provided under the EU SEA Directive (Directive 2001/42/EC).

The findings of the SEA are contained in the Environmental Report that is available to view alongside the Guidelines. The emerging conclusion of the SEA is that:

- The Guidelines will help to facilitate the development of wind energy capacity that will contribute towards meeting renewable energy generation and greenhouse gas emission targets set in binding EU requirements; while

- Ensuring environmental protection and management, including with respect to the issues of biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationship between the above factors.

In addition to facilitating the integration of environmental considerations into the Guidelines, the SEA provides a monitoring programme that will be implemented by the Department and is detailed in the Environmental Report.

Cumulatively contributing towards regulatory framework

The SEA identifies the need for implementation of the Guidelines to comply with all environmental legislation and align with and cumulatively contribute towards – in combination with other users and bodies and their plans etc. – the achievement of the objectives of the regulatory framework for environmental protection and management. It is the intention that the Guidelines are implemented in this manner.

8.2 APPROPRIATE ASSESSMENT

Stage 2 Appropriate Assessment (AA) is being undertaken alongside the preparation of the Guidelines.

AA is a focused and detailed impact assessment of the implications of a strategic action or project, alone and in combination with other strategic actions and projects, on the integrity of an ecologically designated European Site in view of its conservation objectives. The requirement for AA is provided under the EU Habitats Directive (Directive 1992/43/EEC) and the European Communities (Birds and Natural Habitats) Regulations 2011.

The findings of the AA are contained in the Natura Impact Report that is available to view alongside the Guidelines. The emerging conclusion of the AA is that the Guidelines will not adversely affect the integrity of ecologically designated European Sites (collectively referred to as the Natura 2000 network). Notwithstanding this, development plan and project level assessment will be required which will need to address the more detailed considerations necessary to ensure that the integrity of the designated sites will not be adversely affected except as provided for by Article 6(3) and Article 6(4). [40]

8.3 STRATEGIC FLOOD RISK ASSESSMENT

A screening exercise for the need to undertake a Strategic Flood Risk Assessment (SFRA) has found that SFRA is not required to be undertaken on the Guidelines. The findings of this exercise are provided in the Flood Risk Statement that accompanies the Guidelines.

The measures contained within the Guidelines have been considered from a flood risk perspective and it has been identified that many of the measures will contribute towards avoiding any increases in flood risk. Lower tiers of decision making will be required to comply with *The Planning System and Flood Risk Management Guidelines* (2009, DEHLG/OPW) (including any clarifying Circulars or superseding versions of same) and relevant outputs of the Catchment and Flood Risk Assessment and Management Studies. This includes the undertaking of strategic

[40] Except as provided for in Article 6(4) of the Habitats Directive, viz. There must be:
(a) no alternative solution available,
(b) imperative reasons of overriding public interest for the plan to proceed; and
(c) adequate compensatory measures in place.

Flood Risk Assessments for development plans and site-specific Flood Risk Assessments for individual developments.

APPENDIX 1 LANDSCAPE SENSITIVITY ANALYSIS METHODOLOGY

A number of different studies can be undertaken to classify a county's landscape according to sensitivity to wind energy development. These may involve to varying degrees the public, the local planning authority and/or the landscape consultants. An outline of a stepwise procedure that can be used is provided below:

Desk Reviews – Carry out a literature review of the most pertinent documents relating to landscape sensitivity, including the current County Development Plan (CDP). This review should include reference to the National Landscape Strategy for Ireland 2015-2025, a National Landscape Character Assessment or National Landscape Map that may be prepared and any existing Landscape Sensitivity Analysis or Landscape Character Assessment for the county and/or adjacent counties.

Consultation with Planning Staff – Carry out an exercise to map landscape quality with the aid of landscape consultants, if considered appropriate.

Provide planning staff with large-scale maps of the county to map the following, using their own experience and impressions:

a) those scenic routes which are currently designated in the CDP but which might have deteriorated over time such that they no longer warrant designation;
b) roads currently not designated in the CDP as scenic routes but which are perceived to be of such high quality that they might warrant designation;
c) areas of landscape that are of such high quality that they could not accommodate wind energy developments; and
d) areas of landscape that could accommodate wind energy development.

Initial Field Work – Planning staff and/or landscape consultants spend time in the field examining the landscapes and identifying those locations that are deemed to be of very high quality. Areas of high quality will tend to agree with those highlighted in the mapping exercise carried out above.

Public Consultation – At least one open focus group meeting (perhaps 2 or more in larger counties) should be held in order to consult with local communities and other interested parties regarding the development of a wind energy strategy for the county. These events should be well advertised and all statutory consultees should be formally invited. Following introductory presentations by the planning staff and/or consultants, the focus group attendees can participate in a series of hard-copy mapping exercises with the aim of identifying:

a) landscapes of exceptionally high quality;
b) ordinary (non-remarkable) landscapes;
c) (locations where wind energy development would be unacceptable (to the consultees); and
d) locations where wind energy developments could be acceptable.

Such mapping exercises are a very effective medium for classifying landscape sensitivity according to different values held by the attendees. Despite the wide ranging views held by different individuals and groups (ranging from very pro-development to highly conservative), common ground will often be found when the maps are collectively reviewed. The focus group classification of landscape sensitivity to wind energy development will often closely agree with the findings from the consultation with the planning authority, as well as with the conclusions drawn from the initial field work by the planning staff and/or landscape consultants.

Preparation of Draft Sensitivity Map – All the marked-up maps prepared by the focus groups are examined in detail and a broad classification of sensitivity can be developed using GIS. As an example, areas which are identified as being exclusion zones by both the planning authority and the focus groups and which were assessed as being of high quality might be classified as being high in sensitivity. Conversely, areas where little concern was expressed regarding wind energy developments, and where the consultants felt that quality was unremarkable, could be classified as being moderate, or in some cases low, sensitivity. The sensitivity classification could include areas that are:

a) acceptable in principle;
b) open to consideration; or
c) not acceptable.

Further Field Work and GIS Studies – Following the public consultation, further field studies should be carried out to test the emerging draft landscape sensitivity map. The most challenging aspect of this is to define the boundaries of different zones (e.g., between an exclusion zone and an acceptable zone). Given that the focus of the study is primarily landscape, computer-based studies known as zones of theoretical visibility (ZTV) can be effectively employed to identify such boundaries. It is also critically important to consult with adjacent planning authorities to see how classifications in one county fit with that of their neighbour(s).

In cases where, for example, a no-go area flanks a preferred area along a political boundary such as a ridgeline or river, some discussion may be required between both parties to produce a classification that is logical and balanced. An “ordinary” landscape in one county might be a “special” landscape in a neighbouring county and the concerns of the latter may require the former to use a buffer zone of, say, open for consideration, to provide some level of protection.

APPENDIX 2 ADVICE FOR DEVELOPERS ON COMMUNITY ENGAGEMENT

Providing the public with a good flow of information about a proposed wind energy development in their locality prior to formal application can avoid conflict in the future. A developer is required to undertake community engagement and prepare a community report for wind energy development. The advice below is intended to assist with the identification of the appropriate geographical area and stakeholders who should be invited to engage with the pre-application discussions, and suggestions with regard to the methods of communication which might be used. When the final consultation area has been selected and a list of stakeholders has been identified, this information must be provided within the community report submitted to the planning authority alongside the planning application.

Identifying the appropriate geographical area for engagement:

A fair and transparent process should be employed to identify the appropriate groups to consult, and individual groups must not be cherry-picked. Note that this is not a checklist to be applied to every development, nor is it an exhaustive list. The number and nature of the factors selected will be dependent on the local context. The local authority may also be able to assist with identifying the likely geographical area and stakeholders to be considered.

- The developer should circulate information pertaining to the proposal to the immediate population whose properties are within approx. 1km of the proposed wind energy development, and to community groups, churches and clubs etc. within approx. 10km radius. However, please note that proximity to site (perimeter/boundary) may be dependent on scale of project and whilst concentric circles may give a starting point for identifying an area of benefit, larger developments (installed MW) should generally have a larger circle. Also, relying on a concentric circle only may pose challenges for example when this divides administrative boundaries, fails to take topography or the characteristics of the development into account, hence the other factors listed below should also be taken into account.
- Geography and topography.
- Characteristics of development: Size, scale, siting and visibility of development.
- Construction/Decommissioning: The communities which will be affected in either short-term or long-term by the construction and decommissioning of the development.

- Demographics – population density/spread: Be sensitive to any significant populations which may have been overlooked, and for example in more rural areas the consultation may more appropriately be spread over a wider area to include a larger population and the locations of key services or facilities used by those within the wider area.
- Other relevant stakeholder areas: The catchment area of any local schools; travel to work areas.
- Consider any available local authority policy/guidance on community benefit.
- Proposed and existing community benefit fund arrangements in the area (renewable energy community benefit or otherwise).

Developers are encouraged to communicate and work together where possible and appropriate, and to be aware of other nearby renewable energy developments. Working collaboratively is likely to optimise opportunity and impact for the community and achieve high credibility by developers, while reducing the burden on community volunteers. Developers should also recognise that some groups may require support to fully contribute to discussions while some well-resourced communities may have established networks which can be utilised. There may be existing action plans or similar which can be supported and community issues might have already been identified through other means such as those identified through consultation with local authority and community members.

Identifying stakeholders

Once the developer has considered an appropriate geographical boundary for consultation, links should be explored and where possible developed with individuals and groups as listed below:

- Local residents
- Local businesses and business groups such as Chambers of Commerce
- Land managers
- Community associations such as community or town councils
- Local politicians
- Social groups, for example youth groups, sports groups or organisations representing the retired or elderly
- Other existing community groups
- Local environmental bodies
- Other key service providers, e.g. schools, colleges, healthcare facilities, residential facilities, care providers, community transport services, credit unions etc.

These stakeholders should be invited to propose any other spatial or interest groups which they feel should be included in the process at this stage. Once appropriate contacts have been identified, these stakeholders should then be invited to form a contact group or 'community liaison group' to take forward further discussions, or any other appropriate method of working together can be employed, for example community open days or events. The key stakeholders identified at this stage should be invited to have the opportunity to influence decision making on any future fund administration and distribution on behalf of the local community following a process of receiving a mandate to do so, rather than being invited to engage as a beneficiary of the fund.

Methods of consultation

All consultation should be conducted in an open and transparent manner. Encouraging and facilitating ongoing dialogue should be the focus of the process, alongside ongoing provision of information about different aspects of community benefit. Developers need to be clear at the outset about what elements of the community benefit package can be shaped by the consultation and what cannot. There are a range of engagement methods which developers are expected to draw on and tailor to specific developments and communities. The following non-exhaustive lists suggest some starting points for designing the consultation process.

Possible methods of providing information:

- Letter notification;
- Press releases;
- Community newsletters/ websites;
- Formal consultation documentation;
- Public meetings/community drop-in session;
- Use of social media and internet and creation of a project website with key information on progress and links to planning documentation;
- House visits;
- Information road show/street stalls/mobile exhibitions;
- Via community stakeholders such as community council representatives or other locally elected representatives;
- Presence at local community event;
- Stakeholder forum/workshop;
- Telephone hotline.

A formal letter should be sent to the immediate neighbours and key stakeholders to:

- Introduce the wind energy development promoters and details of the proposed development.
- Indicate the necessity of wind energy development in a context of national and international policy.
- Identify the scope of the pre-consultation (who else is being contacted).
- Invite the recipient to further public exhibitions, outlining date, times and location of the exhibitions.

Project information leaflet should:

- Detail location (small map), and scale of the proposed development.
- Detail an anticipated project timetable (including public exhibitions).
- Outline the environmental and social benefits that the development will affect both locally and globally, including any planning gain for the local community.
- Identify a contact name and contact details for the promoters of the development for further information.

Posters and Advertising

Where a recipient has access to community groups or clubs (e.g., in churches, community halls, sports facilities, etc.) it is a good idea to use posters advertising and inviting attendance to the public exhibitions.

Response form

A pre-paid response form for the recipient to complete may be included with the information letter to identify:

- If the recipient would like to receive further information about the proposal;
- If the recipient can identify other people not targeted by the promotion information; and
- If the recipient does not wish to receive further related information.

The engagement process should continue after views have been gathered from the community; developers should provide feedback on how and why points were or were not accepted and this should be outlined clearly in the Community Report submitted with the planning application.

Ongoing Engagement

Ongoing consultation with the community during the construction, operational and decommissioning phases of the development is also required. The Community Report must set out how the developer intends to keep the community informed. Usually this will involve a dedicated contact person (Community Liaison Officer) with contact details advertised on the project leaflet and/or website who will regularly meet the community liaison group and provide updates on progress, as well as being a contact point for complaints or queries. Any planned disruption or traffic restrictions in the local area associated with particular phases of the construction or decommissioning of the project should be highlighted to the local community in advance. The developer should also prepare an annual report which outlines the various methods which were used to keep the local community updated, any issues which arose and how these were dealt with. The annual report should be published on the project website or otherwise made available to the local community and local authority.

APPENDIX 3 LANDSCAPE AND VISUAL IMPACT ASSESSMENT OF WIND ENERGY DEVELOPMENT PROPOSAL

Structure of a landscape impact assessment report

Landscape impact assessment forms an integral part of the Environmental Impact Assessment of wind energy proposals. In line with recommendations made in the Environmental Protection Agency Guidelines on environmental impact assessment, the landscape impact assessment reports for wind energy development should include the following stages:

1. Description of proposed development, including alternatives considered during the design process;
2. Description of geographic location and landscape context;
3. Definition of study area, informed by identifying the Zone of Theoretical Influence;
4. General landscape description of the Study Area;
5. Selection of viewshed reference points from where the proposal is examined in detail;
6. Assess the sensitivity of landscape from each viewshed reference point;
7. Preparation of photomontages;
8. Estimation of the likely degree of impact on landscape;
9. Recommendation of mitigation measures. Stages 3, 5, 7 and 8 are considered in detail below.

With the support of the UK Institute of Environmental Management and Assessment (IEMA), the Landscape Institute published the 3rd edition of Guidelines for Landscape and Visual Impact Assessment (GLVIA3) in April 2013. This publication offers detailed guidance on the process of assessing the landscape and visual effects of developments and their significance.

Definition of study area and Zone of Theoretical Visibility

Zone of Theoretical Visibility (previously referred to as Zone of Visual Influence) is a computer-aided procedure, which aims to predict from where the turbines might be visible. The following recommendations are made in relation to the preparation of Zone of Theoretical Visibility maps:

- For blade tips up to 100m in height, a Zone of Theoretical Visibility radius of 15km would be adequate (this is greater than the current standard by some 50% but reflects the technical difficulty of depicting "small and medium" turbines at 20km)

- For blade tips in excess of 100m, a Zone of Theoretical Visibility radius of 20km would be adequate (this is twice conventional thresholds and reflects greater visibility of higher structures).
- In areas where landscapes of national or international renown are located within 25 km of a proposed wind energy development, the Zone of Theoretical Visibility should be extended as far (and in the direction of) that landscape. This reflects the fact that highly sensitive landscapes deserve extra special treatment by developers and planners.
- It is recommended that the Zone of Theoretical Visibility should assess the degree of visibility based on the numbers of turbines visible to half the blade length in addition to hub-height. It is not sufficient to only use the hub height in the preparation of the Zone of Theoretical Visibility maps because this would exclude potential visibility of the entire blade. Likewise, using blade tip height is not necessarily appropriate because this would identify all locations that can see literally the tip of the blade and nothing else.
- It is important to overlay the Zone of Theoretical Visibility map on the 1:50,000 series Ordnance Survey maps and print preferably at a scale of 1:50,000 or at another scale ensuring that locations theoretically exposed to viewing can be easily identified. The print quality and scale of the map(s) should be such that the underlying information such as place names and roads are clearly legible.
- Colour coding of the Zone of Theoretical Visibility map according to the number of turbines visible at any one location should be capable of being easily understood by viewers of the map. It is essential to provide a clear legend.
- The resolution of the Digital Terrain Model used to prepare the Zone of Theoretical Visibility map should be a maximum of 50 by 50 metres to ensure high resolution.
- The cumulative effects of a number of different wind energy developments should be clearly represented using Zone of Theoretical Visibility maps.
- In addition to a Zone of Theoretical Visibility being based simply on contour data, screening objects such as forestry, buildings, etc., may be introduced to a Zone of Theoretical Visibility map.

A very useful exercise at the initial design stage of preparing the wind energy development layout is to carry out a “reverse zone of theoretical visibility” (reverse-ZTV) from locations known to be highly sensitive and from where views of turbines should be avoided. All locations theoretically visible from the sensitive viewpoint can be identified and, if any cross over the wind energy development site, they can be eliminated from the workable area. This effectively means that the wind energy development can be designed thereafter knowing that no turbines will be exposed to viewing from the chosen location.

Selection of viewshed reference points/import viewpoints

This stage involves the identification of those locations from where visibility of the proposed wind energy development might be provided. It is helpful to consult with the relevant local authority(s) in identifying and choosing viewshed reference points so that delays owing to omissions can be avoided. The following guidance should be followed in selection of viewshed reference points:

1. They should reflect local designations as might be relevant from the County Development Plan or Local Area Plan, including Views and Prospects and other scenic amenity designations.
2. They should be located at varying distances from the wind energy development and, where relevant, afford views from all directions so that a good sense of what is proposed can be observed. This might include locations outside the jurisdiction of the planning authority to which the proposal is being lodged.
3. They should always present the worst case (most open) available view from any given location.
4. It is advisable to consult with the relevant planning authority(s) in identifying and choosing viewshed reference points so that delays owing to omissions can be avoided.

Preparation of photomontages of the development

Photomontages provide a graphic depiction of the view from each viewshed reference point after introduction of the turbines. The following guidance should be followed in the preparation of photomontages:

1. A camera lens focal length of 50-70mm is recommended for taking photographs for preparation of photomontages.
2. Panoramic photographs included to illustrate the context in which the development might be visible should be prepared by splicing photographs taken with a 50-70mm lens and not by inclusion of views taken with a wide-angle lens.
3. Unless specifically requested to do so by the relevant planning authority or by statutory consultees, the vast majority of photomontages should be prepared from places that do provide views of the proposed wind energy development. The Zone of Theoretical Visibility is prepared to highlight places from where views are not provided and they generally do not need to be considered further thereafter.
4. The landscape depicted in the photomontage should represent the most open view possible in the direction of the wind energy development. Care should be taken so as not to place an object such as vegetation or structures between the wind energy development site and the camera.

5. Turbines that are not visible from the viewshed reference point (resulting from intermittent screening) should not be depicted on the photomontages.
6. Related to the above, the photomontage should be accompanied by a wire frame computer generated perspective view of the landscape, or shaded-relief model, illustrating all theoretically visible turbines. These wire frame diagrams may also be used to indicate turbines that are not visible in whole or in part due to screening, simply to prove that point. Wire frames and photomontages should be at the same scale and presented in unison so that direct comparison/correlation can be made.
7. The recommended distance at which the page depicting the photomontage should be held for viewing purposes should be clearly stated (this should not be less than 30cm).
8. The print quality of the photomontages should be high- low resolution or faded colour photocopies are not acceptable.
9. A reference map should be included for orientation purposes, and the longitude and latitude national grid coordinates provided for each camera position used to take the photographs, along with the coordinates of the target point. This will enable the planning authority to test the accuracy of wire frames using their own contour data.

Estimation of likely degree of impact on landscape

A structure for this critical part of the Landscape Impact Assessment is proposed below, carried out in respect of each key viewpoint.

1. Describe the landscape in general, including landform, landcover, structures and features, spatial flow/interconnection and degree of naturalness or human influence.
2. Assess the visual presence of the wind energy development, for example, how spatially dominant it is. (This does not necessarily correspond to the ultimate landscape impact).
3. Assess the aesthetic impact of the wind energy development on the landscape, referring in particular to Chapter 6 of these Guidelines and determining whether the impact might be adverse or positive.
4. Using the results of the earlier estimate of landscape sensitivity from each key viewpoint along with those of visual presence and aesthetic impact, estimate the significance of the impact on the landscape.

APPENDIX 4 BEST PRACTICE FOR WIND ENERGY DEVELOPMENT IN PEATLANDS

Development of most peatland sites (including upland and lowland bog types, fens and heaths) will generally lead to impacts on natural heritage. Notable exceptions to this would be areas of exploited peatland such as within the extensive milled peat bogs, mainly in Ireland's midlands, and those that have been converted to farmland.

It is recommended that consideration of carbon emissions balance is demonstrated when the development of wind energy developments requires peat extraction.

Where wind energy developments are permitted on peatlands, the implementation of the following construction guidelines (along with others that are recommended in the Environmental Impact Statement) may serve to reduce impacts, including minimising habitat disturbance and loss, hydrological disruption and the risk of erosion:

1. A thorough ground investigation, including hydro- geological investigations where appropriate, and a detailed evaluation of the nature of the peat, its geotechnical properties and the associated risk of instability and habitat loss or disturbance during construction and operation of the wind energy development, is to be carried out where the depth of peat is in excess of 50cm.
2. Avoid construction, if possible, on wet areas, flushes and easily eroded soils.
3. Avoid the excavation of drains, where possible, unless it is necessary for geotechnical or hydrological reasons.
4. If drains are unavoidable, ensure that silt traps are constructed and that there is only diffuse discharge of water; attenuation ponds may be necessary.
5. Avoid blocking existing drains.
6. Where blasting is being used in or near a peatland area for borrow pits, foundations etc., the possible effect on the peat stability should be assessed.
7. Avoid stock grazing on any disturbed peat until local peatland vegetation has recovered (e.g., by use of temporary electric fencing).

Construction of Access Tracks/Roads in Peatland Areas

1. Construct roads to take the required vehicular loadings, having due regard to overall site stability.

2. Operate machinery and vehicles used in road construction from the road as it is constructed.
3. Make the road width the minimum compatible with sound engineering practice.
4. Use hard rock to construct the road batters.
5. Culverts should be placed under roads, where appropriate, to preserve existing surface drainage channels.

Construction of Foundations for Turbine Towers

1. A geotechnical analysis must be carried out for each turbine base into the method of excavation and the location for placing and storing excavated material to ensure that these operations do not give rise to slope or site instability.
2. Each tribune base should be assessed on an individual basis for stability purposes.
3. Lay out and store surface vegetated scraghs/turves, for re- sodding bare areas, off-site and water them in dry weather.
4. If, during excavation, spoil is likely to fall onto the adjacent peatland surface, protect the surface with shuttering boards or geogrid /geotextile.
5. Carefully monitor and control any pumping of water from excavated turbine bases to ensure that water is directed into existing water courses, forestry drains or specially constructed drains, all with adequate capacity to deal with the volumes of water encountered.

Installation of High Voltage Cables

1. Cables should be interred alongside the turbine access routes to minimise the degree of ecological impact on site.
2. All machinery and construction methods on-site should be selected with a view to minimising impact on habitat.
3. Specialised low-ground pressure tracked machinery on bog mats should be used if operating on the peatland surface.
4. Place vegetated peatland scraghs on shuttering or geogrid (or on the road) alongside trenches unless backfilling takes place soon after excavation.
5. Place peat spoil alongside the peatland scraghs on shuttering or geogrid or on the road
6. Carefully backfill the trenches with the peat-spoil.
7. Replace the scraghs/surface turves, vegetated side up, and firm them in with the back of the excavator bucket.

APPENDIX 5 HEALTH AND SAFETY

Construction of Wind-Energy Developments

The design and construction of wind energy developments including the installation of associated equipment such as switchgear, plant rooms etc. is governed by the Safety, Health and Welfare at Work Act 2005 and also by S.I. No. 291 of 2013 the Safety, Health and Welfare at Work (Construction) Regulations 2013. Generally, wind turbines are built in isolated, often mountainous areas, for maximum benefit from the prevailing winds. This often means that in addition to the wind-energy development itself, access roads often need to be built or strengthened before major construction work can begin. The construction work itself will generally involve transport of heavy equipment, heavy cranage and specialised electrical installation and commissioning.

Design Process

Typically, these projects will require the appointment of Project Supervisors for the Design Process (PSDP) and for the Construction Stage (PSCS) under the Safety, Health and Welfare at Work (Construction) Regulations 2013.

The PSDP must be appointed in writing by the Client at the start of the design process. Their responsibilities include: coordinating the designers involved in the project, including any temporary works designs during the construction stage; developing, on a preliminary basis, a safety and health plan for the project taking account of any particular risks; developing a safety file to give to the Client at the end of the project with relevant details on the structure for any future construction design and work. Designers must try and design out risks at source so as to eliminate / reduce risks during the construction stage and during the operation and maintenance of the structure. The design stage should include peat stability risk assessments to identify zones of high risk. This is particularly important when planning and designing floating roads or traffic access routes through the site, ensuring the site remains stable during construction and safeguarding against the risk of bog slides.

Construction Stage

The Safety and Health Plan must be developed by the PSCS to incorporate all risks identified during the design stage, and any further risks identified, and ensure continuity of management of the site taking account of all risks that may arise during the construction stage. The PSCS's responsibilities include: coordinating the work of all contractors on site; ensure co-operation of contractors with regard to health and safety; ensuring only competent trained and authorised people can access site; provision of appropriate welfare facilities. Special care should be taken to ensure that cranes or lifting equipment required during the construction phase complies with the requirements of the Safety, Health and Welfare at Work (General Application Regulations) 2007 (S.I. No. 299 of 2007) as amended. Lifting activities should be planned and organised to ensure a stable platform during lifting operations.

Guidelines on the requirements of the Safety, Health and Welfare at Work (Construction) Regulations can be found at

https://www.hsa.ie/eng/Publications_and_Forms/Publications/Construction/Guidelines_on_Procurement_Const_regs_2013.pdf

Dangerous Occurrence

The Safety, Health and Welfare at Work (General Application) (Amendment) (No. 3) Regulations 2016 (S.I. NO. 370 of 2016) amending S.I. No. 299 of 2007, added certain occurrences involving wind turbines to the instances where the relevant employer or person in charge of the place of work is statutorily required to report details of the occurrence to the Health and Safety Authority within 10 working days of the incident occurring.

Wind Turbines as Machinery

Each wind-turbine, incorporating the tower, blades, gearbox and ancillary equipment in the tower and nacelle are considered to be machines under the European Machinery Directive [2006/42/EC]. The duties on designers and manufacturers of machinery are set out in the Machinery Directive, which has been transposed into national law by the 2008 European Communities (Machinery) Regulations [S.I.No.407/2008].

All wind turbines should be CE marked, which is in effect, a mark of assurance that the wind-turbine complies with the essential health and safety requirements (EHSRs) of EU supply law. In all cases, the manufacturer or the manufacturer's authorised representative must compile information in a technical file confirming how the machine complies with these requirements.

The maintenance of turbines and ancillaries must only be carried out by competent, trained and qualified personnel. The system of work for operation and maintenance must be planned, organised, maintained and revised to ensure safety of personnel.

Working at Height

As maintenance work mainly involves working at height in some cases external to the structure, all personnel operating in the wind energy sector must be able to demonstrate a common level of competency for working at height and rescue within a wind turbine. Adequate means for rescue of workers must be put in place with appropriate training completed.

Wind Turbines in Operation

There is a very remote possibility of injury to people or animals from flying fragments of ice or from a damaged blade. It should be noted that turbines may start without warning and warning signs at access points should highlight this issue. These should advise the public not to stand close below towers, and to take care when nearby and in-line with turbine blades, under icy conditions.

Most blades are composite structures with no bolts or separate components and the danger is minimised as a result. The build-up of ice on turbine blades is unlikely to present problems. Most wind turbines are fitted with anti-vibration sensors, which will detect any imbalance caused by the icing of the blades. The sensors will cause the turbine to wait until the blades are de-iced prior to beginning operation.

TECHNICAL APPENDIX 1 SPECIAL AUDIBLE CHARACTERISTICS OF WIND ENERGY DEVELOPMENT NOISE

1 INTRODUCTION

The Wind Energy Development Guidelines 2019 including two technical appendices, hereafter the Guidelines' have been developed in the context of modern wind turbine design and international best practice.

The Wind Energy Development Guidelines (2006) (the 2006 Guidelines) approach was based on a similar method adopted in the UK using ETSU-R-97. ETSU-R-97 was the first detailed noise assessment planning guidance for wind energy development. It was written prior to the development of multi-MW turbine design. The Institute of Acoustics (IoA) has since published a '*Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise*' (IoA 2013). Subsequently on the 9 August 2019 IoA published guidance on a '*Method for Rating Amplitude Modulation in Wind Turbine Noise'*.

The Guidelines draw from the IoA and other international guidance and adapt the current (at the time of publication) guidance for wind energy developments in Ireland. Wind turbine noise measurements shall generally be made in accordance with the IoA guidance with the additional requirements set out in the Guidelines.

This Technical Appendix includes the measurement of special, audible characteristics and specifies a penalty scheme for calculating the Relative Rated Noise Level ($L_{A\ rated}$).

1.1. WIND TURBINE NOISE

There are two main components to wind turbine noise, mechanical noise and aerodynamic noise, which may or may not be apparent depending on the turbine design, operation and location.

Mechanical noise is currently less of a concern for amenity due to modern designs with additional acoustic enclosure of components to minimise noise emissions. Some manufacturers have eliminated the requirement for a gearbox, which in the past could generate significant tonal noise. Tonal noise may still arise but the dominant source of wind turbine noise is currently aerodynamic noise.

Aerodynamic noise is caused by the airflow patterns generated by the wind turbine components, primarily the turning action of the blades. Aerodynamic wind turbine noise is described as broadband noise, i.e. noise that has the same intensity over a wide frequency range. In the case of wind turbines, the noise level generally plateaus in the frequency range 200 Hz to 2,000 Hz.

Many noise complaints relating to wind turbine noise refer to special audible characteristics such as tonal, infrasonic, low frequency noise or amplitude modulation. There is no evidence that wind turbines generate perceptible infrasound. In order to adequately control wind turbine noise, it is necessary to set noise level limits and to control the other special audible characteristics of the noise.

1.2 ETSU-R-97

The Assessment and Rating of Noise from Wind Farms ETSU-R-97 was published by the UK Department of Trade and Industry (DTI) in 1996[41]. The document was written by an expert working group set up by the Energy Technology Support Unit (ETSU) within the DTI.

ETSU-R-97 was considered in the development of the Wind Energy Development Guidelines (2006) and this methodology has been applied on many wind energy developments in Ireland. In order to address issues arising from the development of modern large-scale turbines, the recent IoA Good Practice Guide and other international guidance has been used in the development of the Guidelines and the Technical Appendices.

1.3 IOA GOOD PRACTICE GUIDE FOR ETSU-R-97

Since the publication of ETSU-R97, some issues have arisen regarding its suitability for large modern wind turbines, notably the issues of wind shear, special audible characteristics and the environmental impact of significant increases in noise levels over background levels. In order to provide appropriate guidance on current implementation of ETSU-R-97, the Institute of Acoustics (IoA) established a working group to review its operation. The IoA published a Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise in

41 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/49869/ETSU_Full_copy__Searchable_.pdf (accessed April 2018)

May 2013[42] which addressed the issues of wind shear, noise modelling and wind turbine noise measurement in particular. Tonal noise from wind turbines is addressed in ETSU-R-97.

Subsequently the IoA has published a reference method for determining amplitude modulation[43], another of the special audible characteristics. The International Standards Organisation (ISO) has published an objective method for assessing the audibility of tones in noise[44] which clarifies the calculation methodology. The special audible characteristic of low frequency noise is addressed in Section 3.3 of this document.

In order to provide an appropriate level of control on special audible characteristics a penalty scheme for special audible characteristics is being adopted.

ETSU-R-97 recommended that a fixed limit for night time noise of 43 dB(A) $L_{A90,10\ min}$ was appropriate. This meant that the night time noise limit under ETSU-R-97 was in many cases higher than the day time limit. Under these Guidelines background noise curves will be utilised to set appropriate noise limits.

Wind turbine noise from larger turbines is recognised as being a particular issue during the evening and at night. Due to higher hub heights, turbines can operate when there is little or no wind at noise sensitive locations. The problem is exacerbated if the wind turbine noise includes special audible characteristics. Amplitude Modulation which arises from periodic variations in noise levels from large wind turbines can be a particular problem in this regard.

A 10 dB(A) outdoors to indoors noise reduction, on which ETSU-R-97 was based, is not achievable for low frequency noise components and a fixed night time noise limit is considered inadequate to protect night time amenities. In order to protect amenity, noise limits will be based on night time background noise levels. Low frequency noise components are addressed in Section 3.3 of this technical appendix.

The developer is required to identify a study area within which the predicted RRNL, at noise sensitive locations, may exceed 30 dB L_{A90} at up to 12 m/s wind speed or an area contained within a perimeter line offset by 3,000 metres (3 km) from the proposed, consented and existing wind turbines, whichever is the lesser. At the survey scoping stage, the definition of the 30 dB L_{A90} contour is often preliminary, because (for example) the precise positions and type of wind turbines are not finalised.

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42 http://www.ioa.org.uk/sites/default/files/IOA%20Good%20Practice%20Guide%20on%20Wind%20Turbine%20Noise%20-%20May%202013.pdf

43 http://ioa.org.uk/sites/default/files/AMWG%20Final%20Report-09-08-2016_0.pdf

44 ISO/PAS 20065:2016 Acoustics — Objective method for assessing the audibility of tones in noise — Engineering method

It will also be necessary to include an allowance for any potential special, audible characteristic penalties when calculating the extent of a study area. For the avoidance of doubt, the developer can use turbine source noise data with an appropriate allowance for measurement uncertainty. The developer is further required to assess the proposed turbine design and following an assessment by the competent person, state in the application what additional penalty estimate has been included in the noise modelling calculations. Inclusion of any estimated penalty for special, audible characteristics at application stage shall not be considered when determining compliance.

2 RELATIVE RATED NOISE LIMIT (RRNL)

The relative rated noise levels ($L_{A\ rated\ 10\ min.}$) resulting from wind energy development and taking into account the cumulative impact of noise levels resulting from other existing and approved developments shall not exceed:

(1) Background noise levels by more than 5 dB(A) within the range 35-43 dB(A), or

(2) 43 dB(A),

both measured as $L_{90,10\ min}$ outdoors at specified noise sensitive locations.

The Guidelines noise limit is based on Relative Rated Noise Limits against which the Rated Wind Turbine Noise Level ($L_{A\ rated}$ - measured on site and calculated) is compared. The calculation of $L_{A\ rated}$ is based on the noise attributable to the wind turbines plus ‘penalties’ for special audible characteristics. The Guidelines set out that the Relative Rated Noise Limit is determined using the background noise level curve.

These Guidelines adapt the IoA implementation of ETSU-R-97, along with international standards and guidance on tonal noise and low frequency noise, for wind energy developments in Ireland. Wind turbine noise assessment will be based on the L_{den} indicator which is defined in the Environmental Noise Directive (2002/49/EC).

The L_{den} indicator is calculated as the A-weighted average sound pressure level, with a 10 dB penalty added to the night time (23:00–07:00) level, a 5 dB penalty is added to the evening

(19:00–23:00) level and no penalty added to the daytime (07:00–19:00) level. The penalties are introduced to indicate people's extra sensitivity to noise during the evening and night periods.

$$L_{den} = 10log\frac{1}{24}\left[12 * 10^{\frac{L_{day}+0}{10}} + 4 * 10^{\frac{L_{evening}+5}{10}} + 8 * 10^{\frac{L_{night}+10}{10}}\right]$$

L_{den} is the A-weighted average sound pressure level, with a 10 dB penalty added to the night time (23:00–07:00) level, a 5 dB penalty is added to the evening (19:00–23:00) level and no penalty added to the daytime (07:00–19:00) level

Due to the inclusion of temporal penalties in the noise indicator, noise during the night time period is critical in determining the overall noise level and consistency with the WHO conditional recommendation.

During the day period there are practical limitations to measuring wind energy development noise levels, it has been found that isolating wind energy development related noise is best carried out during the night period. In order to be able to directly compare background noise levels to wind turbine operation noise levels it is necessary to measure background noise levels at night and set evening and daytime noise limits based on these levels.

For the avoidance of doubt RRNL curves will be based on the background noise level curve developed from night time noise data. The evening and day time curves are extrapolated from the night time curve using the 5 dB(A) and 10 dB(A) differentials set out in the Environmental Noise Directive. It is necessary to control noise emissions during the day and evening periods in this way to ensure annual noise emissions remain within WHO conditional recommendation.

Further guidance on data processing and derivation of the background curves is provided in the IoA Supplementary Guidance Note 2.

Detailed guidance on how to apply the RRNL is set out below.

2.1. BACKGROUND NOISE MEASUREMENT (PRE-CONSTRUCTION)

The WHO conditional L_{den} noise criterion is based on long term average noise level values rather than short-term measurements. It is well documented that wind turbine noise levels can be close to background levels and difficult to isolate. It is also important that post-completion compliance measurements can be compared directly with pre-construction background noise levels.

Regarding post-completion compliance monitoring the IoA GPG states that:

'*Unless there is any particular requirement to measure day-time noise levels (i.e. complaint during these periods) it may be useful to filter out all data except that measured between 2300 and 0400 when competing noise (including early morning birdsong and traffic) would be at a minimum. Evening measurements may also be sufficiently unaffected by spurious sources, depending on the background noise character of the locality*.'

This is in line with current experience which indicates that the night period is in most cases the only time that wind turbine (in the absence of special audible characteristics) noise dominates. The guidelines will have the effect of further reducing wind turbine noise, making it harder to isolate for post completion measurements.

In order to ensure night time noise levels are tightly controlled the background noise measurement period will be set at 23:00 hrs to 07:00 hrs with data filtering in accordance with Supplementary Guidance Note 2: Data Processing and Derivation of ETSU-R-97 Background Curves (IoA 2014b). A curve using adequate filtered data for the night time background noise measurement period shall be developed in accordance with these guidelines. Attention is drawn to the requirements for adequate valid data for each wind speed bin and filtering to remove rainfall, traffic, dawn chorus, other existing wind energy developments and other extraneous noise from the baseline data.

For the avoidance of doubt, the night time background noise curve shall be taken as the noise measured during the background noise measurement period (23:00 hrs to 07:00 hrs). The evening period background noise curve shall be taken as the night time background noise curve plus 5 dB(A) and the day time background noise curve shall be taken as the night time background noise curve plus 10 dB(A). The RRNL is set at 5 dB above the background noise curves subject to wind turbine noise levels remaining in the range 35-43 dB(A).

It is necessary to set the evening and day time background noise curves in this way to ensure that when the wind energy development is in operation the $L_{A\ rated}$ remains consistent with the WHO conditional recommendation of 45 dB L_{den}. Should a site have a high level of wind turbine noise during the day, due to a high daytime limit, it may mean that the 45 dB L_{den} limit will be exceeded unless there are restrictions applied to evening and night time operation.

Figure 2-1 below provides an illustrative series of night time background noise measurement period readings for a range of wind speeds at a quiet rural site. The cut off at 20 dB(A) is typically due to the noise floor of the measuring equipment. There is usually a significant spread in the data at all wind speeds.

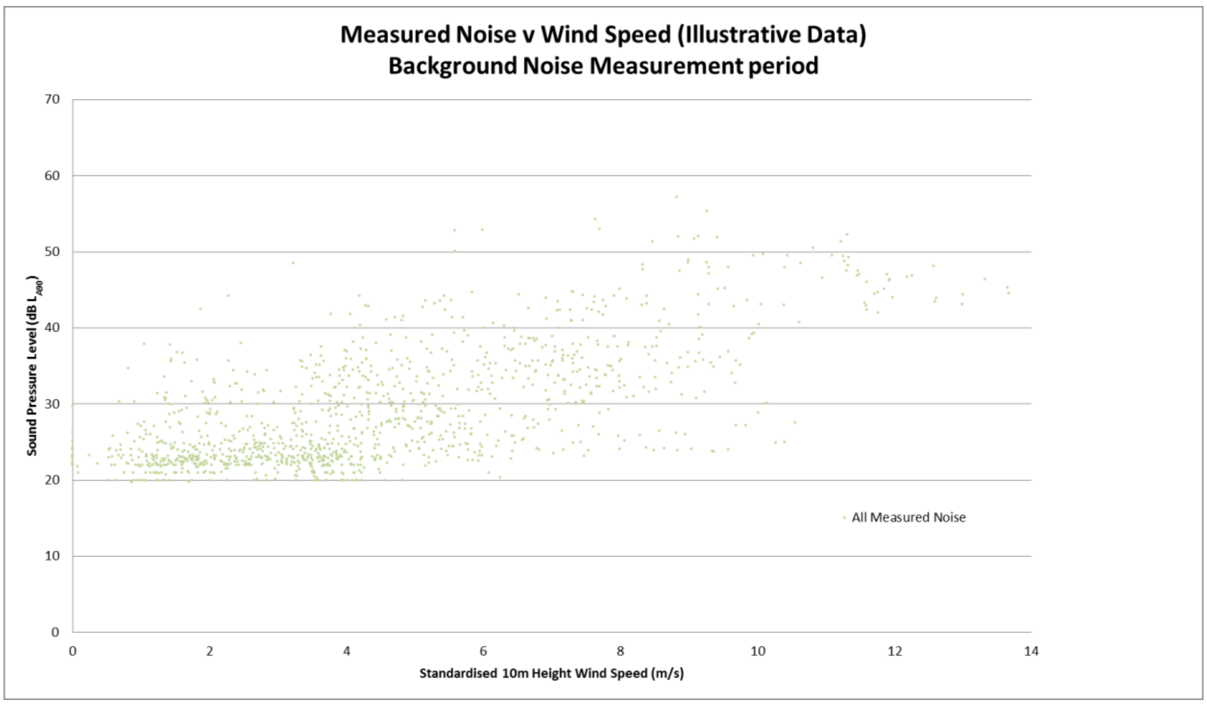


Figure 2-1 Measured Background Noise Data

2.2 DETERMINING RELATIVE RATED NOISE LIMIT (PRE-CONSTRUCTION)

Technical Appendix 2 specifies how background noise level data is to be collected and analysed. The resultant background noise level curve provides a trendline in accordance with IoA GPG Supplementary Guidance Note 2. The trendline with the best fit for the data plot, as shown in Figure 2-2 below, is used to calculate the Relative Rated Noise Limit based on the background noise measurement period.

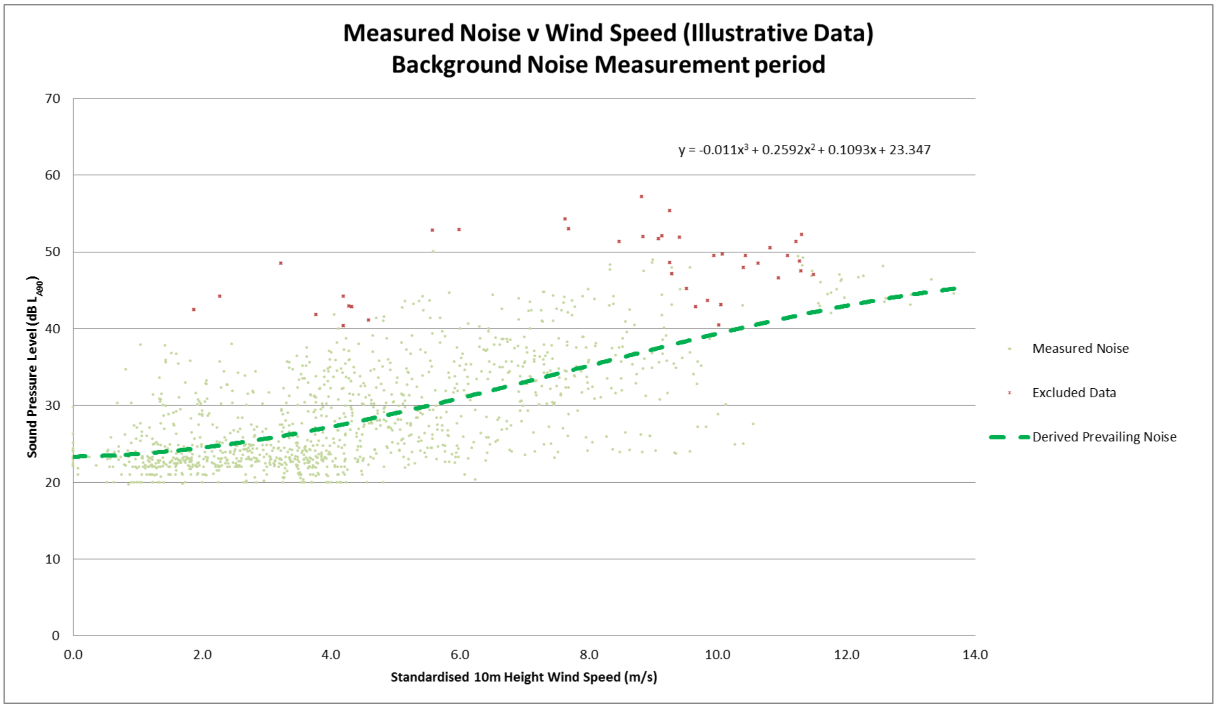


Figure 2-2 Derived Background Noise Curve (Background Noise Measurement Period Data)

The trendline is a line that best fits the wind speed and noise level data. The best fit line is the line for which the sum of the distances between each of the data points and the line is as small as possible. The line is generally a curved line with formulae of the form $y = bx^2 + cx + d$ (second order) or $y = ax^3 + bx^2 + cx + d$ (third order). Refer to Section 2.6.6 of IoA GPG Supplementary Guidance Note 2 regarding the best fit expression to be used.

The limit in this case is based on the green line which is a third order quadratic equation.

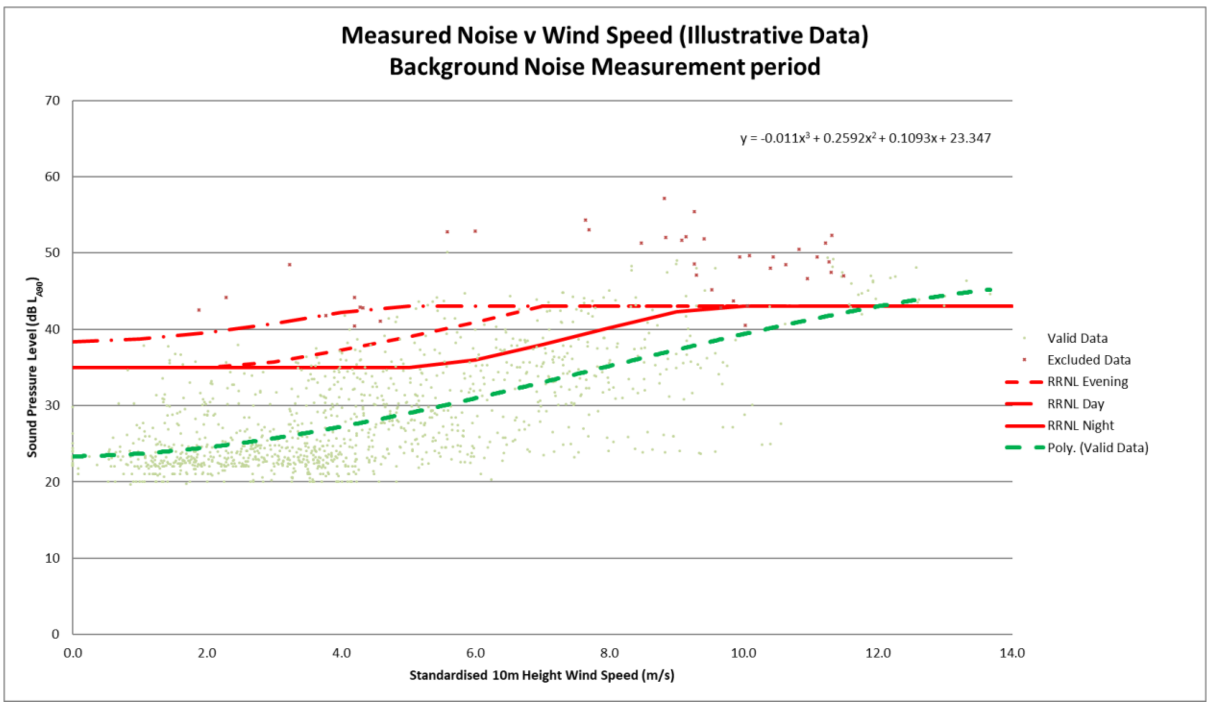
The data from the trendline is digitised and reported at 1 m/s wind speed intervals as shown in Table 2-1 below. The Table entries for the RRNL permitted are calculated by applying +5 dB(A) to the background noise level curve for night periods between a background level of 35 dB(A) and a maximum level of 43 dB(A), +5 dB(A) for evening periods and + 10 dB(A) for day periods within the range of 35 – 43 dB(A), with 43 dB(A) being the maximum permitted.

Table 2-1 Relative Rated Noise Limits expressed in dB(A)

Location X	Standardised wind speed at 10 metre height (m/s)											
	1	2	3	4	5	6	7	8	9	10	11	12
Night time Background	23.7	24.5	25.7	27.2	29.0	31.0	33.0	35.2	37.3	39.4	41.3	43.0

(from best fit trendline)												
RRNL (Night)	35.0	35.0	35.0	35.0	35.0	36.0	38.0	40.2	42.3	43.0	43.0	43.0
RRNL (Evening)	35.0	35.0	35.7	37.2	39.0	41.0	43.0	43.0	43.0	43.0	43.0	43.0
RRNL (Day)	38.7	39.5	40.7	42.2	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0

The RRNL limits are plotted in Figure 2-3.



<u>**Figure 2-3 Relative Rated Noise Limits for Day, Evening and Night Periods**</u>

The solid red line represents the night time RRNL; the dashed red lines represent the RRNL for the evening and day periods. The upper and lower limits are the same for all periods but higher noise levels are permitted at wind speeds over 2 m/s in the evening period and at all wind speeds in the day period. The turbine cut-in wind speed will mean no noise emissions will arise at lower wind speeds.

The Relative Rated Noise Limit (RRNL) includes any penalties which need to be applied for Special Audible Characteristics post construction. Based on available data (acoustic test reports for the turbines, wind data indicating a high probability of turbulence or wind shear, etc.) the developer is advised to consider a design goal lower than the RRNL, see Section 5.7.11 of the Guidelines.

2.3 DETERMINING PENALTIES AND COMPLIANCE (POST CONSTRUCTION)

Due to the possibility of special audible characteristics associated with wind turbine noise a rating system on such characteristics is set out in this Technical Appendix. This noise rating system is imposed using a penalty for special audible characteristics and adding it to the measured noise level from the wind energy development. The 'rated' noise level ($L_{A\ rated}$) is then compared to the noise limit for the appropriate period (RRNL). This assessment will indicate if the wind energy development is in compliance with the predicted noise levels, subject to the noise limits set out in section 5.7.7.

An example of a rated noise level calculated in accordance with Section 5 of this technical Appendix using illustrative data is provided in Figure 2-4. (There is a tonal penalty applied to the trendline). As shown in this illustrative dataset the wind energy development is not compliant at wind speeds of 4 m/s.

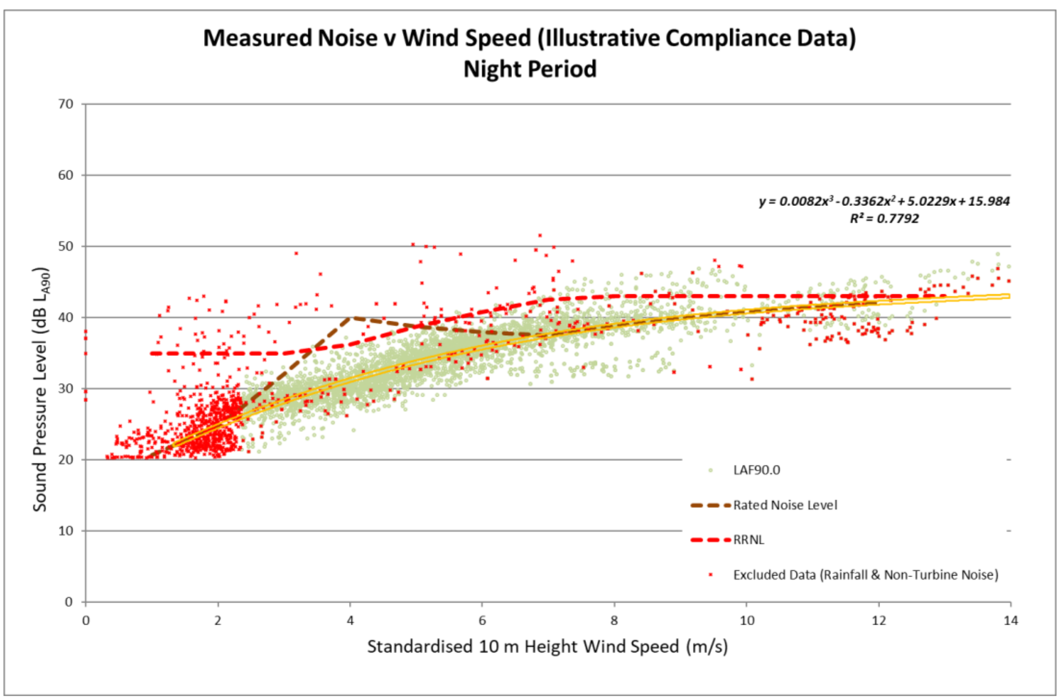


Figure 2-4 Assessment for compliance

Wind turbine development has brought about continuous improvement in reducing noise emissions. Noise emissions from more recent wind turbine design are generally less than those of equivalent older wind turbines. The trend of noise reduction with technology advancement is expected to continue, in tandem with and driven by planning controls for noise measured at adjacent noise sensitive locations. Turbine design now includes the option of interventions to control the noise envelope through improved aerodynamic design, dynamic noise control and low noise operating modes.

3 SPECIAL AUDIBLE CHARACTERISTICS

There are three categories of special audible characteristics that may arise from wind turbines:

1. Tonal Noise
2. Amplitude Modulation
3. Low Frequency Noise

This Technical Appendix will set out control criteria for each of these three special audible characteristics. This Technical Appendix should be read in conjunction with:

- The Institute of Acoustics (2013), Good Practice Guide to the Application and Assessment of ETSU-R-97 for the Assessment and Rating of Noise from Wind Farms.;
- ISO 1996-2 third Edition 2017 Acoustics - Description, measurement and assessment of environmental noise - Part2: Determination of sound pressure levels
- ISO/PAS 20065, Acoustics - Objective method for assessing the audibility of tones in noise - Engineering method; and
- Proposed criteria for the assessment of low frequency noise disturbance, Moorhouse, Waddington and Adams, DEFRA Contract no. NANR45 revision 1 December 2011.

For the avoidance of doubt this Technical Appendix will take precedence over these publications where any conflicts arise.

In order to assess wind turbine noise for special audible characteristics, three separate tests are applied. Depending on the results of the tests, acoustic rating penalties for tonal noise and or amplitude modulation may apply to the measured noise level. Low frequency noise outside the threshold outlined in this guideline is not permitted and will result in turbine shut-down. Normal operation of wind turbines should not result in such characteristics.

Values of the $L_{A90,\ 10\text{-minute}}$ noise index shall be measured in accordance with the IoA GPG. Measurements shall be undertaken in such a manner to enable a tonal penalty to be calculated and to allow an amplitude modulation penalty to be calculated for periods where a tonal or amplitude modulation assessment is required.

To enable compliance with these guidelines to be evaluated, the wind energy development operator shall continuously log arithmetic mean wind speed in metres per second (m/s) and arithmetic mean wind direction in degrees from north in each successive 10-minutes. The wind speed at turbine hub height shall be 'standardised' to a reference height of 10 metres as described in ETSU-R-97 at page 120 using a reference roughness length of 0.05 metres. It is this standardised 10 metre height wind speed data which are correlated with the noise measurements determined as valid. All 10-minute periods shall commence on the hour and in 10-minute increments thereafter synchronised with Universal Time (UT).

3.1 TONAL NOISE

Any rotating equipment may generate tonal noise. Tonal wind turbine noise can generally be attributed to gearbox related noise. As stated in these Guidelines improvements in turbine design have greatly reduced potential tonal noise. Under this guideline the methodology to be applied in relation to quantifying tonal emissions from wind energy developments is in accordance with ISO 1996-2 third Edition 2017 Acoustics - Description, measurement and assessment of environmental noise – Part 2: Determination of sound pressure levels Annex J and ISO/PAS 20065 on an objective method for assessing the audibility of tones in noise. The method aims to assess the audibility of a tone as perceived by the average listener. The methodology identifies prominent tones in an appropriate noise frequency band and calculates the audibility of the tone. Based on the level of tonal audibility a tonal penalty is applied. The analysis of non-stationary tones is quite complex and rarely carried out in real time. It is therefore recommended to record the wind turbine noise and analyse the signal offline. For each tonal assessment 2-minutes of uninterrupted clean A-weighted recording is required.

Where, in accordance with Annex J ISO 1996-2:2017(E), the noise contains or is likely to contain a tonal component, a tonal audibility shall be calculated for each 10 minute period using the following procedure.

a. For each 10-minute period for which a tonal assessment is required, this shall be performed on noise immissions during 2-minutes of each 10-minute period. The 2-minute periods should be spaced at 10-minute intervals provided that uninterrupted uncorrupted data are available ("the standard procedure").

b. For each of the 2-minute samples the tone level above audibility shall be calculated by comparison with the audibility criterion given in Annex J ISO 1996-2:2017(E). Samples for which the tones were below the audibility criterion or no tone was identified, a value of zero audibility shall be substituted. Where data for a 10 minute period are corrupted, that period shall be removed from the tonal analysis.

c. The tone level above audibility for each 10- minute period shall be placed in the appropriate data sub set and wind speed bin.

3.2 AMPLITUDE MODULATION

Amplitude modulation components in wind energy development noise have been the subject of considerable complaint. Amplitude modulation is the 'whoomping' or 'thumping' noise which may cause annoyance at a considerable distance from the wind energy development. The nature of amplitude modulation components from large turbines is that they occur around the blade passing frequency, typically 1 Hz. In many instances, amplitude modulation is conflated with low frequency noise. The two characteristics need to be assessed separately.

Subjective listening tests and direct measurement using low frequency microphones have been used to measure amplitude modulation but do not provide a reliable method of quantifying the characteristic. In order to control amplitude modulation a robust and reliable methodology for quantifying the characteristic is required.

The Institute of Acoustics (IoA) Working Group, was established to develop a methodology to measure amplitude modulation with consistent accuracy, defined wind turbine amplitude modulation as follows:

> "*Wind turbine amplitude modulation is defined as periodic fluctuations in the level of audible noise from a wind turbine (or wind turbines), the frequency of the fluctuations being related to the blade passing frequency of the turbine rotor(s).*"

The procedure is based on outdoor measurements in the vicinity of dwellings, primarily because of the practical difficulties associated with making repeatable noise measurements indoors. Reliance on external measurements is consistent with established standards and procedures for assessing environmental noise.

3.2.1 Overview of the Method[45]

Under this guideline the methodology to be applied in relation to quantifying amplitude modulation emissions from wind energy developments is the IoA reference method. The IoA reference method is a 'hybrid' approach, based on a frequency domain method (using Discrete Fourier Transform or DFT). Frequency analysis of the time signal allows the identification of the pattern of clear modulation which, when it occurs, is typical of wind turbine amplitude modulation and distinguishes it from other time-varying sources found in all noise environments. Such a pattern becomes a distinct peak in the resulting power spectrum, which may be related to the blade passing frequency of the turbine(s), particularly if it is consistent in time.

In outline, the method requires:

- The input signal (a time series of band-limited (50-800 Hz), A-weighted, 1/3-octave L_{eq} data in 100 millisecond samples) is split into blocks of 10 seconds.
- It is transformed to the frequency domain using Fourier analysis to obtain a modulation spectrum.
- If a clear (prominent) peak in the FFT data is present at a rate expected from the turbines, a window around that frequency (and the next two harmonics) is selected (subject to some tests).
- An inverse Fourier transform is applied to the filtered spectrum to reconstruct a filtered time-series.
- The modulation depth in the filtered time-series is then determined.
- A value for a 10-minute period is calculated from a combination of the 10-second modulation depths within that period.

The modulation depth over 10 seconds is determined directly from the difference between the L_5 and L_{95} values within the filtered time-series. The method produces a single value for a 10-minute period.

For each 10-minute interval for which an amplitude modulation assessment is required this shall be performed in accordance with The IoA Metric. The value of amplitude modulation for each 10 minute period shall be converted to a penalty in decibels in accordance with Figure and the penalty shall be placed in the appropriate data sub set and wind speed bin. Where a penalty is zero it should be placed in the bin in the same way.

[45] The method is detailed in Institute of Acoustics, IOA Noise Working Group (Wind Turbine Noise) Amplitude Modulation Working Group Final Report, *A Method for Rating Amplitude Modulation in Wind Turbine Noise*, 9 Aug 2016, Version 1. Available from http://www.ioa.org.uk/sites/default/files/AMWG%20Final%20Report-09-08-2016_1.pdf (November 2019).

3.3 LOW FREQUENCY NOISE

There is no evidence that wind turbines generate perceptible infrasound. Information relating to general low frequency noise needs to be evaluated carefully as it can be confusing and may not relate to wind turbine noise. Low frequency noise associated with modern wind turbine design is regarded as occurring at very low intensity levels. Studies on the impacts of low frequency noise on people generally relate to workers who are likely to have been exposed to extremely high intensity low frequency noise, frequently accompanied by vibration for a long period of time. Such studies are not comparable to the levels of low frequency noise arising from wind turbines at noise sensitive locations.

It is also important to note that many of the studies regarding low frequency noise from wind turbines relate to downwind turbines. Downwind turbines had a propensity to generate significant low frequency noise components along with significant amplitude modulation. Downwind designs are no longer used for large onshore wind turbines.

In the event of a low frequency noise complaint, the methodology to be applied in relation to quantifying low frequency noise emissions from wind energy developments will be the University of Salford Proposed Criteria for the Assessment of Low Frequency Noise Disturbance, Revision 1, (Moorhouse et al. (2011)). Low Frequency Noise (LFN) is taken to mean noise below a frequency of 160Hz. The average human hearing threshold is 0 dB at 1000 Hz. A low frequency sound needs to be approximately 27 dB louder at 100Hz, 80 dB louder at 20Hz and even louder at lower frequencies to be audible. This means that low frequency noise must be quite loud in order to be audible.

Natural levels of low frequency noise arise in the environment. Regular environmental low frequency noise sources include rivers, waterfalls, waves on the sea, and air turbulence from the wind. Occasional short duration sources include thunder, landslides, avalanches and earthquakes. Low frequency noise from man-made sources includes industrial facilities, transportation, mechanical ventilation systems and some household tools and appliances.

3.3.1 Low Frequency Noise Limits

The Moorhouse et al. (2011) report under contract to the UK Department for Environment, Food and Rural Affairs (DEFRA) was designed to provide guidance on the assessment of low frequency noise complaints.

These Guidelines set a zero-tolerance for towards low frequency noise attributable to wind energy developments exceeding the thresholds set out in Table 4.1. The maximum limit for low frequency noise from wind turbines at a noise sensitive location shall not exceed the levels set out in the Figure 1 of Moorhouse et al. (2011), subject to the recommended 5 dB relaxation during the day period. The prohibition on low frequency noise also means that the RRNL can be based on an A-weighted metric while taking account of low frequencies.

3.3.2 Assessment of Low Frequency Noise

- Low Frequency noise is only required to be measured when a complaint is received.
- When a complaint is received by a planning authority in relation to low frequency noise the planning authority must work with the complainant to establish under what conditions (i.e. weather, time etc.) the low frequency noise is experienced.
- In the first instance the planning authority shall notify the developer of the complaint and require the developer to carry out a preliminary investigation.
- The developer shall, subject to commercial sensitivity and confidentiality, provide the following information to the planning authority:
    - Confirmation of which turbines were operating at the time of the complaint;
    - Provide access to wind energy development operation and weather data for the period in question; and
    - Provide information on any abnormal activity, e.g. malfunction of controls, breakdowns, etc. occurring at the time of the complaint.
    - Provide a possible explanation for the occurrence of low frequency noise and what if any measures they intend to take to prevent a recurrence.
- The Planning Authority shall carry out such enquiries they see fit including a review of the noise monitoring reports from the wind energy development to assess for noise level breaches or Amplitude Modulation. If these are ruled out, they should then continue to assess whether Low Frequency exists.
- As Low frequency noise is often misunderstood, the Planning Authority may investigate other non-wind related sources of low frequency noise. This may include other sources of noise, the subject of complaint or otherwise, to reasonably conclude that the source of the low frequency noise is wind energy development related.

- The planning authority may carry out the noise measurements themselves or engage another competent person to carry out the measurements on their behalf.
- The planning authority shall arrange for noise measurements to be taken by a competent person under similar weather conditions to those under which the complaint arose.
- Noise measurements shall be taken at the expense of the wind energy developer.
- Planning Authorities shall take reasonable steps to conclude if Low Frequency is occurring. A maximum of three sets of noise measurements, under weather conditions identified as similar to those occurring at the time of the complaint, may be considered reasonable to establish if low frequency noise is occurring.
- If, in the opinion of the competent person, the noise limits set out in Table 4.1 are not exceeded, the planning authority are not obliged to take any further action.

4 RRNL PENALTY SCHEME

Assessments of environmental noise are increasingly based on a ‘rated’ noise level to protect amenities. A rated noise level is a measured level with a penalty for special audible characteristics. For example, there has long been industry standard practice to apply a rating for night time noise.

Penalties relating to audible characteristics of the noise, such as a tone, are widely accepted as necessary. Noise from wind turbines can have three specific audible characteristics. These are tonal noise, amplitude modulation and low frequency components. In the case of tonal noise and amplitude modulation, it is generally accepted that a certain level of each is tolerable and penalties are not applied until a threshold is reached.

The UK method for wind energy development noise assessment ETSU-R-97 was based on British Standard 4142 (Methods for Rating and Assessing Industrial and Commercial Sound) and included a penalty for tonal or impulsive noise. The cumulative penalty was 5 dB in 1997. BS 4142 was revised in 2014 (BS4142:2014) and now includes separate penalties for tonal, impulsive, intermittent or ‘other’ sound characteristics that can cumulatively amount to 18 dB depending on the noise source.

Under these guidelines, there is a prohibition on exceeding the thresholds for low frequency noise and a penalty rating is to be applied in the case of tonal noise and amplitude modulation.

4.1 PENALTY SCHEME TO APPLY

The RRNL penalty scheme is based on cumulative penalties for:

1. Tonal noise characteristics
2. Amplitude modulation

An individual penalty for each characteristic is assessed and then added to the measured wind turbine noise level, based on the $L_{A90,\ 10\ min}$ metric.

4.1.1 Tonal Noise

The tonal penalty scheme is based on the ISO 1996-2 third Edition 2017-07 penalty scheme.

Due to the need for clarification and consistency in determining tonal noise, the International Standards Organisation revised ISO 1996 in 2017. ISO 1996-2 third Edition 2017-07 Acoustics - Description, measurement and assessment of environmental noise - Part2: Determination of sound pressure levels, Annex J sets a maximum penalty of 6 dB. The tonal adjustment to be applied in calculating the rated level shall be in 3 dB steps as follows:

$\Delta L \leq 2dB$: $K_T = 0$ dB

$2dB < \Delta L \leq 9dB$: $K_T = 3dB$

$\Delta L > 9dB$: $K_T = 6dB$

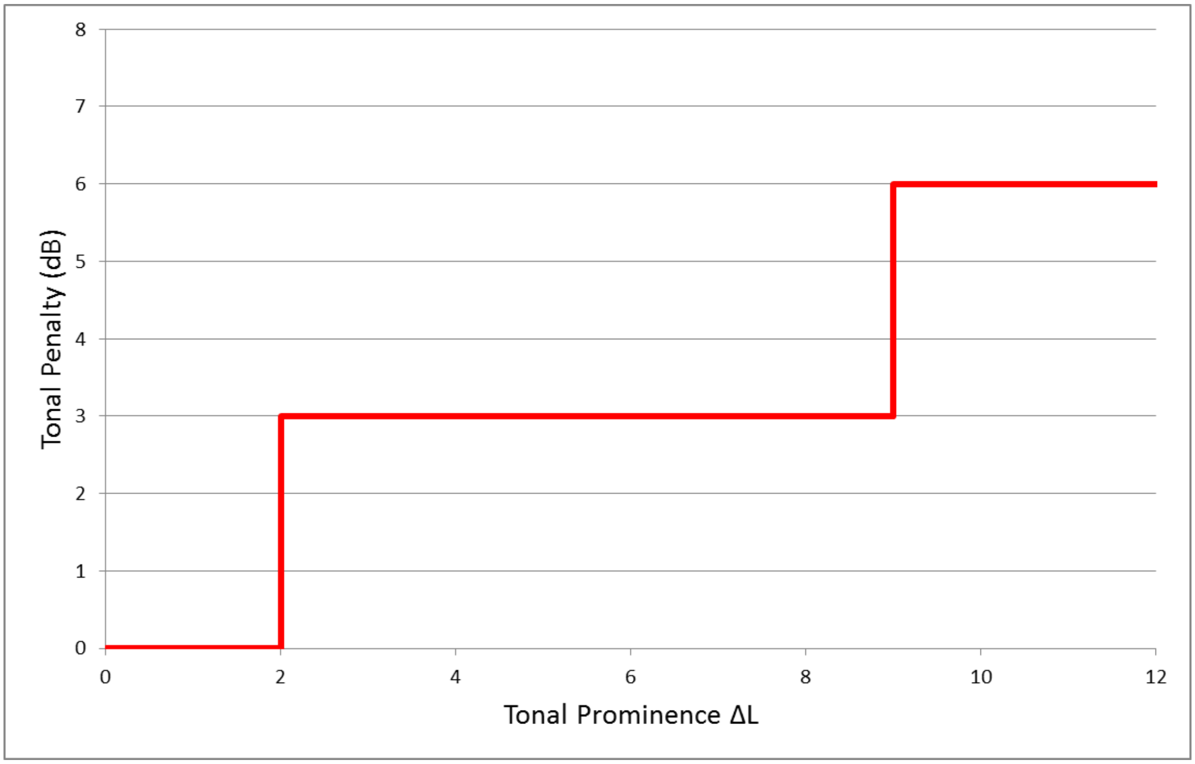


Figure 4-1 Tonal Noise Penalty Scheme

4.1.2 Amplitude Modulation

The UK Department of Energy and Climate Change commissioned a report on an appropriate measurement method and penalty scheme for amplitude modulation. A Phase 1 report was prepared by the research team, subjected to consultation and peer review and revised to incorporate the feedback received. This resulted in a Phase 2 report being published in August 2016[46].

The report concluded that the IoA AMWG proposals for the amplitude modulation metric provide the most robust method available for the identification of amplitude modulation. They described the methodology as objective, precise, and having overcome many of the criticisms of previously used metrics for amplitude modulation in the field.

The report states:

> *"The setting of a threshold for excessive AM is not straightforward. The available research does not identify a clear onset of increased annoyance from AM. The research*

[46] Wind Turbine AM Review Phase 2 Report, Department of Energy and Climate Change, August 2016

also does not identify a clear level at which the impact of WTN or AM becomes 'significant', 'excessive' or 'unacceptable'. It does suggest an onset of perception for AM at about 2 dB (peak-to-trough level difference in the Fast-weighted sound pressure level), and an association of rising annoyance with increasing depth of AM above 2 dB, when relating to L_{Aeq}. Moreover, the research highlights a very strong relationship between annoyance and the overall time-averaged level of noise, with the presence of AM in the noise increasing the annoyance."

The IoA AMWG suggest it would be unreasonable to penalise operators when periods of amplitude modulation are not cause for complaint, thus the condition is targeted only to periods that give rise to valid/ justified complaints. It is possible that high levels of amplitude modulation may occur at other times of the day which, for a number of reasons, do not lead to complaints. In order to isolate wind energy development noise from other potential noise sources assessment for amplitude modulation penalties will only be carried out on night time noise measurements processed in accordance with the IoA GPG.

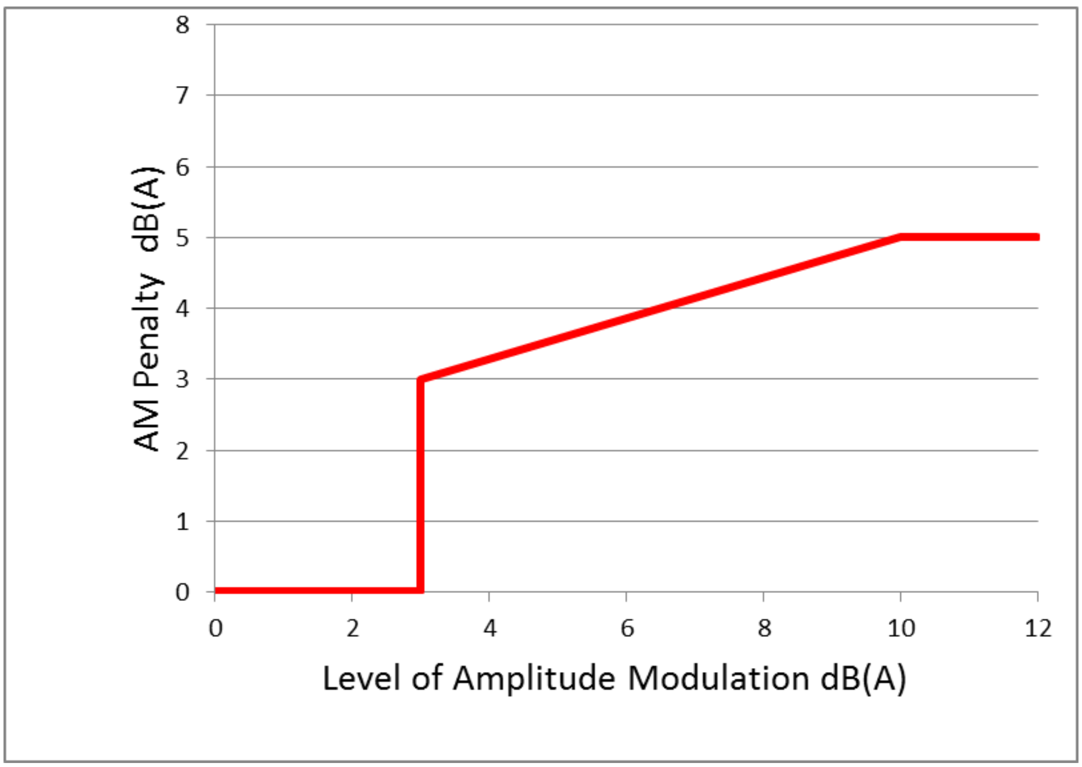


Figure 4-2 Amplitude Modulation Noise Penalty Scheme

The application of this penalty scheme is as follows:

- For amplitude modulation with a peak to trough level of <3 dB there is no amplitude modulation penalty.
- For amplitude modulation with a peak to trough level of 3-10 dB there is a sliding scale of penalties ranging from 3-5 dB.
- For amplitude modulation with a peak to trough level of ≥ 10 dB there is a 5 dB penalty.

At an exceedance level above 3 dB, a 3 dB penalty is incurred. Between cumulative exceedance levels of 3 dB and 10 dB, a sliding scale of penalties is introduced, varying linearly from 3 dB to 5 dB which is the maximum penalty applied for amplitude modulation. No penalties are incurred at cumulative exceedance levels below 3 dB.

4.2 LOW FREQUENCY NOISE

Low frequency noise shall be measured as $L_{90\ unweighted,\ 10\ min}$ during the night period in one third octave bands and the levels compared to those in Table 4.1.

Table 4-1 Low Frequency Noise Limits

Standard Limit $dB_{unweighted}$	Frequency Hz												
	10	**12.5**	**16**	**20**	**25**	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
Wind turbine noise limits (indoors)	92	87	83	74	64	56	49	43	42	40	38	36	34

The planning authority shall examine such measurement results. Where the planning authority makes an interim determination, following an assessment of low frequency noise as set out in Section 3.3.2 of this technical appendix, they shall inform the operator in writing and require appropriate measures to be taken. Having been notified by the planning authority of its interim determination, the relevant wind turbine(s) must be taken out of operation by the operator until such time as the operator has demonstrated to the satisfaction of the relevant planning authority that noise reduction measures have been completed and, any other steps that the authority requires have been taken to ensure compliance. The planning authority may then approve a testing programme to demonstrate compliance and return the turbine(s) to operational service, subject to which the turbines may be returned to operational service.

5 CUMULATIVE PENALTIES AND COMPLIANCE

Wind turbine noise is weather dependent, in particular on wind direction and strength. Noise levels are generally greater in the downwind direction but atmospheric conditions and directionality of the source can result in significant geographical variation in noise levels.

All assessments of wind turbine noise levels shall consider the influence of weather conditions, e.g. wind speed and direction on the potential sources of wind turbine noise and potential influences on noise propagation.

Amplitude modulation has been shown to occur in both downwind and crosswind conditions. Where a complaint relates to amplitude modulated noise all wind directions associated with amplitude modulation shall be included in determining the rated noise level.

5.1 WIND TURBINE NOISE MEASUREMENTS (COMPLIANCE STAGE)

Values of the $L_{A\ 90,10\text{-minute}}$ noise index should be measured in accordance with IOA GPG Supplementary Guidance Note 1. Measurements shall be undertaken in such a manner to enable a tonal penalty to be calculated and, to allow an AM penalty to be calculated for selected periods where a tonal or AM assessment is required.

To enable compliance with the conditions to be evaluated, the wind energy development operator shall continuously log arithmetic mean wind speed in metres per second (m/s) and, arithmetic mean wind direction in degrees from north in each successive 10-minute period, in a manner to be agreed in writing with the planning authority. The wind speed at turbine hub height shall be “standardised” to a reference height of 10 metres as described in ETSU-R-97 at page 120 using a reference roughness length of 0.05 metres. It is this standardised 10 metre height wind speed data which are correlated with the noise measurements determined as valid. The wind energy development operator shall continuously log arithmetic mean nacelle anemometer wind speed, arithmetic mean nacelle orientation, arithmetic mean wind direction as measured at the nacelle, arithmetic mean rotor RPM and whether each wind turbine is running normally during each successive 10-minute period for each wind turbine on the wind energy development. All 10-minute periods shall commence on the hour and in 10-minute increments thereafter synchronised with Universal Time (UT).

In the event of a complaint being received by the planning authority, either the local authority or a competent person approved or appointed by the planning authority, shall identify at the expense of the operator a sub set of data having had regard to:-

- the conditions (including time of day and corresponding wind directions and speeds) at times in which complaints were recorded;
- the nature/description recorded in the complaints if available;
- information contained in the written request from the local planning authority;
- likely propagation effects (downwind conditions or otherwise); and
- the results of the tonality/AM analysis where relevant.

In cases where it is possible to identify patterns of clearly different conditions in which complaints have arisen, additional sub sets may be considered provided this does not introduce unreasonable complexity in the analysis and can be justified by the competent person.

Within each of the sub set(s) of data identified, data shall be placed into separate 1 m/s wide wind speed bins.

5.1.1 Calculation of the $L_{A\ rated}$

The L_{A90} sound pressure level for each data sub set and wind speed bin is the arithmetic mean of all the 10 minute sound pressure levels within that data sub set and wind speed bin, except where data has been excluded for reasons which should be clearly identified by the competent person. The tonal penalty for each bin is the arithmetic mean of the separate 10 minute tonal audibility levels in the bin converted to a penalty in accordance with Figure . The AM penalty for each bin is the arithmetic mean of the AM penalties in the bin. The assessment level in each bin is normally the arithmetic sum of the bin L_{A90}, the bin tonal penalty and the bin AM penalty, except where the AM penalty and the tonal penalty relate to the same characteristic (e.g. amplitude modulated tones) when the sum of both penalties may overly penalise the characteristics of the noise. Such cases should be identified and only the larger of the AM or tonal penalty should be applied.

If the assessment level in every bin lies at or below the values set out in the table(s) attached to the conditions then no further action is necessary. In the event that the assessment level is above the limit(s) set out in the tables attached to the noise conditions (as set out in the schedule of commitments in the report submitted with the planning application) in any bin, the competent person shall undertake a further assessment of the rating level to correct for background noise so that the rating level relates to wind turbine noise immission only. Correction for background noise need only be undertaken for those wind speed bins where the assessment level is above the limit.

The wind energy development operator shall ensure that all the wind turbines in the development are turned off for such periods as the competent person requires to undertake the further assessment. The further assessment shall be undertaken in accordance with the following steps:

Repeating the steps in Section 5.1 of this technical appendix, with the wind energy development switched off, and determining the background noise (L_b) in each bin as required in the protocol. At the discretion of the competent person and, provided there is no reason to believe background noise would vary with wind direction, background noise in bins where there is insufficient data can be assumed to be the same as that in other bins at the same wind speed.

The wind energy development noise (L_{wf}) in each bin shall then be calculated as follows where (L_{tot}) is the measured level with turbines running but without the addition of any tonal nor AM penalty:

$$L_{wf} = 10log\left[10^{\frac{L_{tot}}{10}} - 10^{\frac{L_b}{10}}\right]$$

The rating level shall be calculated by adding the tonal and AM penalties to the derived wind energy development noise L_{wf} in that bin.

If the rating level after adjustment for background noise contribution and adjustment for tonal and AM penalties in every bin lies at or below the values set out in the Tables attached to the condition at all wind speeds then no further action is necessary. If the rating level at any integer wind speed exceeds the values set out in the Table(s) attached to the condition then the development fails to comply with the planning condition in the circumstances represented by that bin.

TECHNICAL APPENDIX 2 TREATMENT OF NOISE IN THE PLANNING PROCESS FOR WIND ENERGY DEVELOPMENTS

1 INTRODUCTION

This revision to the Wind Energy Development Guidelines, hereafter the WEDGs, has been developed in the context of modern wind turbine design and international best practice.

The Wind Energy Development Guidelines (2006) approach was based on a similar approach adopted in the UK using ETSU-R-97, which was the first detailed noise assessment planning guidance for wind energy development. It was written prior to the development of multi-MW turbine design. The Institute of Acoustics (IoA) has since published a 'Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (IoA 2013). Subsequently the IoA published guidance on a 'Method for Rating Amplitude Modulation in Wind Turbine Noise'. These Guidelines draw from best international practice including the Institute of Acoustics guidance documents, international standards and low frequency noise guidance which are referenced in the bibliography. For the avoidance of doubt the text of these Guidelines and Technical Appendices sets out the specific planning policy requirements and is definitive in all matters of interpretation.

These Guidelines draw from the IoA GPG as recognised international best practice for background noise measurement and advise on its application taking account of the Irish planning context, in particular the setting of noise limits. Therefore, where there are any differences between this Technical Appendix and the IoA GPG or other guidance, this Technical Appendix shall take precedence.

This Technical Appendix addresses the process to be undertaken by competent persons, engaged by wind energy developers, in developing robust predictive modelling for wind energy developments during the planning process and demonstrating compliance with planning requirements (and the predicted noise level model) during the operation phase. Noise and vibration from the construction phase of the wind energy developments are covered in Section 3 of this Technical Appendix.

2 PRE-PLANNING NOISE ASSESSMENT

It is recommended that the developer engages with all stakeholders prior to preparing a planning application. Where a development falls within the scope of strategic infrastructure development, a pre-application consultation with An Bord Pleanála is mandatory.

Pre-planning engagement should be aimed at providing both parties with information on the proposed development including its location, anticipated geographical extent, turbine sizes, the location of any existing or permitted wind energy developments in the area, any existing or permitted developments which may contribute to cumulative or in-combination noise effects, and any cross-boundary (different planning authority jurisdictions) or cross-border (Ireland and Northern Ireland) considerations. The consultations should assist the developer, as advised by a competent person acting on their behalf, in delineating a study area within which noise sensitive locations can be identified and assessed in terms of noise.

For the avoidance of doubt, the planning application shall include a cumulative noise impact assessment incorporating the impact of all existing and approved (see Glossary) wind energy noise sources in the study area. The background noise level shall be taken as the ambient noise level excluding any existing or approved wind turbines.

Information on existing turbines and proposed turbines for which planning permission has been granted is available from the planning register or other appropriate registers. Where simultaneous planning applications may arise, the planning authority may make the applicant aware of this and it is the applicant's responsibility to ensure any additional necessary information is submitted to the planning authority, as required. For the avoidance of any doubt, consultation regarding any aspect of the planning application will be at the sole discretion of the planning authority and in accordance with Irish planning legislation and practice.

2.1. STUDY AREA DEFINITION

At the start of the pre-planning stage, the study area for the noise assessment shall be delineated by the developer. The developer must engage a competent person, as defined in the WEDGs for this task. The study area shall include the area within which the amenity of noise sensitive locations can potentially be disturbed by noise from wind energy developments. This shall be the greater of the following:

- An area within which the wind turbine noise level is estimated to be equal to or greater than a level of 30dB L_{A90} at up to 12 m/s wind speed; or

- An area contained within a perimeter line offset by 3,000 metres (3 km) from the outermost wind turbines in the proposed development or an adjacent existing or permitted wind energy developments.

It may be prudent to consider some specific noise sensitive locations marginally outside the study area due to propagation effects over water, a particular sensitivity or population density.

2.2 BACKGROUND NOISE MEASUREMENTS

2.2.1 Background Noise Monitoring Locations

At pre-planning stage, the wind energy developer shall identify noise monitoring locations at various locations throughout the study area in order to measure the background noise level. The locations should be chosen using the professional judgment of a competent person. The locations are to be representative of the varying conditions existing within the study area, including topography, buildings/ homes/noise sensitive locations, etc. For the avoidance of doubt, the noise monitoring locations shall include but not be limited to noise sensitive locations. The chosen locations should provide confidence all areas are fully considered in establishing the potential variation in background noise level across the study area.

The use of proxy or surrogate monitoring locations may be considered in the context of a proposed wind energy development to determine the background noise levels. Surrogate monitoring locations may be located closer to wind turbines than noise sensitive locations to help isolate wind turbine noise from background noise during the operation phase. The selection of surrogate noise monitoring locations shall be undertaken by a competent person and details shall be clearly stated in the acoustic report accompanying the planning application.

Background noise monitoring shall be carried out simultaneously, where practicable, at all monitoring locations and records of environmental factors (e.g. wind speed, wind direction, precipitation, temperature, etc.) shall be reported with the noise monitoring data.

The competent person shall determine the background noise levels in accordance with the methodology set out in the Institute of Acoustics' A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (hereafter the IoA GPG) and the related Supplementary Guidance Notes. Where the IoA GPG refers to 'daytime amenity' and 'night' hours, this is to be replaced with consideration of background noise period.

Under these guidelines a background noise curve will be utilised to set appropriate noise limits based on the background noise level at night. Where there are one or more existing wind turbines in the study area, the developer must exclude noise emissions from these turbines, by measurement or calculation, from the calculation of background noise levels to determine the background noise levels in accordance with Section 5 of the IoA GPG.

2.2.2 Noise Verification Monitoring Locations

The developer shall incorporate noise verification locations into the plans for the wind energy development. A minimum of four locations are to be identified for verification monitoring and are to be clearly identified on a drawing submitted at planning application stage. The noise verification locations are to be used to compare the results of the pre-construction wind energy development noise modelling with the actual noise levels at those locations during the full operation of the wind energy development operating at maximum output.

The results from the noise verification monitoring locations will be used as part of the compliance check with planning conditions. Surrogate noise verification locations may be required and it may be appropriate to establish such noise verification locations at or inside the site boundary. Boundary noise levels could also be utilised in situations where there may be problems with free access to noise sensitive locations for the taking of measurements. Where practicable noise verification locations should overlap with noise assessment locations. In some cases, it may be necessary to carry out noise verification measurements at other locations as a result of noise complaints.

2.2.3 Data Quality

Background noise level measurements shall comply with “IoA GPG Supplementary Guidance Note 1: Data Collection” and “IoA GPG Supplementary Guidance Note 2: Data Processing and Derivation of ETSU-R-97 Background Curves”, to determine background noise curves as required by the Guidelines. Where the IoA GPG refers to ‘daytime amenity’ and ‘night’ hours, this is to be replaced with consideration of day, evening and night time background noise level.

2.3 NOISE COMPLAINT PROCEDURE

Proposals to manage noise complaints shall be included in the planning information to be submitted by the developer. The proposal shall include a methodology for addressing a complaint from a location within the study area that may not have an associated background noise curve.

The procedure will require that the wind energy development operator must maintain a written record (electronically stored) of all noise complaints received relating to the operation of the wind energy development. This shall be included with the annual noise verification monitoring report. As a minimum the operator shall record:

- Date and time of complaint.
- Name and contact details of the complainant.
- Details of the nature of the complaint.
- Weather conditions (e.g. wind direction, wind speed, etc.) relevant at the time that the complainant became aware of the noise.
- Actions taken to address the complaint.
- The response by the wind energy development operator to the complainant.

The "Good Practice for Wind Energy Development Guidelines"[47], provides that there is an effective complaints procedure put in place by wind energy development operators in relation to all aspects of wind energy development projects where members of the public can bring any concerns they have about operational difficulties, including noise nuisance, to the attention of the wind energy development operator. Adherence to the Code of Practice will be a requirement under these Guidelines and should inform the development of a noise complaint procedure.

2.4 NOISE LEVEL PREDICTION

The competent person shall oversee the development of a noise prediction model for the wind energy development. The results of the noise prediction, along with supporting data shall be submitted in a report to accompany the planning application. The noise prediction modelling shall be carried out in accordance with the IoA GPG. A validated computer software program shall be used to generate the model, graphs, plots, and maps. Software validation shall be in accordance with ISO 17534[48]

[47] http://www.dccae.gov.ie/documents/Code%20of%20Practice%20community%20engagment.pdf

[48] ISO 17534-1:2015 Acoustics -- Software for the calculation of sound outdoors -- Part 1: Quality requirements and quality assurance, ISO/TR 17534-2:2014 Acoustics -- Software for the calculation of sound outdoors -- Part 2: General recommendations for test cases and quality assurance interface and ISO/TR 17534-3:2015 "Acoustics -- Software for the calculation of sound outdoors -- Part 3: Recommendations for quality assured implementation of ISO 9613-2 in software according to ISO 17534-1"

All input parameters to the model are to be clearly identified and the values used stated in the report. Where assumptions have been made they must also be clearly stated and the basis for the assumption supported with reasoned evidence and/or justifications.

The competent person shall consider the intensity of special audible characteristics that are to be included in the noise prediction model. This shall include the likelihood of occurrence of special audible characteristics, the magnitude of the effect including an evaluation of the turbine sound power data and provide for a penalty (which may be in the range 0 to 11 dB(A)) to be applied to the predicted noise level. The reasoning, supported by technical noise reports, and justification for the penalty shall be stated in the report.

The report accompanying the planning application shall include the requirements of Section 6 of the IoA GPG. The following information shall also be included in the report:

- Geographic location of each turbine considered in the report, i.e. easting and northing in Irish Transverse Mercator (ITM) coordinates.
- The background noise levels measured and/or calculated at noise sensitive locations, including all background noise level data used in the report. Background noise monitoring data shall be provided to the planning authority in an appropriate format, such as comma separated value digital files.
- Computer-generated noise level contour maps illustrating the existing and permitted wind turbines and noise sensitive locations for the entire study area.
- A table (see sample below at Table 2.1) of relative rated noise level ($L_{A\ rated}$) at varying wind speeds predictions with the proposed wind energy development in normal operation in the following format:

Table 2.1 - Background Noise Level and Relative Rate Noise Level at NSLs

Location 1	**Standardised wind speed at 10 metre height (m/s) within the site averaged over 10-minute periods**										
	2	3	4	5	6	7	8	9	10	11	12
Noise sensitive location 1 – background noise level (night)											

Noise sensitive location 1 – Predicted $L_{A\ rated}$ (night)											
Proposed Relative Rated Noise Limit											
Repeat above for all noise sensitive locations											

- A computer-generated noise level contour map illustrating the noise sensitive locations and the predicted L_{Arated} from the wind energy development in normal operation at 12m/s wind speed. The rated noise level prediction shall be for the night period. Should the developer wish to operate at higher noise levels during the evening or day time) separate tables shall be provided for these periods.
- A table of adjustment to the $L_{A\ rated}$ (@ 12 m/s wind speed) for wind speeds to be used with the noise level contour map. This will be used by the planning authority to determine compliance at intermediate wind speeds, i.e. wind speeds at which the RRNL is between 35 and 43 dB(A).
- A digital plot of the data (georeferenced DXF, SHP or other agreed file format) to allow the planning authority to overlay different maps and assess the cumulative impact.

Table 2.2 - Adjustment to Noise Contour Map for Lower Wind Speeds

	Wind speed m/s										
	2	3	4	5	6	7	8	9	10	11	12
Adjustment to predicted noise											0

level											

- Where other wind energy developments are present, the predicted noise level and proposed RRNL with all wind energy developments, including the proposed wind energy development, in normal operation at 12m/s wind speed.
- Where other wind energy developments are present, a computer-generated noise level contour map illustrating the noise sensitive locations and the predicted $L_{A\ rated}$ with all wind energy developments, including the proposed wind energy development, in normal operation at 12m/s wind speed.

The report shall include a schedule of commitments including the following:

1. A proposed noise monitoring and control procedure for the construction phase.
2. A clear statement that the wind energy development shall not exceed the predicted $L_{A\ rated}$ levels stated in the noise report.
3. A proposed detailed methodology for a post completion noise survey in accordance with the IoA GPG Supplementary Guidance Note 5: Post Completion Measurements for each turbine to be commenced within four weeks of commissioning of any turbine or group of turbines.
4. A map showing the noise monitoring locations for the ongoing operation phase of the wind energy development along with a detailed proposed noise monitoring and reporting procedure.
5. A proposed complaints handling procedure.

2.5 SUGGESTED PLANNING CONDITIONS

The following are sample noise related planning conditions that should be applied to wind energy developments which are granted permission.

2.5.1 Schedule of Commitments

The construction, operation and decommissioning of the wind turbines and ancillary equipment shall be undertaken strictly in accordance with the noise impact assessment and mitigation measures set out in the planning application documentation listed on this decision letter.

Prior to the commencement of development, a noise compliance monitoring programme, including any mitigation measures required to ensure compliance with the noise limits set out by this permission, shall be submitted to and approved in writing by the planning authority.

The results of the initial noise compliance monitoring shall be submitted to and approved in writing by the planning authority within 3 months of the first use of the development for the generation of electricity.

Reason: To protect the amenities of noise sensitive locations in the vicinity of the site and the environment during the all stages of the development.

2.5.2 Relative Rated Noise Limits

The Relative Rated Noise Limit (RRNL) is set at planning decision stage by the planning authority. The RRNL shall be the Proposed Relative Rated Noise Limit set out as Table 2.1 above in the table submitted with the planning application. The planning authority shall include a planning condition specifying the RRNL:

a. The rated noise level ($L_{A\ rated}$) from the combined effects of the development hereby approved shall not exceed the Relative Rated Noise Limit(s) (RRNL) identified in respect of each noise sensitive/monitoring location (measured outdoors) listed within a table included as part of the noise impact assessment hereby approved, and shall not exceed the values for the relevant integer wind speed set out in or derived from the background noise curves, tables and maps submitted with the planning application. For the avoidance of doubt, $L_{A\ rated}$ noise levels are to be measured as dB L_{A90} plus appropriate penalties for special audible characteristics, where relevant, as outlined in the approved noise impact assessment.

Reason: To protect the amenities of noise sensitive locations in the vicinity of the site.

2.5.3 Annual Noise Monitoring Report and Additional Noise Monitoring Locations.

An annual noise monitoring report shall be prepared by a competent person on behalf of the operator of the wind turbines for each calendar year, or part of a calendar year where the development commences during the calendar year that the wind turbines are operational. This report shall be submitted to the planning authority for recording purposes within 3 months of the end of the previous calendar year and held by the operator for inspection by the planning authority as required at any time. All annual reports shall be published on a website maintained by the operator but accessible to the public as soon as they are submitted to the planning authority.

The operator shall undertake noise monitoring at additional noise monitoring locations, which may include the relocation of existing noise monitoring equipment locations, as may be required at the discretion of the planning authority, in response to complaints relating to non-compliance. In the event of a complaint being received in relation to a noise sensitive location which was not included in the noise impact assessment submitted with the planning application, the planning authority may require the operator to undertake an assessment of the background noise level for that additional noise sensitive location, and the planning authority may impose noise limits based on a listed noise sensitive location previously approved where a similar background noise level is experienced. The operator shall provide any such additional background noise assessment as may be required by the planning authority within 1 month of such a request being made, and they shall install any such additional noise monitoring equipment as may be required by the planning authority within 3 months of such a request being made. Details of the additional or relocated noise monitoring locations shall be included in all subsequent annual noise monitoring reports.

Reason: To monitor the compliance of the development in respect of noise of the wind energy development on the amenity of noise sensitive locations in the vicinity of the site.

2.5.4 Construction and Environmental Management Plan

A Construction and Environmental Management Plan shall be submitted to and approved in writing by the planning authority prior to the commencement of development and the development shall thereafter be carried out in accordance with the agreed plan.

Reason: To protect the amenities of noise sensitive locations in the vicinity of the site and the environment during the all stages of the development.

2.6 NOISE VERIFICATION MONITORING

Noise verification monitoring (for the purposes of condition 2.5.2 and 2.5.3) shall be carried out on in accordance with the particulars included in the planning application, the IoA GPG and these

Guidelines. All verification monitoring locations (a minimum of four) are to be proposed in the planning application subject to the requirement for additional monitoring locations arising from a complaint. The verification monitoring locations will be used to compare the results of the pre-construction wind energy development noise model with the actual noise levels at those locations during the full operation of the wind energy development operating at maximum output. If the wind energy development is being made operational in phases over different years, then verification monitoring must be completed for that portion of the wind energy development that is operational in each year.

Verification monitoring is to be carried out under the following conditions:

- For wind energy developments with 25 turbines or more or with a total output of 50MW or more, continuous monitoring at a minimum of four locations is required.
- For all other wind energy developments (i.e. less than 25 turbines or less than 50MW total output), the planning authority shall specify one of the following two options:
    - quarterly monitoring at a minimum of four locations over a continuous period of two weeks in each quarter (suitable for single turbines or smaller developments), or
    - continuous monitoring at a minimum of four locations (suitable for developments with 5 or more turbines).

2.6.1 Compliance

The planning authority may, direct the operator, at any time during the operation of the development, to take any necessary measures, up to and including the taking of turbine(s) out of operation, where it is of the reasoned view that the development is not operating in compliance with the conditions attached to this permission, including the Relative Rated Noise Limit (RRNL) as set out in the planning application. In such case the operation shall not restart until the operator demonstrates to the satisfaction of the planning authority that any necessary measures have been taken to ensure that the development can operate in compliance with the approved noise levels. This shall include the discretion to take turbines out of operation and to allow for temporary switching on of the equipment during hours specified by the planning authority to allow for testing to take place for noise monitoring purposes.

2.7 NOISE MONITORING REPORTING

2.7.1 Quarterly Reporting

Where quarterly or continuous monitoring is undertaken, a quarterly noise verification report must be submitted to the planning authority within four weeks of the end of the quarter. The quarterly report must demonstrate compliance with the planning permission granted as conditioned.

The quarterly report must be signed off by a competent person with a declaration that the wind energy development is either compliant or non-compliant with the planning conditions. The report shall be submitted to the planning authority within four weeks of the end of the reporting period.

2.7.2 Annual Reporting

For all wind energy developments, an annual noise verification report must be submitted by the developer to the planning authority. The results of the noise verification monitoring must be compiled into an annual noise monitoring report by the operator. The annual noise monitoring report shall be prepared by a competent person on behalf of the operator for each year, or part of a year, that the wind energy development is operational. The report shall cover the period 1 January to 31 December inclusive. The report shall include all monitoring results within the reporting period. Any non-compliance shall be included in the report. The report shall be submitted by the developer/operator to the planning authority within four weeks of the end of the reporting period. The report shall include the following information as a minimum:

- Name, address and contact details of the competent person responsible for the preparation of the report.
- Monitoring locations (in ITM coordinates) with noise sensitive locations clearly identified. These must be as shown on the planning application. If alternative locations are to be used, these must be agreed a minimum of 8 weeks in advance of carrying out noise monitoring with the planning authority and supported with justified reasons.
- Monitoring strategy.
- Date, time and environmental conditions during monitoring.

- Results of the monitoring.
- Comparison against planning conditions and RRNLs.
- Noise complaints log.

The report must be signed off by a competent person with a declaration that the wind energy development is either compliant or non-compliant with the planning conditions.

With regard to noise complaints received by the wind energy development, the following information shall be reported in the annual noise verification report:

- Date and time of complaint.
- Name and contact details of the complainant.
- Details of the nature of the complaint.
- Weather conditions (e.g. wind direction, wind speed, etc.) relevant at the time that the complainant became aware of the noise.
- Actions taken to address the complaint.
- The response by the wind energy development operator to the complainant.

2.8 NON-COMPLIANCE

The developer must satisfy the relevant planning authority that they are compliant with the relevant planning conditions. Where non-compliance issues with the noise from the wind energy development are measured, the developer must comply with any requirements of the planning authority to undertake necessary measures up to and including taking the turbine(s) out of operation. The planning authority may approve a testing programme to demonstrate compliance before turbine(s) are returned to operational service.

Where there are any exceedances of permitted RRNL values, the developer must present a noise mitigation strategy to the planning authority within four weeks of the submission of the quarterly or annual noise verification report. The noise mitigation strategy shall provide details of how the noise from the wind energy development will be reduced to comply with the planning permission and conditions and a timeline for achieving this. Submission of the noise mitigation strategy does not alleviate the responsibility on the developer to ensure that the wind energy development operates within the granted planning conditions.

Where it is considered by the developer that the cause of the non-compliance is not attributable to the wind energy development, the preferred approach is for monitoring to be carried out during complete shut-down periods of the relevant turbine or turbines. Where isolation of background noise levels from wind turbine noise is particularly difficult, the developer may propose the use of surrogate noise monitoring locations. The selection of surrogate noise monitoring locations and conditions under which surrogate noise monitoring is undertaken are subject to the prior agreement of the relevant planning authority. For the avoidance of doubt, the planning authority must be satisfied and accept in writing any proposals from the developer with regard to demonstrating compliance with planning conditions.

3 CONSTRUCTION AND DECOMISSIONING NOISE CONTROL

Noise arising during the construction phase and decommissioning and reinstatement of wind energy development sites are similar in nature. The range and scale of the equipment required are broadly similar along with the conditions and hours of operation. The noise control measures adopted for both of these phases in the development can therefore be considered as similar.

Conditions relating to noise levels are attached to planning permissions for wind energy developments to protect the amenity of nearby noise sensitive locations. Conditions relating to noise should address the issues of:

- Level limits;
- Locations at which those limits apply;
- Time of day at which the limit applies;
- Parameters to be measured for control purposes; and
- Access to data generated by the monitoring programme.

It may be appropriate to attach a condition to control the hours in which construction may take place rather than attach conditions to control noise from the actual construction works, which are of a temporary nature. However, in attaching such a condition, it would be important to ensure that operational matters are taken into account, for example, the transport of exceptionally long loads at night to avoid traffic congestion.

3.1 CONSTRUCTION AND DECOMMISSIONING NOISE CRITERIA

With regard to the construction and decommissioning stages, it is reasonable that a compromise between the practical limitations of a construction project and the need to ensure an acceptable ambient noise level for nearby residents is achieved. Weekend and night time working may be necessary for the transportation and erection of turbine components in favourable weather conditions. In addition to this, it is likely there may be need for other works to be carried out at night time and weekends, including the commissioning phase and prior to handover for operation.

Construction activity outside normal business hours will require the explicit permission of the relevant local authority in accordance with the limits set out in Table 2 below. Any explicit permission for night or weekend working will give consideration to the potential disruptive effects there may be on nearby noise sensitive location and restrictions on noise and other adverse environmental emissions may be conditioned to any approval granted.

Annex E of BS 5228-1:2009 + A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 1*(BS 5228) presents various methods of determining the significance of noise effects due to construction works. Control of noise during the construction and decommissioning of wind energy developments will be carried out using the ABC method detailed in Annex E.3.2 of BS 5228.

The time periods correspond with the Environmental Noise Directive and WHO guidelines. Using the ABC method, the measured ambient noise level is rounded to the nearest 5 dB for the appropriate period (night, evening/ weekends or day). This is then compared with the estimated construction noise level. If the construction noise level exceeds the appropriate category value, then there is potential for a significant effect to occur. The example threshold for significant effects at noise sensitive locations is shown below in Table 2**.**

Table 2: Threshold of Significant Effect during Construction and Decommissioning

Threshold value period (L_{Aeq})	**Threshold value (dB)**		
	Category A	**Category B**	**Category C**
Night time (23:00-07:00 weekdays)	45	50	55

Evenings (19:00-23:00) and Weekends (13:00-22:00 Saturdays) and (07:00-19:00 Sundays)	55	60	65
Daytime (07:00-19:00 weekdays) and Saturdays (08:00-16:30)	65	70	75

(Based on: BS 5228 -1:2009 + A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise time periods modified as outlined in the text.)

The values in Category A, B and C are the threshold values to be used to determine the potential for significance at a noise sensitive receptor, based on ambient noise levels rounded to the nearest 5 dB. A receptor is categorised by comparing its rounded ambient noise level with the values assigned to Category A for the relevant time period and, is then categorised depending on whether the rounded ambient noise levels are less than, equal to, or higher than the values in Category A column, respectively. For example, if the rounded daytime ambient noise level is below 65 dB(A), then it is a Category A receptor and the threshold for potential significance is 65 dB(A). If the rounded daytime ambient noise level is equal to 65 dB(A), then the receptor is assigned to Category B and the threshold level is 70 dB(A).

In the event of construction or decommissioning noise exceeding these thresholds, work will cease until appropriate mitigation measures are put into effect to reduce noise levels to these thresholds.

Blasting activity may be required during the earthworks phase of construction. When blasting is required air overpressure from any required blasting shall not exceed a limit value of 125 dB(linear) max peak, with a 95% confidence limit when measured at the nearest noise sensitive location. No individual air overpressure value shall exceed the limit value by more than 5 dB(Linear).

A draft Construction and Environmental Management Plan (CEMP) shall be submitted with the planning application. The CEMP will address all activities likely to affect aspects of the environment including but not limited to noise, dust, odour, traffic, surface water run-off, risk of spillages, discharge of effluents etc. and will include proposed environmental protection measures such as monitoring, protection barriers, settlement, wastewater treatment, operational procedures and contingency measures. The CEMP will, as a minimum, incorporate the requirements listed below together with the requirements of statutory authorities:

- Standard environmental protection measures, including monitoring procedures, operational procedures and contingency measures, to reduce the environmental impact of construction activities.

- Limit normal working hours to 08:00 to 18:00 for weekdays and 09:00 to 13.00 on Saturdays during construction. No work shall take place at night-time, Sundays or bank holidays unless prior written approved permission is provided by the planning authority for a specific defined time period.

- Comply at a minimum with the provisions of BS 5228 in relation to noise levels on the construction site. The developer shall measure the background noise to include all routes, roads, lands and establish background noise before mobilization and during construction proposed monitoring methodology and frequency shall be specified in the CEMP.

- Vehicles using site access roads shall have their speed restricted, and this speed restriction must be enforced rigidly. On any un-surfaced site access road and on hard surfaced access roads that site management dictates speed shall be restricted to 20 km per hour.

- Any sub-Contractors employed on site will be required to comply with the CEMP for their specific area of work, albeit the developer will be held accountable.

In addition to the above the developer shall revise the CEMP to include any mitigation measures arising from planning conditions imposed by the planning authority.

GLOSSARY

Aerofoil: the cross-sectional shape of an object that, when moved through a fluid such as air, creates an aerodynamic force.

Alternatives: Description of alternative locations, alternative designs and alternative processes.

Anemometer: The anemometer measures the wind speed and transmits wind speed data to the Controller.

Ambient Noise: The average noise level over a given period of time, usually composed of sound from many sources, near and far.

Amplitude modulation: If a sound has a noticeable change in sound level which is of a regular and repeating nature, this sound pattern can in some cases be described as displaying amplitude modulation. An example would be the sound of waves crashing on the shore.

Approved noise sources: All other anthropogenic noise sources which may include; wind turbines, roads, railways, airports, EPA licensed activities, quarries and other industrial noise sources which have been approved (either by the grant of planning approval or other form of formal consent e.g. EPA licence) but have not yet been constructed or made operational.

Audible Frequency Range: The frequency range at which a person can hear. The human ear can distinguish sound at roughly 20 Hz - 20 kHz.

Background Noise Level: A measurement of the natural and anthropogenic noise already present within the environment in the absence of wind energy development operation.

Berm: An extended mound of soils, overburden or structure erected as a barrier to sight, sound or water.

Best Available Technology (BAT): The most effective and advanced stage in the development of an activity and its methods of operation, which indicate the practical suitability of particular techniques for providing, in principle, the basis for emission limit values, and in the case of an industrial emissions directive activity other additional licence conditions, designed to prevent or eliminate or, where that is not practicable, generally to reduce an emission and its impact on the environment as a whole", where:

'best', in relation to techniques, means the most effective in achieving a high general level of protection of the environment as a whole;

'available techniques' means those techniques developed on a scale which allows implementation in the relevant class of activity specified in the First Schedule to the EPA Act 1992, as amended, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced within the State, as long as they are reasonably accessible to the person carrying on the activity;

'techniques' includes both the technology used and the way in which the installation is designed, built, managed, maintained, operated and decommissioned.

Bin: A bin is a subset or group into which data can be sorted; in the case of wind speeds, bins are often centred on integer wind speeds with a width of 1 m/s. For example, the 4m/s bin would include all data with wind speeds of 3.5 to 4.5 m/s.

Blades: Blades lift and rotate when wind is blown over them, causing the rotor to spin. They are most commonly made of glass reinforced plastic or wood epoxy, but can be made of aluminium or steel. Modern turbines typically have three blades.

Blade Pitch: The pitch motor turns (or pitches) blades out of the wind to control the rotor speed, and to keep the rotor from turning in winds that are too high or too low to produce electricity.

Blade Pitch Actuator: This adjusts the pitch angle of a rotor blade.

Borrow Pit: An area of excavation of rock and/or soil material that is used elsewhere within the site development boundaries.

Brake: The brake stops the rotor mechanically, electrically, or hydraulically, in cases of emergency.

Broadband Noise: Noise whose energy is distributed over a wide section of the audible frequency range.

Built Environment: Refers to both architectural heritage and archaeological heritage.

Commissioning: The making fully operational of a project.

Competent Person: The competent person shall hold an appropriate qualification in acoustics, engineering, science or a related field along with a recognised professional qualification in accordance with the list of regulated professions in Schedule 1 of the European Union (Recognition of Professional Qualifications) Regulations 2017 (S.I. No. 8/2017) or those regulated by another EU Member State. The competent person shall also have a minimum of five years' experience with an appropriate combination of, expertise and knowledge of the latest and most appropriate scientific methodology and assessment procedures for the correct interpretation of acoustic data.

The competent person may delegate some tasks to suitably trained personnel. Suitably trained means holding an appropriate qualification in acoustics, engineering, science or a related field, and with a minimum of one years' post-graduate experience in acoustics, noise and vibration. The competent person shall supervise the work of less experienced personnel and ensure that it is carried out in accordance with these guidelines.

Controller: The controller starts up the machine at wind speeds of about 8 to 16 miles per hour (mph), equating to 3-4 metres per second and shuts off the machine at about 55 mph or 30 metres per second. Turbines do not operate at wind speeds above about 55 mph because they can be damaged by the high winds.

Cut-in Wind Speed: The wind speed at which a turbine produces a net power output. This is usually at hub height wind speeds of 4-5 metres per second.

dB (decibel): For the measurement of sound, decibels refer to the logarithmic scale in which sound pressure level is expressed relative to 20 MicroPascals. When measuring environmental noise, a weighting network is used which filters the frequency of sound, and is expressed as dB(A). The decibel scale is logarithmic. Every10 dB increase in sound level represents a doubling of loudness. A change of 3 dB is the minimum perceptible under normal circumstances.

dBA or dB(A): An "A-weighted decibel" - a measure of the overall noise level of sound across the audible frequency range (20Hz- 20 kHz) with A- frequency weighting (i.e., "A" weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

DCCAE: Department of Communications, Climate Action and the Environment.

Decommissioning: The final closing down of a development or project when it has reached the end of its operational/useful life.

Development Applications Unit: Unit of the Department of Culture, Heritage and the Gaeltacht, which includes the National Parks and Wildlife Service.

DHCPLG: Department of Housing, Planning, Community and Local Government.

DHPLG: Department of Housing, Planning and Local Government.

EIA: Environmental Impact Assessment: The process of examining the anticipated environmental effects of proposed project - from consideration of environmental aspects at design stage, through consultation and preparation of an Environmental Impact Assessment Report (EIAR), evaluation of the EIAR by a competent authority, the subsequent decision as to whether the project should be permitted to proceed, encompassing public response to that decision.

EIAR: Environmental Impact Assessment Report: A report or statement of the effects, if any, which the proposed project, if carried out, would have on the environment.

END: Environmental Noise Directive, Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise - Declaration by the Commission in the Conciliation Committee on the Directive relating to the assessment and management of environmental noise (as amended).

EPA: Environmental Protection Agency.

European Site: Designated European site, also known as Natura 2000 Sites and include Special Areas of Conservation (SAC) under EU Directive on the Conservation of Habitats, Flora and Fauna (92/43/EEC) known as The Habitats Directive, that is in the listing process, an agreed candidate or designated and Special Protection Areas under Council Directive 2009/147/EC on the conservation of wild birds known as The Birds Directive.

Existing or approved noise sources: Existing or approved noise sources includes; wind turbines, roads, railways, airports, EPA licensed activities, quarries and other industrial noise sources.

Flushes: Areas of vegetation that differ from surrounding vegetation and are influenced by moving ground or surface water.

Gearbox: The gearbox connects the low-speed shaft to the high-speed shaft and increases the rotational speeds from about 15-30 rotations per minute (rpm), to about 1,000-1,800 rpm; this is the rotational speed required by most generators to produce electricity. The gear box is a costly (and heavy) part of the wind turbine and modern design is based on "direct-drive" generators that operate at lower rotational speeds and don't need gear boxes.

Generator: The generator produces AC electricity. Off-the-shelf induction generators are generally used.

Geology: Science of the earth, including the composition, structure and origin of its rocks.

Habitat: Area in which an organism or group of organisms live.

Hub height: Height of wind turbine tower from the ground to the centre-line of the turbine rotor.

Hydrology: Science concerned with the occurrence and circulation of water in all its phases and modes.

Hertz: Hz: Unit of frequency of sound, in cycles per second. Frequency determines pitch of sound. (1,000 Hz = 1 kHz)

Impact: Degree of change in an environment resulting from a development.

Infrasound: Infrasound occurs naturally in the environment (e.g. wind sound effects) and is generated by many human activities and the operation of many types of machines (e.g. motor cars, washing machines etc.). Infrasound generally occurs at frequencies below the normal range of human hearing, namely less than about 20Hz. It has been demonstrated that modern wind turbines do not emit any perceptible level of infrasound.

Key Viewpoints: Places from which a development can be viewed that are crucial and sensitive with respect to observer numbers and interest.

LA90, T: LA90 is the A-weighted sound level that is exceeded for 90% of the measurement interval during the sample period (T) For example, during a measurement interval of 10 minutes (giving LA90, 10min), it is the noise level that is exceeded for ten minutes, thus excluding the highest level sounds which occur during the period. In practice the higher level sounds which are excluded would for example include a car passing, a dog barking or such other short-duration sounds unrelated to wind turbine-generated sound.

LAeq, T: LAeq, T is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T).

Land Use: The activities that take place within a given area of space.

Low frequency noise: The definition of low frequency noise can vary, but it is generally accepted to be within the range of 10Hz to 160Hz. Traffic noise would be considered to have low frequency content.

Megawatt: Used as a measurement of electrical generating capacity. A megawatt (MW) is equal to 1,000 kilowatts (kW) or 1,000,000 watts (W).

Mitigation: Measures designed to avoid, reduce, remedy or compensate for adverse environmental effects that are identified.

Monitoring: Repetitive and continued observation, measurement and evaluation of environmental data to follow changes over a period of time, to assess the efficiency of control measures.

Nacelle: The nacelle sits atop the tower and contains the key mechanical components of the wind turbine including the gearbox, generator, controller, and brake. A yaw mechanism is employed to turn the nacelle so that the rotor blades face the prevailing wind.

Natura 2000 Site: Designated European Site. In combination Special Areas of Conservation and Special Protection Areas will constitute Natura 2000 network of protected sites for habitats and species across the EU.

Natural heritage: Refers to habitats and species of flora and fauna.

Noise: Any sound that has the potential to cause disturbance, discomfort or psychological stress to a subject exposed to it. Described as "unwanted sound".

Noise Sensitive Location: A noise sensitive location is defined in the case of wind energy development as any location in which the inhabitants may be disturbed by noise from the wind energy development. This incorporates a dwelling, house, hotel or hostel, health building (providing patient services), nursing/retirement home, educational establishment, place of worship or entertainment, or other facility which may justifiably require for its proper use the absence of noise at levels likely to cause significant effects. This definition may include protected wildlife areas, areas of particular scenic quality or special recreational amenity importance designated in a Development Plan.

Pitch controlled: These are turbine controls included to rotate the angle of the blades depending on the wind speed in order to regulate output and rotational forces.

Photomontage: Image whereby an impression of a potential development is superimposed upon an actual photograph.

Protected Wildlife Areas: Habitats protected under The Wildlife Acts 1976 to 2018 (as amended), EU Directive on the Conservation of Habitats, Flora and Fauna (92/43/EEC) known as The Habitats

Directive, Council Directive 2009/147/EC on the conservation of wild birds known as The Birds Directive e.g. Natura 2000 sites, European sites, SACs, SPAs, Nature Reserve, Ramsar Sites and Wildfowl Sanctuaries.

Repowering: Renewing power plants that produce renewable energy, including the full or partial replacement of installations or operation systems and equipment for the purposes of replacing capacity or increasing the efficiency or capacity of the installation.

Rotor: Blades and hub together form the rotor.

RMP: Record of Monuments and Places, the county maps showing the archaeological sites and accompanying manuals.

RPS: Record of Protected Structures, a record of protected structures in the functional area of the Planning Authority and contains an identifying number and address for each protected structure and one or more maps which identifies the location of each protected structure.

SAC: Special Area of Conservation under Habitats Directive (92/43/EEC), designated for rare, vulnerable and endangered habitats and species (e.g. plants, mammals and fish), listed in Annexes I and II.

Scoping: Process of identifying the significant issues that should be addressed by a particular Environmental Impact Assessment.

Sensitivity: Potential for significant change to any element in the environment that is subject to impacts.

Shadow Flicker: Term used to describe the short-lived effect of shadows cast by rotating blades of wind turbines when the sun passes behind them, which occurs under certain combinations of geographical positions and time of day.

Sound Frequency: Sound comprises a range of frequencies extending from the very low, such as a rumble of thunder, to high frequencies, such as those generated by a small bell. Allowing for individual variation, the audible range of frequencies for the human ear is generally in the region of 20Hz to 20,000Hz.

Frequency weighting is the process by which sound levels are corrected to account for the non-linear frequency response of the human ear.

An A-weighted decibel measurement scale is frequently used as the basis for measurement and regulation as this scale is designed to approximate the response of the human ear over a range of frequencies.

Sound Pressure: Sound pressure is usually measured in A-weighted decibels, which are generally denoted as dB (A). The audible range of sound levels for humans is commonly considered to span from 0dBA, the hearing threshold, to about 120dBA, above which sound levels can cause pain.

The decibel scale is logarithmic and not linear in nature. This means that if, for example, two instances of the same sound level occur at the same time and each has a sound level of 30dBA, their combined level will be 33dBA, and not 60dBA.

Average sound levels in city street traffic would typically be about 65 - 80dBA, while a conversation between a small number of people would be about 60dBA. A quiet office would be in the range 50-65dBA, while the humming of a refrigerator when running would be around 40dBA.

SPA: Special Protection Area under Birds Directive (09/147/EEC), designated for bird species listed in Annex I of the Directive, in particular internationally important concentrations of migratory and wetland birds. Designation is focused on habitats of these species.

Stall regulated: These turbines have blades locked in place which do not adjust during operation. Instead the blades are designed to increasingly "stall" as wind speeds increase to control power output and protect the turbine from excessive wind speeds.

Substation: Connects the local electricity network to the electrical system of the wind energy project through a series of automatic safety switches.

Tonality: Tonal noise has been described as containing a discrete frequency component, most often of a mechanical origin. Examples can include the hum from an electrical transformer located at the base of a wind turbine, which can exhibit low frequency tones, the dial tone on a phone, a mid-frequency tone, and whistling which tends to comprise higher frequency tones.

Tower: Made from tubular steel, concrete, or steel lattice, the tower supports the structure of the turbine. Because wind speed increases with height, taller towers enable turbines to capture more energy and generate more electricity.

Transformer/Voltage Regulator: This is a device for changing the voltage of the alternating current. Electricity is typically generated at less than 1000 volts by the wind turbine and the transformer "steps up" this voltage to match that of the national grid. This may be housed either inside or alongside the tower.

VAC: Visual Absorption Capacity. This attempts to measure the inherent ability of a landscape to absorb development without loss of visual integrity, i.e., still maintain its visual character. The more complex the landscape, the higher the VAC.

Viewshed Reference Points: Those locations from where visibility of the proposed wind energy development might be provided.

Wind direction: Is the determinate in the design of the turbine. Upwind turbines face into the wind while downwind turbines face away.

Wire frame/wireline diagram: Computer generated diagrams that illustrate how development will appear upon landforms from identified viewpoints. A useful tool to illustrate visual impact, especially when used in combination with photographs from the same view.

Yaw drive: Orients upwind turbines to keep them facing the wind when the direction changes. Downwind turbines don't require a yaw drive because the wind manually blows the rotor away from it.

Yaw motor: The yaw drive is powered by the yaw motor.

ZVI: Zone of Visual Influence: Provides a visual representation, usually presented as a map with markings or colourings, of the area over which a site and/or a proposed development may be visible.

ZTV: Zone of Theoretical Visibility. The maps produced are theoretical because they estimate exposure of proposed development based upon landform data only, and take no account of intermittent screening by vegetation or structures. ZTV maps estimate visibility of the proposed development in the surrounding landscape and not its "visual influence".

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