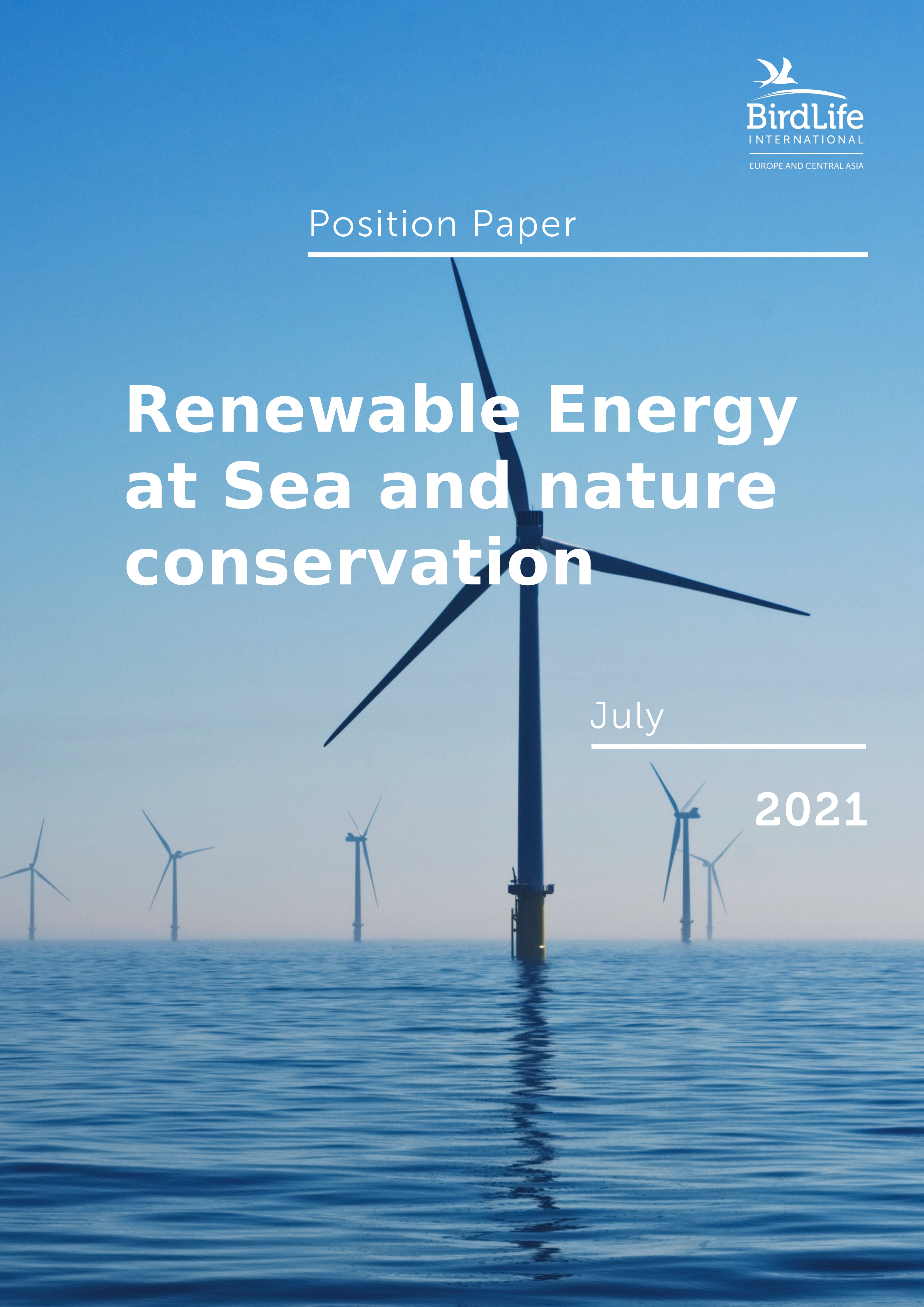

BirdLife INTERNATIONAL
EUROPE AND CENTRAL ASIA

Position Paper

# Renewable Energy at Sea and nature conservation

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## SUMMARY


- Climate change is a major threat to people and biodiversity, and renewable energy must be one of the foundations for combating climate change, combined with enormous increases in energy efficiency and reduced energy consumption.

- Nationally Determined Contributions submitted by Parties to the Paris Agreement should be ambitious and highlight how emission reductions will be achieved in the coming years through different appropriate measures, including the promotion of renewable energy and energy savings.

- Energy generation, including renewables, can have damaging consequences for nature if sited in important areas for wildlife and this is recognised across several international fora.

- National energy plans, with full Strategic Environmental Assessment ('SEA') and associated environmental sensitivity maps, should be used to indicate the expected relative contribution of the marine and terrestrial environments to achieving renewable energy objectives.

- In the marine environment, the ecological carrying capacity of a specific ocean basin or coastal zone determines and ultimately limits quantitative targets for offshore renewable energy developments[1].

- Renewable energy and related infrastructure projects must not add any further pressure to marine species or habitats with unfavourable conservation status.

- Combating climate change and implementing renewable energy may in some cases be an Imperative Reason of Overriding Public Interest, but a particular project should never be considered as such in order to be authorised in a protected area or to allow it to affect a species with an unfavourable conservation status.

- Instead, less damaging alternative projects should be enacted following a process that incorporates: (i) national assessment of emission reduction solutions, (ii) comprehensive data collection and modelling of habitats and species, (iii) production of ecological sensitivity map(s), (iv) Strategic Environmental Assessment and the creation of national government's Marine Spatial Plans (MSPs), and (v) project specific Appropriate Assessments (within the EU) and Environmental Impact Assessments before any project consents are issued.


1. Offshore renewable energy includes wind energy installation and other marine renewable energy technologies (e.g. tidal, wave, current, thermal, floating solar)

- Cumulative and in combination impacts, including impacts from other sectors and transboundary impacts, must be fully considered in the development of Marine Spatial Plans.

- Protected areas, together with a buffer zone, are generally highly sensitive, and therefore very unlikely to be suitable for any development, and should, for precautionary avoidance and legal certainty, be as much as possible excluded from any offshore renewable energy development and related electricity grid network infrastructure, where in some countries they already exclude offshore renewable energy developments in national decree.

- Independent rigorous research and monitoring should be implemented, funded by national governments and the energy sector in consultation with relevant experts, to improve our understanding of the impacts of offshore renewable energy developments on nature conservation in the marine environment.

Northern Gannet, *Morus bassanus* ©Yves Adam

# Offshore renewable energy in the wider context of climate policy and decarbonization

**1.** Climate change caused by excessive human greenhouse gas emissions is a major threat to people and is one of the major threats for biodiversity[2]. Parties to the Paris Agreement must submit Nationally Determined Contributions (NDCs) to the UN which, amongst other matters, highlight the contributions that Parties will make to the global effort to reduce emissions and combat climate change. NDCs should highlight how emission reductions will be achieved in the coming years through different appropriate measures, including the promotion of renewable energy.

**2.** Renewable energy is a key element for combating climate change by reducing dependence on fossil fuels, hence reducing greenhouse gas emissions and contributing to lower global temperature rise. Wind energy is one of the most technologically mature and marketed renewable technologies and focus is increasingly moving to the offshore environment[3]. A number of offshore grid options are also being planned and considered in order to help maximise offshore wind energy efficiency. In addition, other marine renewable energy technologies (tidal, wave, current, thermal, floating solar) are at differing stages of technical and economic viability and have advantages and disadvantages in terms of complementing the variability of wind energy production. Depending on their speed of development and their impacts on marine biodiversity these technologies may become increasingly important during the next decade.

**3.** Through the 2030 Climate and Energy Framework, the European Union has set targets to reduce greenhouse gas emissions by 40% compared to 1990 levels, to increase the share of renewable energy to 32% of final energy consumption, and to improve energy efficiency by 32.5% by 2030. In addition, the EU has committed to reduce its greenhouse gas emissions by 80-95% compared to 1990 levels and strive towards Climate Neutrality by 2050. The EU policy framework aims not only to combat the climate crisis, but also to increase energy efficiency and security. This will only be successful if renewable energy expansion and replacement of fossil fuels is combined with significant increases in energy efficiency and drastic reductions in energy consumption and material use.

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**2.** BirdLife (2015) BirdLife International's Position on Climate Change http://www.birdlife.org/sites/default/files/attachments/birdlife_climate_change_position_lores-november-2015.pdfhttp://www.birdlife.org/sites/default/files/attachments/birdlife_climate_change_position_lores-november-2015.pdf

**3.** Innovation is continuing to improve the feasibility of wave and tidal technologies but deployment at scale is currently not considered commercially viable.

**4.** Within the EU, BirdLife considers that National Energy Plans (NEPs), with full Strategic Environmental Assessment (SEA) and associated environmental sensitivity maps, should be used by Member States to identify the relative contribution of the marine and terrestrial environments to achieving renewable energy objectives and to steer the development of renewable energy and associated infrastructure. Other national or subnational instruments such as renewable energy capacity auctions, electricity grid plans, spatial land-use and energy plans, together with EU planning instruments for river basins and marine areas, should be used (with SEA in the case of the different plans) to identify clearly how the renewable energy priorities identified in NECPs will be met with minimal risk to biodiversity and other environmental objectives. For individual projects, Environmental Impact Assessments (EIAs) and licensing/permitting procedures should determine more site-specific issues.

**5.** As Parties to the Paris Agreement, all non-EU countries in the Europe and Central Asia Region must present NDCs which indicate their commitment towards meeting global emission reductions and other internationally agreed goals. Outside the EU, national climate and energy objectives and planning processes may differ, but similar climate and energy targets and planning, and environmental assessment provisions, should be followed.

**6.** Energy infrastructure for primary energy generation and distribution, including renewables and related grid networks, can have damaging consequences for nature[4] if sited in important areas for wildlife. However, with careful planning, site selection and management, wind power can make a significant contribution to reducing climate risks to nature and people with minimal short-term conservation risks. Offshore wind and other marine renewable energy developments, and related network and other energy infrastructure, all need to be planned, built and operated with respect for nature conservation and according to ecological capacities if they are to provide a sustainable solution to climate change. It is not only site selection of offshore renewable energy developments that is of critical importance in the marine environment, the related service traffic also needs to be carefully assessed and regulated prior to granting permits. Issues such as the service ships' specific route (avoiding protected areas), frequency, seasonal timing (avoiding ecologically sensitive times in the respective areas) and speed (including impacts from underwater noise) need to be evaluated.

**7.** In order to help minimise impacts on the natural environment from the transition to a low carbon energy future, EU energy demand needs to be understood through sound scenario modelling to 2050 in the EU Long Term Strategy based on updated ambitious 2030 climate targets and the achievement of net zero by 2050. Scenario modelling must consider the ecological carrying capacity of the sea and how to integrate all marine and commercial uses in line with strictly protecting marine areas for conservation purposes, and the results used to inform the role that offshore energy needs to play in the renewable energy mix.

**4.** BirdLife (2015): Fighting Climate Change Protecting Nature – BirdLife Europe's priorities for the EU Climate and Energy Policy to 2030. http://www.birdlife.org/sites/default/files/attachments/01-2022.pdf http://www.birdlife.org/sites/default/files/attachments/01-2022.pdf

Future scenarios should therefore be based on assumptions that take into account the latest scientific research and scenario-related work under both the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) as well as ecological limits. A focus is needed on energy efficiency, grid flexibility and maximising the potential of renewable energy installations to minimise the need for new generation capacity and infrastructure. Essential new generation and other infrastructure needs to be carefully planned so that both the mix of generation types and the location of new development have minimal impacts on the natural environment as a core objective alongside reducing carbon emissions. Projected renewables scenarios must not impede achieving the goals of the Biodiversity Strategy for 2030, which entails legally protecting a minimum of 30 % of the EU's sea area with at least 10 % of the EU's sea being strictly protected.

**8.** Renewable energy installations and electricity grid network infrastructure must comply with environmental legislation, and in addition must seek to maximize synergies across all relevant legal frameworks. In the EU, this includes achieving the objectives of the Birds, Habitats, Marine Strategy Framework and Marine Spatial Planning Directives. International legislation and Multilateral Environmental Agreements (MEAs) have also placed considerable emphasis on avoiding potentially damaging effects of renewable energy developments. Under the 2015 Paris Agreement on Climate Change, all Parties committed to ensure that environmental integrity is maintained when taking measures to reduce greenhouse gas emissions, with particular reference to biodiversity[5]. The European Commission has recognised the impacts of renewable energy infrastructure on nature, and has issued a guidance document[6] which intends to help wind energy developers comply with the Birds and Habitats Directives. The topic has also been raised under several international conventions, notably the Bern Convention, the Convention on Migratory Species (CMS) and The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA).

**9.** There has been insufficient research and data collection regarding the negative impacts of renewable energy infrastructure on biodiversity. It is imperative that independent rigorous research and long-term monitoring, including during the construction process, is implemented, funded by national governments and the energy sector, in consultation with relevant experts and with the participation of civil society, to improve our understanding of the impacts of renewable energy installations on biodiversity and nature conservation. Special attention needs to be given to migration routes, breeding grounds, and foraging areas. The seasonal timing of construction, as well as operational and maintenance activities, need to be closely managed in line with ecological boundaries and biodiversity needs, in particular the presence of migratory species.

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**5.** Recital, paragraph 13. Article 4, point 13. Article 6, point 1 and point 2. https://unfccc.int/sites/default/files/english_paris_agreement.pdf

**6.** European Commission  Guidance document on wind energy developments and EU Nature legislation : https://ec.europa.eu/environment/nature/natura2000/management/docs/wind_farms_en.pdf

**10.** Renewable energy and related infrastructure projects must not add any further pressure to species or habitats with unfavourable conservation status. To achieve this the role out of renewable energy at sea will often need to be preceded and accompanied by targeted species inventories and habitat protection and restoration programmes carried out or coordinated by national or regional governments. In some cases, project proponents may fund this directly or indirectly.

**11.** Individual/isolated environmentally damaging renewable energy or electricity grid network infrastructure installations should not be permitted because of Imperative Reasons of Overriding Public Interest or because of "common interest" where less environmentally damaging alternative projects and non-generation measures can be delivered by National Governments. In this case individual projects cannot be considered essential. Compulsory sustainability criteria that take into account nature conservation, climate protection and social needs must form the basis for decisions on approval and financial support for Projects of Common Interest and Projects of Mutual Interest[7].

*Offshore wind farm ©Gritte/Unsplash*

7. Project of Common Interest (PCIs) and Projects of Mutual Interest are key cross border infrastructure projects that link the energy systems of EU and neighbouring countries. The legal basis for these projects are the Trans-European Networks for Energy (TEN-E) policy. Based on their status, these projects benefit from accelerated planning and permit granting and can apply for funds from the Connection European Facility (CEF).

**12.** BirdLife considers/recommends that the following process should be followed:

**a.** Firstly, national assessment of emission reduction solutions with prioritisation of action on low impact (non-generation) options.
**b.** Secondly, comprehensive data collection and modelling of habitats and species on status and trends, protection category and distribution features.
**c.** Thirdly, production of ecological sensitivity maps based on this data and modelling.
**d.** Fourth, a Strategic Environmental Assessment and the creation of national Marine Spatial Plans (MSPs) identifying low sensitivity areas for energy infrastructure.
**e.** Fifth, project specific Appropriate Assessments (within the EU) and Environmental Impact Assessments (as required by current legislation) before any project consents are issued.
**f**. Finally, project consents should only be granted where Appropriate Assessments and Environmental Impact Assessments determine that projects will not have a significant adverse effect on the conservation objectives of the species and habitats (i.e. site integrity).

**13.** All parties involved in renewable energy development should contribute to this process. It should be carried out to a high professional standard and in a scientifically sound way, drawing on the best available relevant expertise and gathering new data where it is required for a robust assessment. To guarantee the independence of technical experts carrying out the assessments, this work should be contracted by the competent authority rather than a developer, but the costs of the assessment could be charged to project proponents. Conservation NGOs (e.g. national BirdLife Partners) should be consulted from an early stage in order to ensure the best possible results for both renewable energy development and nature conservation.

**14.** The cumulative and in-combination impacts of activities (including from other sectors and transnational impacts) must be a component of Strategic Environmental Assessments, Marine Spatial Plans, and Appropriate Assessments, and considered in the context of the current, already degraded, status of the marine environment[8]. The overall reduction of cumulative environmental impacts of anthropogenic activities and reaching the Good Environmental Status (GES) according to the MSFD could facilitate offshore renewable energy expansion.

**15.** In addition, research and development of new, potentially lower ecological impact technologies, for example bladeless or vertical axis wind turbines, and lower-impact floating structures as well as as-yet-unseen innovations, should be encouraged and supported to minimise potential impact further. However, there are also technologies for which the impacts are still largely unclear, and which should not be encouraged for use in marine ecosystems e.g. floating solar. Independent and further research on environmental impacts need to be funded and carried out before enabling investments. Without sufficient information, the precautionary principle must be applied.

8. http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014DC0097

# Renewable energy at sea and wildlife

**16.** European seas are driven by human impact and have failed to reach GES in 2020. Offshore renewable energy installations include offshore wind power, tidal power and wave power, can have additional detrimental effects on the marine environment, as evidenced by a number of reviews on the effect of wind farms on birds[9,10] , and peer-reviewed studies[11]. The evidence highlights the following impacts:

a. Displacement and disturbance. Displacement and disturbance can occur during the construction, operation and decommissioning of energy installations, either due to the presence of the structures themselves and/or associated infrastructure or human activity. The additional shipping traffic during construction and thereafter for regular maintenance can lead to considerable disturbance. Noise pollution can be particularly problematic for fish and cetaceans, through pile-driving and transmission of turbine blade rotation noise to the water column.

b. Collision mortality. Offshore renewable energy installations, particularly windfarms, may lead to significant collision mortality for sensitive species, especially in the case of inappropriately sited or poorly designed installations. Much work is needed to monitor collisions with offshore installations to validate the predictions of collision risk models, and to develop mitigation solutions.

c. Habitat destruction and alteration. Habitat destruction and alteration can be associated with the installation of infrastructure, for example through the introduction of artificial hard substrate to naturally soft substrate/sandy areas of the seabed. The effect of this could be significant, particularly if local oceanographic processes are altered (i.e. altering of currents and mixing of different water layers), introducing changes to benthic and pelagic habitats and influencing prey abundance and availability, with implications for trophic cascades.

d. Barrier effects. Barrier effects can be caused by installed devices, particularly wind turbines (both in isolation and in-combination) disrupting or diverting flight lines or other links between feeding, roosting and nesting areas, or by blocking migratory routes, resulting in increased energy expenditure for species as they divert around the structures.

**17.** Most of these effects have been insufficiently studied at existing offshore renewable developments to enable accurate quantification of their magnitude or the subsequent implications for marine populations. Many current predictions of impacts are based on modelling approaches that are not validated by empirical data. Significant investment into further research into these issues is urgently required (see Research and Monitoring section below).  It is therefore essential that assessments adopt the precautionary principle wherever there is uncertainty.

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**9.** Gove B, Langston RHW et al (2013) Wind Farms and Birds: an updated analysis of the effects of wind farms on birds, and best practice guidance on integrated planning and impact assessment. https://wcd.coe.int/ViewDoc.jsp?id=2064209&Site=. p 3-4.

**10.** Mendel B, Schwemmer P, Peschko V, Müller S, Schwemmer H, Mercker M, Garthe S (2019): Operational offshore wind farms and associated ship traffic cause profound changes in distribution patterns of loons (Gavia spp.). Journal of Environmental Management 231: 429-438.

**11.** RECIAN, W. J., INGER, R., ATTRILL, M. J., BEARHOP, S., GODLEY, B. J., WITT, M. J. and VOTIER, S. C. (2010), Potential impacts of wave-powered marine renewable energy installations on marine birds. Ibis, 152: 683–697. doi:10.1111/j.1474-919X.2010.01048.x

# Marine electricity grid network infrastructure and wildlife

**18.** Electricity grid network infrastructures such as sub-sea cabling and powerlines can have detrimental effects on marine wildlife and habitats. In particular, based on a review by the OSPAR Commission[12], the evidence suggests:

**a.** Disturbance and habitat damage. During construction, sub-sea cable laying disturbs, and can potentially damage, seabed and shoreline habitats. Whilst these impacts are generally expected to be localised and temporary, the main long-term impact of submarine cables is the presence of the cable itself and any accompanying protective structures. These can provide artificial hard substrate habitats that attract flora and fauna that may not be typical of the area. Since this effect is confined to the cable route itself, such change is not likely to be significant. However, possible cumulative impacts as the scale/quantity of subsea cabling in the marine environment continues to increase are not fully understood. In tidal environments and those with strong currents it is particularly difficult to ensure that cables stay permanently submerged near the coastline – regular intervention is often necessary to submerge the cables again, which can lead to extended disturbance and habitat damage.
**b.** Electromagnetic fields and thermal radiation: Submarine cables, particularly power transmission lines, may have operational impacts in the form of electromagnetic fields and thermal radiation. The effects of the electromagnetic fields on migrating species (fish – especially elasmobranchs – and marine mammals) are not sufficiently understood, and significant impacts cannot be excluded. Field studies on changes in benthic communities and microbial sediment processes due to increased temperatures in the immediate vicinity of sub-sea cables have not been conducted. Until the effects on the overall environmental state are better known, a precautionary approach is essential.

**19.** The scale of artificial hard substrate associated with renewable energy is, so far, relatively small and localised (the impacts of which are captured above). However, much larger artificial constructions are being proposed to support a substantial increase in renewable energy deployment. This includes proposals for artificial islands and energy hubs, which are likely to fundamentally change the ecology of the areas in question. The scale of impacts from such proposals is not well understood and detailed studies will be required to ensure that they do not adversely affect or hinder the delivery of conservation objectives.

**20.** It is also important to note that the presence of renewable energy infrastructure can displace other marine activities, such as fishing. This could have knock-on impacts, e.g. on prey availability, extending the impacts of a development far beyond its initial footprint. It is vital that such in-combination effects are therefore properly evaluated and incorporated into assessments, especially in Marine Spatial Plans.

12. http://qsr2010.ospar.org/media/assessments/p00437_Cables.pdf

# Sensitivity Mapping and Marine Spatial Planning

**21.** The development of renewable energy infrastructure across Europe should be considered within a framework for sustainable development that prioritises energy demand reduction and efficiency, a mix of renewable energy sources to meet an overall increasing electricity demand (as heating and transport sectors are transformed) and the protection of biodiversity. Such an approach will require individual countries and the EU as a whole to assess the potential contribution of different clean energy sources to the energy mix and integrate these assessments within a strategic and ecosystem-based marine spatial planning approach that considers impacts on species and habitats, and climate. Such an assessment is needed as soon as possible before further areas of seabed are leased to developers, in order to encourage development in the least damaging places and avoid wildlife hotspots. Marine spatial planning is a useful tool for achieving these environmental objectives but is just one pillar towards their delivery and not an end in itself.

**22.** Renewable energy installations and electricity grid network infrastructures can be a threat to species populations, their habitats, and migration routes and bottlenecks. Determining the sensitivity of biodiversity to these developments is a fundamental requirement prior to the development of marine spatial plans. These sensitivity assessments should take place nationally and ensure regional cooperation to ensure assessments are carried out at a sea basin scale in an effort to decrease the negative effects of plans/programmes on marine biodiversity and aid decision-making. Such a map should identify known potentially sensitive locations, locations that are not considered to have adverse implications for wildlife, and locations for which further information is needed to determine whether construction and operation of renewable energy installations in these areas are compatible with biodiversity conservation priorities. All stages of the life cycle and the habitats and locations that support essential functions (including – for example in the case of birds – feeding, breeding, moulting, resting, and non-breeding, including migration stopovers) need to be taken into account. Sensitivity maps should be regularly updated and should be funded and promoted by national, regional, or local governments. Energy planning should prioritise use of available low ecological sensitivity areas.

**23.** Protected areas are fundamental instruments to stop biodiversity loss[13] and a standard feature of sensitivity maps. These areas, together with a buffer zone[14], are generally highly sensitive, and therefore very unlikely to be suitable for any development, and should, for precautionary avoidance and legal certainty, be as much as possible excluded from any offshore infrastructure development. In some countries such as Germany, marine spatial planning already excludes offshore windfarms from marine protected areas.

**24.** Cumulative and in-combination impacts, including impacts from other marine-related sectors and transboundary impacts, must be fully considered in the development of marine spatial plans. The already degraded status of the marine environment[15] must also be considered and the appropriateness of renewable energy development in an area linked to the conservation status of species and habitats. Renewable energy projects must not add further pressure to species or habitats with unfavourable conservation status. To achieve this the role out of renewable energy at sea will often need to be preceded and accompanied by targeted species and habitat protection and restoration programmes carried out or coordinated by national or regional governments. In some cases, project proponents may fund this directly or indirectly.

**25.** Despite strategic level marine spatial planning, project specific detailed assessments will always be necessary to determine the appropriateness of individual projects. See below.

# Impact assessment

**26.** National, regional and local governments have to undertake Strategic Environmental Assessments (SEA) of all offshore renewable energy and network infrastructure plans and programmes that have the potential for significant environmental impacts. SEAs should start at the earliest stages of marine spatial planning development and be an iterative process that continues throughout all stages. If there are potential trans-boundary effects, then international co-operation with other governments must be sought. The scale of SEAs should be determined by consideration of the likely biological and ecological scale of potential impacts. SEAs must be used to inform strategic site selection for renewable energy generation (a plan) and should identify the information needs for individual EIAs/AAs. Marine spatial plans should not remove the obligation to conduct detailed project specific assessment before consents can be issued. Key stakeholders, including BirdLife partners should be consulted throughout this process.

13. IPBES (2019): Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo (editors). IPBES secretariat, Bonn, Germany.
14. https://www.ftz.uni-kiel.de/de/forschungsabteilungen/ecolab-oekologie-mariner-tiere/laufende-projekte/offshore-windenergie/Seetaucher_Windparkeffekte_Ergebnisse_FTZ_BIONUM.pdf
15. http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014DC0097

**27.** Appropriate Assessments (AA)[16] (under EU legislation), in accordance with the requirements of Article 6 of the Habitats Directive, have to be carried out for all renewable energy and network plans/programmes if it cannot be excluded, on the basis of objective information, that the plan or programme will have a significant effect[17] on a Natura 2000 site. For marine IBAs, where Member States have failed so far to designate these as marine SPAs, only the stricter provisions of Art. 4 (4) of the Birds Directive apply.

**28.** All projects should be screened to determine whether significant environmental impacts are likely. This screening should apply suitable selection criteria[18]. Comprehensive Environmental Impact Assessments (EIAs) must be undertaken for all proposed offshore renewable energy developments, including associated infrastructures (e.g. powerlines, access roads onshore) for which the screening process indicates a need.

**29.** If after thorough consideration, including after undertaking sensitivity analysis, there is still the possibility that a proposed offshore renewable energy installation can have a significant effect on a marine SPA, SAC and/or marine IBA, the plan should undergo an Appropriate Assessment[19] (or equivalent where the EU legislation does not apply).

**30.** In all environmental assessments needed (SEAs, EIAs and Appropriate Assessments), the cumulative impacts of the plan, programme or project in question must be assessed in combination with other plans, programmes and projects in the area (both for consented and built wind farms and other developments) in order to take account of in-combination and cumulative effects of existing and proposed projects (including transnational projects and other related maritime anthropogenic activities).

**31.** All sensitivity mapping and assessments should be carried out to a high professional standard and in a scientifically sound way, drawing on relevant expertise. To guarantee independence of the technical experts carrying out the assessments, this work should preferably be contracted by the competent authority (through a neutral, external verifying authority) rather than the project proponent. The competent authority should charge the costs to the project proponents. Where this is not ensured, the sensitivity mapping must at least be examined by independent technical experts, and the assessments only be adopted if a positive opinion is provided. Conservation NGOs (e.g. national BirdLife Partners) should be informed and consulted from an early stage in order to ensure best possible results for both renewable energy development and nature conservation.

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**16.** If a proposed development is likely to have a significant effect on any of the SPAs/Natura 2000 site's qualifying features of interest, an Appropriate Assessment is required. Further, if from the Appropriate Assessment, it cannot be ascertained that there will not be an adverse impact, then the wind farm should not proceed. It seems impossible not to find alternative locations and it is unlikely that an individual wind farm will give grounds for "imperative reasons of overriding public interest".
**17.** The meaning of "significant effect" is clarified in the Judgement C-127/02 ("Wadden Sea ruling", European Commission vs. The Netherlands) as an effect that is likely to undermine the site's conservation objectives.
**18.** In particular, by reference to the selection criteria set out in Article III of Directive 85/337/EEC on the 'Assessment of certain public and private projects on the environment', as amended by Directive 2014/52/EU).
**19.** Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, article 6(3) and 6(4).

# Research and monitoring

**32.** There remain substantial and concerning ecological data gaps in relation to the interactions of renewable energy development in the marine environment and wildlife. Further research to improve our understanding of impact risks, and reduce uncertainty, is vital before continuing large-scale offshore energy planning and to approach ecological carrying capacities of marine ecosystems. Thorough monitoring of the impacts existing projects are having is also essential. Data collected should be shared for the improved understanding of all parties. Only by improving the knowledge base can a truly sustainable energy transition be ensured.

**33.** Independent rigorous research and monitoring should be implemented, funded by national governments and the energy sector, in consultation with relevant experts, to improve our understanding of the impacts of renewable energy installations on nature conservation. Special attention needs to be given to migration routes, breeding grounds, and foraging areas. National governments should provide marine spatial plans, SEAs, EIAs and appropriate assessments, including an English summary, that are readily and publicly available along with monitoring results. This should be an iterative process that will inform decision-making, appropriate site selection and renewable energy installation design. The European Commission should ensure that all Member States' Marine Spatial Plans/SEAs/AAs/EIA summaries and monitoring results are presented on a central website to ensure transparency and provide high quality data.

**34.** The European Commission should provide sufficient funding and encourage scientific research, especially into the cumulative effects of renewable energy installations and ecological carrying capacities to further inform appropriate seascape level planning. The results of research should be published in international scientific journals to ensure wider dissemination.

**35.** Research and pre-, during- and post-construction (operational) monitoring are needed to investigate a project's effects and potential population level impacts on birds, other marine species, and habitats, either because of direct mortality or because of reduced fitness or reduced reproductive output. Research and monitoring effort should examine:

- a. collision mortality,
- b. disturbance, including displacement from the area around the installations,
- c. barriers to movement between feeding, breeding, wintering and moulting areas,
- d. habitat loss, change or damage,
- e. The best mitigation options and the effectiveness of the mitigation measures finally adopted.

**36.** Research particularly needs to focus on measuring the real impacts of offshore renewable energy installations (including mitigation measures) to test the predictions of the models used in impact assessments (e.g. models of collision risk, displacement and population level impacts), and refining modelling methods accordingly.

**37.** There is a need for studies at individual installations and for assessment of cumulative impacts of multiple installations. The outputs of studies should be presented in a standardised way, and any changes to standardised study methods must be extremely carefully designed to enable before-after comparison and to facilitate comparison of different sites. Standardised studies should lead to scientifically robust assessments and should use rigorous monitoring methods, employing power analysis at the study design stage to ensure that the monitoring can detect the changes it is designed to measure.

**38.** There is a need to encourage ongoing technological innovation to maximise the efficiency of renewable energy installations, to require replacement of old installations with more efficient ones (provided that the old installations were appropriately sited). Research and development of new technologies[20] as well as as-yet-unseen innovations, that may have the potential to reduce impacts should be encouraged and supported.

**39.** There is a particular need for better cooperation between different developers of offshore projects, national authorities, scientists/researchers and NGOs. Relevant monitoring data needs to be exchanged and published transparently to ensure a coordinated and environmentally-sound energy transition across Europe.

*Scientists on boat ©SEO/BirdLife*

20. Examples of such developments include bladeless wind turbines and low-impact floating structures