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COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

Offshore Wind Energy: Action needed to deliver on the Energy Policy Objectives for 2020 and beyond

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1. OFFSHORE WIND ENERGY — A SEA OF UNEXPLOITED OPPORTUNITIES

Wind energy will play an essential role in meeting the objectives of the new Energy Policy for Europe. Today electricity from wind provides a substantial share of total electricity production in only a handful of Member States, but its importance is increasing: more than 40% of all new electricity generation capacity added to the European grid in 2007 was wind, making it the fastest growing generation technology except for natural gas[1]. The modelling scenario used for the Second Strategic Energy Review[2] suggests that wind will represent more than one third of all electricity production from renewable energy sources by 2020 and almost 40% by 2030, representing an accumulated investment of at least 200-300 billion Euros (or about a quarter of all power plant investments) by 2030.

The Commission's Communication of 2007 on An Energy Policy for Europe[3] stated that it will be necessary to develop further the use of oceans and seas to promote the EU's energy goals, given their potential to support the generation of energy and to diversify energy transport routes and methods. **While land-based wind energy will remain dominant in the immediate future, installations at sea will become increasingly important**. Compared to onshore wind, offshore wind is more complex and costly[4] to install and maintain but also has a number of key advantages. Winds are typically stronger and more stable at sea than on land, resulting in significantly higher production per unit installed. At sea, wind turbines can be bigger than on land because of the logistical difficulties of transporting very large turbine components from the place of manufacturing by road to installation sites on land. Wind farms at sea also have less potential to cause concern among neighbouring citizens and other stakeholders unless they interfere with competing maritime activities or impact negatively on important marine environmental interests. In fact, wind farms at sea may be advantageous to protect marine ecosystems and may generate synergies with other emerging uses of the sea such as offshore aquaculture, which can benefit from the substructures of wind farms.

The **wind resources over Europe's seas represent a vast, indigenous source of clean, renewable energy**. By generating electricity without fossil fuel and by creating jobs and growth in a sector in which European businesses are global leaders, **offshore wind can make a significant contribution to all three key objectives of the new Energy Policy**: reducing greenhouse gas emissions, ensuring security of supply and improving EU competitiveness.

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1 Source: "Pure Power" by European Wind Energy Association (EWEA).
2 COM(2008) 738.
3 COM(2007)1.
4 See comparison of technology costs in SEC(2008) xxx.

In physical energy terms the wind resource could theoretically cover Europe's entire electricity demand. However, the variability of wind, together with other technical, political or economic challenges and constraints in practice determine the pace and extent to which the significant potential is harnessed. Today, the potential for offshore wind energy is largely untapped: even excluding potential deepwater deployments based on floating foundations, **the potential exploitable by 2020 is likely to be some 30-40 times the current installed capacity[5], and in the 2030 time horizon it could be up to 150 GW[6], or some 575 TWh**. A proactive policy is necessary to ensure that this opportunity is seized.

While this Communication addresses specifically the actions needed for a large deployment of offshore wind, many of the challenges and initiatives presented are also of relevance for other EU offshore renewable energy resources, such as tidal, wave, thermal and marine current energy. These offshore energy resources, although less developed than wind energy, are also emerging and will be able to contribute to the goals of Europe's Energy Policy.

In this context the scope for synergy between Europe's energy policy and the new EU integrated maritime policy[7] is wide and is likely to increase in the future. The fundamentals of both policies are the same: both aim for an integration of economic development and environmental protection. If joined up, they will allow a better exploration of the geopolitical value of Europe's oceans and seas for energy security, competitiveness and sustainability[8].

2. AN EMERGING MARKET FACED WITH MANY CHALLLENGES

2.1. Improvements to the overall framework are on the way

Like other renewable energy technologies offshore wind needs clear, stable and favourable framework conditions if it is to develop its potential in competition with conventional energy sources. At EU level, the main regulatory instruments to provide that have so far been the general internal electricity market legislation[9], the "Renewable Electricity Directive"[10], the EU Emissions Trading Scheme[11] and the Community guidelines on state aid for environmental protection[12].

This existing framework is developed in the Commission's **"third internal energy market package"** of October 2007[13] and in the **"energy and climate package"** presented in January 2008[14]. The **timely adoption and implementation of these two packages will form the EU's main contribution to promoting offshore wind** and renewable energy in general. The improvements proposed include binding targets, instruments to encourage stronger regional

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5 Of the 56,5 GW installed in the EU at the end of 2007 only 1,1 GW was offshore (Source: EWEA).

6 The modelling work performed for the Second Strategic Energy Review suggest some 31 GW by 2020. EWEA's "low", "medium" and "high" estimates published in March, are 20, 35 or 40 GW by 2020, and 40, 120 or 150 GW by 2030, respectively. The European Environment Agency is expected to publish an independent resource estimate in late 2008.

7 COM(2007) 575, 10.10.2007

8 See Commission Staff Working Document entitled "Energy policy and maritime policy: ensuring a better fit", SEC (2007)1283, 10.10.2007.

9 OJ L 176, 15.7.2003.

10 OJ L 283 27.10.2001.

11 OJ L 275, 25.10.2003, p. 32

12 OJ C 82, 1.4.2008, p. 1.

13 http://ec.europa.eu/energy/electricity/package_2007/index_en.htm

14 http://ec.europa.eu/energy/climate_actions/index_en.htm

cooperation between energy regulators and between system operators, and more robust requirements on Member States to streamline their planning and authorisation procedures, provide grid access and reduce administrative barriers.

However, **certain barriers affect offshore wind projects specifically or to a particular degree**. Following a public stakeholder consultation conducted earlier in 2008[15], the Commission has identified four key areas which require special attention.

2.2. A sector facing particular industrial and technological challenges

Compared to onshore wind energy, offshore wind is still relatively expensive and technologically undeveloped. Some early projects were essentially offshore applications of moderately adapted onshore technologies and experienced unexpected technical problems, for example with the reliability of turbine components such as gear boxes and transformers. This has made investors more cautious, **has made it harder to finance projects** and entails higher costs because of the risk premiums required by investors. Equally, the experience to date shows the importance of bringing down the costs of installation, operation and maintenance which are much higher in the rougher and less accessible sea environment than on land.

The current structure of the industry complicates this situation further. Today very few turbine manufacturers have long and large-scale experience with machines deployed in offshore applications — this reduces the level of competition and innovation and further increases the cost differential to onshore wind. Moreover, there are **bottlenecks at various points in the supply chain** — the limited availability of turbine components, affordable installation vessels, suitable harbour facilities and similar equipment and infrastructures as well as of skilled personnel with the necessary mix of qualifications is a key barrier.

Existing foundation technologies are limited to relatively shallow waters (typically less than 30 metres of depth). Large-scale introduction of offshore wind would be greatly facilitated by technologies enabling deployment in deep waters, but cost-effective solutions still have to be demonstrated in real applications.

At present **offshore wind competes on the one hand with onshore wind for the existing turbine production capacity and on the other with the oil and gas exploration industry for the existing offshore equipment and expertise**. In this "double-squeeze" the pioneers are struggling to work up from a niche market to a full scale industry because investors are wary of making substantial investments in R&D and in the required increases in supply chain capacity as long as the technology is still climbing up the learning curve.

2.3. Lack of integrated strategic planning and cross-border coordination

In contrast to spatial planning on land, **Member States generally have limited experience with, and sometimes inadequate governance structures and rules for, integrated spatial planning in the marine environment**. The lack of processes looking simultaneously at the spatial distribution of the wind resources, at constraints imposed by other marine activities or interests, and at electricity grid aspects tends to increase uncertainty and the risk of delays in or failure of projects at sea. This applies equally to other renewable ocean resources such as tidal and wave energy.

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[15] A summary of the consultation feedback is available at http://ec.europa.eu/energy/res/consultation/offshore_wind_energy_en.htm

Moreover, the **absence of points of access to the electricity grids at sea leads to uncertainties about the ability to, or costs of, connecting to the grid** and creates additional risks for offshore projects.

On a more positive note, offshore projects can represent an opportunity for creating lines that both connect new generation capacity and establish or increase transmission capacity between different regions in the internal electricity market. However, such **potential synergies between offshore projects and cross-border inter-connectors are currently not being exploited**[16]. One reason for this is the additional complexities that cross-border cooperation entails because of the need to deal with different planning and regulatory regimes. However, without cross-border coordination, grid investments risk being sub-optimal in that they will be viewed from an individual project perspective rather than from a system perspective. Offshore projects that depend on new cross-border connectors are thus more vulnerable to uncertainties arising from differences in regulatory regimes such as support schemes and rules on grid investment cost recovery.

The need for better cross-border cooperation is not only limited to network planning and development, but also relates to system operation and management. Increasing offshore wind penetration may have consequences which need to be reflected in power congestion management strategies and generation/demand balancing plans, and in improved mechanisms for cross-border trade and balancing power markets.

2.4. Lack of knowledge and information sharing hampers a smooth application of EU environmental legislation

Offshore electricity production is relatively new or even non-existent in most Member States, and the experience in applying EU environmental legislation such as the "Birds"[17], "Habitats"[18] and "Environmental Impact Assessment"[19] Directives in respect of such projects is still comparatively scarce. In practice this means that developers of offshore projects face additional uncertainties that can lead to extra delays and costs.

One factor which needlessly frustrates offshore projects is the **delays in Member States' designation of protected areas under the Habitats and Birds Directives in the marine environment**. Failure to identify such areas increases uncertainty about the potential suitability of any given site for wind farms. Without the necessary data on marine ecosystems and information about where sensitive or protected habitats and species occur, impact assessments and consenting procedures may be longer and subject to more disputes.

Another factor relates to awareness about up-to-date knowledge about the impacts of wind farms on natural habitats and species. Such information needs to be generated and shared more systematically to facilitate environmental impact assessments. Although a substantial and rapidly developing body of scientific literature exists, much of it is recent and unknown to many local, regional and national authorities and stakeholders. **In this situation, developers risk being subject to excessive and expensive environmental assessment and monitoring**

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16 The nature of these possible synergies are well illustrated in a recent report by consultants 3E: see http://www.greenpeace.org/eu-unit/press-centre/reports/A-North-Sea-electricity-grid-(r)evolution.

17 OJ L 103, 25.4.1979.

18 OJ L 206, 22.7.1992.

19 OJ L 175, 5.7.1985.

requirements which might have been avoided if state-of-the-art knowledge had been taken into account.

2.5. Dealing with bottlenecks and power balancing in the onshore electricity grids

For a number of reasons, **electricity generation from offshore projects will tend to be less geographically dispersed** than onshore wind and many other RES technologies.

Firstly, the need to establish dedicated grid connections to points far out at sea makes economies of scale particularly important if offshore projects are to be competitive (especially in the case of regulatory regimes where connection costs are paid by the developer rather than through system tariffs). This alone means that offshore projects will tend to be bigger than onshore projects.

Secondly, all offshore energy is produced in areas with no demand (apart from perhaps some consumption on oil and gas platforms), so all the production feed-in points are concentrated on the coastline.

In a scenario with large-scale development of offshore wind power, **this will challenge the capacity of the existing system to balance generation and demand and to transmit the power to the consumption centres**, many of which are inland. In some Member States, especially in Germany, bottlenecks already exist or are expected in the event of significant wind capacity expansion in the North Sea, and the need for further interconnection capacity has been demonstrated e.g. by the German Dena I study[20].

3. THE WAY FORWARD

3.1. Investing in the future competitiveness of the EU wind energy industry

Bringing offshore wind out of the shadow cast by its nearest competitors for investments — onshore wind and offshore oil and gas exploration — will require dedicated efforts to develop technology and supply chain infrastructures over the decades to come. The **Strategic Energy Technology Plan (SET-Plan)**[21], presented in 2007 and endorsed by the European Council in March 2008, constitutes together with the **Seventh Framework Programme for research, technological development and demonstration (FP7)**[22] and the **Intelligent Energy Programme** (IEE)[23] the overall EU framework within which these challenges should be addressed. In addition, the Union's Cohesion Policy Funds will support investments of over 787 M€ in wind energy, including possibilities for offshore projects, for the period 2007-2013. As the Cohesion Policy Funds also can support investments for sustainable energy, including wind energy, under other headings like Research and Development (total allocation of €63,6 bn), the actual support to the wind energy area from the Cohesion Policy is expected to be much higher.

The SET-Plan identified doubled output of the largest wind turbines, with offshore wind as the lead application, as a key challenge for meeting the 2020 targets, and proposed a

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20 www.offshore-wind.de/page/index.php?id=2605&L=1
21 COM(2007) 723, 22.11.2007.
22 OJ L 412, 30.12.2006, p. 1.
23 OJ L 310, 9.11.2006, p. 15.

European Industrial Initiative on Wind Energy. The aim is to foster market deployment and bring down the cost of wind energy, but given that onshore wind is already among the most competitive technologies the Commission believes that **offshore wind should be a key priority of the initiative**. While it may be tempting for industry to concentrate on reaping the benefits of the currently booming onshore market, investing in offshore will be critical to maintaining the EU's global technology leadership and will prepare the ground for new export markets. There will also be important positive spill-over effects on other related markets, a good example being modern High Voltage Direct Current (HVDC) cable technology where European industry has a unique potential[24].

For these reasons, **the Commission has given more emphasis to offshore wind under FP7 starting with the 2009 energy work programme**. The Strategic Research Agenda[25] of the Technology Platform for Wind Energy (TP Wind)[26] published in July 2008 includes proposals for priority research areas for offshore wind which are a welcome input to prioritising and coordinating future EU and national research efforts. In this context, Member States are also encouraged to make further use of the opportunity offered by Cohesion Policy Funds in the area of research and development.

As demonstrated in the Strategic Research Agenda **there are questions about the adequacy of current levels of support for research into wind energy, including offshore, given the new ambitious direction of Europe's energy policy,** and the Commission will consider this issue further in the context of the Communication on financing low carbon technologies announced in the SET-plan. In the same context, **options for combining public, industry and other private resources within the industrial initiative will be considered** to ensure sufficient focus on offshore aspects.

In terms of skilled workers, installation vessels and other specialised resources, offshore wind at present competes unevenly with oil and gas production. However, with time **the common ground between offshore renewables and the oil and gas industry can be turned into an asset if the opportunities are seized in coastal areas to achieve a managed, gradual transition to new energies**. Many regions in Europe are already realising the potential for future jobs, growth and economic regeneration that lies in redeploying existing skills and resources from fisheries, shipbuilding and harbours in decline and other potentially relevant industry sectors. While high oil prices are likely to stimulate continued investments in European oil and gas production for some time to come, production has peaked and it is time to start planning the transition and harnessing the necessary new skills. EU programmes such as Intelligent Energy Europe and programmes under the Cohesion Policy are already being used to fund projects taking a proactive approach in the adjustment to renewables and supporting the development of offshore wind[27].

3.2. Adopting a more strategic, coordinated approach to offshore developments

As explained above, a more strategic and coordinated approach will be important for exploiting Europe's wind resources in a cost-effective way, and a range of planning instruments and forums at EU or regional level may play a role in this respect.

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[24] See for example the "Electra initiative": http://ec.europa.eu/enterprise/electr_equipment/electra.htm

[25] www.windplatform.eu/92.0.html

[26] www.windplatform.eu

[27] Examples include www.power-cluster.net, www.offshore-power.net and www.windskill.eu.

From a **renewable energy source perspective**, the Commission has proposed that the new Directive on energy from renewable sources should contain an obligation for Member States to prepare National Action Plans[28]. This will be an opportunity for Member States to set out a consistent framework for the contribution of different renewable energy sources and technologies. It would appear appropriate for Member States with offshore renewable energy resources to spell out the expected contribution to their 2020 target in this context.

From a **marine environmental perspective**, the implementation of the recently adopted **Marine Strategy Framework Directive**[29] will be an opportunity for Member States to consider offshore wind farms in their overall assessment of the pressure and impacts on the marine environment, and whether these are likely to affect the attainment of the "good environmental status" objectives of that Directive. In this context, the **regional sea conventions** (OSPAR, HELCOM, MAP, BSC etc.) may also contribute to better coordination and much work has already been done e.g. in relation to environmental assessments[30].

From an **electricity grid perspective**, the regional cooperation within the new **European Network of Transmission System Operators (ENTSO)** proposed under the "third package"[31] and their related grid development and investment plans will be important new tools for coordination, and European Transmission System Operators support the idea of dedicated regional offshore wind energy grid plans. The **new Agency for the Cooperation of Energy Regulators** and the existing regional initiatives will also play an important role in coordinating regulatory matters, to ensure that improved markets mechanisms (including for balancing power and cross-border trade) and more coordinated, flexible and favourable conditions encouraging investment in transnational offshore grids are put in place. Moreover, the **European coordinators** appointed under the TEN-E guidelines[32] (including the coordinator for offshore wind in Northern Europe) have specifically been tasked with promoting the European dimension of certain projects by facilitating cross-border dialogue and with helping to coordinate national procedures for consulting stakeholders.

The challenge is to ensure that the various processes are linked up and at the same time to exploit their specific advantages, resources and expertise. As explained in the Commission's Communication on an Integrated Maritime Policy for the EU[33] **the long-term vision for the management of the seas must be to move towards genuinely integrated maritime spatial planning**, and the Commission will present a roadmap to this end before the end of 2008. Such an approach could provide a framework for balancing and arbitrating between different sectoral interests and set stable conditions for investments. **To make timely progress towards this end, practical steps and experience from processes driven forward by actual, sectoral needs of high political priority will be necessary.**

In this perspective the current German-Swedish-Danish work to explore the possibility of a joint connection solution for the three offshore wind farms all located at Krieger's Flak in the Baltic Sea, which is strongly supported by the European coordinator, will yield valuable experience of how to share the potential socio-economic benefits of a common solution combining new wind farms and interconnections. The **Commission will support and**

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28 COM(2008) 19, 23.1.2008.
29 OJ L 164, 25.6.2008, p. 19.
30 See www.ospar.org and www.environmentalexchange.info
31 COM(2007) 528.
32 OJ L 262, 22.9.2006.
33 COM(2007) 575, 10.10.2007.

complement the efforts of the European coordinator to bring together the various processes, authorities and stakeholders, to develop 'best practice' through specific cases, and to stimulate the emergence of similar cooperation efforts elsewhere, beginning with the North Sea. It will notably ensure close interaction with EU funded projects of specific relevance such as NORSEWiND[34] and WINDSPEED[35].

3.3. Maximising the environmental benefits of offshore wind

The environmental benefits of wind energy as a clean source of electricity with no emissions of greenhouse gases or local air pollution and the benefits in terms of security of supply are widely recognised, and the overwhelming majority of Europeans have a very positive attitude to wind energy[36]. The avoidance of water consumption compared to thermal electricity production and the positive, global and long-term contribution to preserving biodiversity in terms of climate change mitigation are less well known but also significant.

Locally, however, individual projects are sometimes the cause of concern because of visual landscape changes, noise or effects on local biodiversity and habitats. If located far from the coast only the latter is potentially a problem for offshore wind farms, and experience to date shows that it rarely actually is: **monitoring programmes at existing offshore wind farms have shown that it is quite possible to construct even large farms without significant impacts on local biodiversity and habitats**.

Nevertheless, farms that are not properly situated may affect sensitive species and habitats. Such **potential problems should be identified at an early stage through strategic assessments**, and if necessary addressed through appropriate mitigation measures to avoid or minimise any significant adverse effects.

The Commission considers that the **existing EU legislation on nature and environmental assessments is an adequate framework which is flexible enough to deal with these aspects**. It recognises, however, that further guidance on its application in the specific context of wind farms in or near protected or sensitive nature areas might help create further certainty for developers, authorities and other stakeholders. Therefore, the **Commission services will step-up work to develop guidance on nature and wind farms with the aim of finalising it in 2009 at the latest**. Options for providing, maintaining and disseminating state-of-the-art overviews of scientific findings about environmental impacts of wind power will be considered in this context. In addition, the Commission will continue work to establish a European Marine Observation and Data network (EMODNET) to facilitate access to data that can underpin environmental impact assessments

As stressed above, striking the right balance between the different interests involved in siting offshore wind farms is facilitated by strategic planning. The **designation of marine Natura 2000 sites under the Habitats and Birds Directives is therefore important for creating certainty for developers**. These designations are long overdue, and a guide has already been

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[34] NORSEWiND is a new project funded by FP7 designed to provide a wind resource map covering the Baltic, Irish and North Sea areas using a combination of traditional meteorological masts, ground based remote sensing instruments and satellite acquired data.

[35] Supported by the Intelligent Energy Europe programme WINDSPEED aims to develop a roadmap for deployment of offshore wind energy in the Central and Southern North Sea taking all spatial marine interactions into account.

[36] Special Eurobarometer, January 2007. http://ec.europa.eu/public_opinion/archives/ebs/ebs_262_en.pdf

prepared by the Commission to assist Member States in identifying and selecting marine sites. The ball is clearly in the Member States' court and the **Commission will take all necessary measures to ensure that sites are designated** in a timely and appropriate manner.

3.4. Integrating large-scale offshore wind in the grid of the future

The large-scale development of offshore wind energy may make bottlenecks in the existing electricity grid more likely if the grid is not adapted to the changes in the generation infrastructure. This problem is already being explored by the European coordinator for offshore wind in Northern Europe, and it is also subject to detailed technical investigations in projects such as TradeWind[37] and the European Wind Integration Study (EWIS[38]).

Before the exact extent and nature of the problem has been better quantified, it is not possible to provide a final answer on how to address it. Any response is likely to involve new transmission capacity and input from modern "smart grid" technologies involving intelligent demand management, energy storage (possibly through greater electrification of the transport sector) and, more generally, systems integration.

The Green Paper on European Energy Networks adopted in parallel to this communication, further work by the European coordinator and the closer cooperation between Energy Regulators and Transmission System Operators as discussed in section 3.2 will, however, provide the appropriate, wider context for this whole debate.

4. CONCLUSIONS

Offshore wind energy is an indigenous resource for electricity production with a vast potential that remains largely untapped. Offshore wind can and must make a substantial contribution to meeting the EU's energy policy objectives through a very significant increase — in the order of 30-40 times by 2020 and 100 times by 2030 — in installed capacity compared to today.

However, developing the necessary technology and industrial supply chain capacity and getting projects through the planning and consenting processes takes time. To make the required investments in time for 2020, the industry urgently needs more certainty and stable, favourable framework conditions. The binding 20% target for renewable energy and the energy and climate package will be key to achieving this, but Member States with offshore wind resources will need to use this framework and the proposed national action plans to spell out clearly their ambitions for offshore wind and take the necessary action.

For its part, the Commission will apply to the full all relevant existing or recently launched EU initiatives as outlined above, and will take further steps if necessary. It will in particular:

- seek to **facilitate regional cooperation on offshore energy site-and grid planning** between Member States, energy regulators, transmission system operators (TSOs) and other relevant stakeholders, **using instruments such as those established by the "third package" and the coordination platform set up by the European coordinator** for offshore wind connections in the Baltic and North Sea areas;

[37] www.trade-wind.eu

[38] www.wind-integration.eu

- **encourage the Members States to implement maritime spatial planning** based on the principles of the forthcoming Commission roadmap on maritime spatial planning to regulate the competing and growing uses of the seas via transparent decision making processes and to achieve optimal site selection.

- encourage TSOs and energy regulators to step-up cooperation to urgently put in place **more favourable regulatory conditions for investments in transnational offshore grids,** for cross-border trade and for the development of efficient balancing power markets;

- **emphasise offshore related research** under the Seventh Framework Programme for research, technological development and demonstration (FP7) and, in the context of the European Industrial Initiative on Wind Energy and the Communication on financing low carbon technologies announced in the SET-plan, **review the possibilities for stepping up support to accelerate the development and market deployment of offshore wind and other marine renewables in the light of the EU's new energy policy objectives** ;

- emphasise in future calls under the **Intelligent Energy-Europe programme** actions to tackle the main non-technological barriers to the use of offshore wind energy;

- finalise the specific **guidance on the application of the EU nature conservation legislation in the context of wind farms** and **take all necessary measures to ensure that Member States designate marine protected areas** under the Birds and Habitats Directives in a timely way, so as to improve planning certainty for project developers and contribute to the EU's biodiversity objectives;

- **consider the large-scale integration of offshore wind in the electricity grids as one of the key issues for the follow-up of the Green Paper on European Energy Networks**, taking into account ongoing studies and work by the European TSOs.