NorthSEE project
WP 5 – Energy Infrastructure in MSP

Status quo report on offshore energy planning provisions in the North Sea Region

Report annexes

Annex 1: Transnational energy cooperation between North Sea countries

April 2018

Project information

Funding programme:	INTERREG VB: North Sea Region Programme 2014 - 2020
Project Name:	NorthSEE: A North Sea Perspective on Shipping, Energy and Environment Aspects in MSP
Project Agreement number:	38-2-2-15
Project implementation period:	May 2016 and July 2019
Lead Partner:	German Federal Maritime and Hydrographic Agency (BSH)
Work Package	WP5 – Offshore Energy
Links to Task(s):	Task 5.1 – Status quo of energy infrastructure provisions in national MSPs Task 5.2 Analysis of national and transnational energy policies by country in the NSR

Document information

Document Title:	Status quo report on offshore energy planning provisions in the North Sea Region
Author(s):	Andronikos Kafas, Malena Ripken, Kirsty Wright, Mailys Billet, Stephen Sangiuliano, Erik Ooms, Ulrich Scheffler Country contributions by: Jeroen van Overloop and Diederik Moerman (Belgium), Lise Schrøder and Suzanne Dael (Denmark), Ulrich Scheffler (Germany), Xander Keijser (Netherlands), Anne Langaas Gossé and Hanne-Grete Nilsen (Norway), Linus Hammar and Jonas Pålsson (Sweden), and Andronikos Kafas, Kirsty Wright, Ian Davies, Peter Hayes, Matt Gubbins, and David Pratt (Scotland). GIS figures by Christian Aden
Version history:	01/03/2017 – Version 1; Partners Review 26/04/2017 – Version 2; Internal review comments addressed 12/06/2017 – Version 3; Restructured report; shared with partners 09/10/2017 – Version 4; North Sea level summaries added; National information moved to annexes and new figures added; shared with partners 18/11/2017 – Version 5; Final draft shared with Political Declaration – Support Group 1, Internal Scottish Government and Energy Working Group 12/04/2018 – Version 6; Shared with European Project Coordination Office (EPCO) for publication on the project website
Publication Date	12/04/2018

Proprietary Rights statement

This document contains information which is proprietary to the "NorthSEE" Consortium. Neither this document nor the information contained herein shall be used, duplicated or communicated by any means to any third party, in whole or in parts, except with prior written consent of the "NorthSEE" consortium.

Disclaimer

NorthSEE is an EU funded project - INTERREG VB: North Sea Region Programme 2014-2020 – and runs from May 2016 and July 2019. Project partners include all of the countries that border the North Sea (Belgium, Denmark, Germany, Netherlands, Norway, Sweden, and the United Kingdom (partner representation only from Scotland) with the exception of France as it is not eligible under the North Sea Region Programme. The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the opinion of the European Union or partner organisations. National information included in the report is indicative, as provided by respective project partners. In many cases, there are formal systems through which Member States/Competent Authorities report to the European Commission. The information provided here is not intended to replace the original formal systems. The data contained in this report have been collected from a variety of online sources (e.g. 4C Global Offshore Wind Farms Database, Wind Europe) and have been verified by the relevant project partners for each country as of early 2017. Information has been collected over the course of 2 years (2016 and early 2017), hence information which became available in late 2017 and early 2018 has not been included in the report. Neither the NorthSEE Consortium nor the European Commission are responsible for any use that may be made of the information contained in this publication.

Acknowledgements

All icons used in the figures included in this report have been designed by Freepik (www.freepik.com) accessed through free icons search engine "Flaticon" and used under Flaticon's Basic Free License (www.flaticon.com , Graphic Resources S.L, Commercial Registry of Málaga, volume 4994, sheet 217, page number MA-113059, with Tax Number B-93183366 and registered office at 13 Molina Lario Street, 5th floor, 29015 Málaga, Spain).

Cover photo

Robin Rigg offshore wind farm in Scotland. Photo by Fiona Thomson, Marine Scotland. Crown copyright 2017.

Please cite this document as:

Kafas, A., Ripken, M., Wright, K., Billet, M., Sangiuliano, S., Ooms, E., Scheffler, U. et al. (2017) Status quo report on offshore energy planning provisions in the North Sea Region, NorthSEE project, INTERREG North Sea Region Programme, Grant agreement 38-2-2-15.

Annex 1: Transnational energy cooperation between North Sea countries

1.1. Offshore energy initiatives in the North Sea

North Sea Countries' Offshore Grid Initiatives

The North Sea Countries' Offshore Grid Initiative (NSCOGI)[1] was established in 2009. NSCOGI is a regional cooperation of 10 countries around the North Sea which was formalized by a Memorandum of Understanding in 2010 in order to achieve the renewable targets up to 2020. It seeks to evaluate and facilitate coordinated development of a possible offshore grid that maximises the efficient and economic use of renewable sources and infrastructure investments. The objectives of the NSCOGI are:

1. To contribute to the move to a sustainable low-carbon economy while maintaining security of energy supply in a cost efficient manner;
2. To maximise the potential of the renewable energy resources of the North Seas, taking account of the scale of investments required in offshore infrastructure and necessary onshore grid reinforcements;
3. To identify and tackle barriers to offshore grid development, in particular as regards technical, regulatory, market, planning and authorisation issues;
4. To facilitate a strategic, coordinated and cost-effective development of offshore and onshore grids.

NSCOGI is subdivided into three working groups concerning Grid implementation; Market and regulation; and Permissions and planning.

The analysis of one of the working group reports titled 'Recommendations for guiding principles for the development of integrated offshore cross-border infrastructure' which was published in 2012 has shown that developing a coordinated infrastructure requires a high level of cooperation between all parties involved. National approaches do not necessarily need to be harmonised but they do need to be compatible in order for such an approach to work. Further work is being carried out on assessing the different issues involved with integrated offshore cross border infrastructure in the work programme of NSCOGI.

[1] https://www.entsoe.eu/about-entso-e/system-development/the-north-seas-countries-offshore-grid-initiative-nscogi/Pages/default.aspx

Also in 2012, Transmission System Operators of the NSCOGI region successfully completed the *NSCOGI Grid Study* which suggested that multi-lateral cooperation between the North Seas Countries is the right way to proceed. It showed that the economic effectiveness of a meshed grid increases as offshore wind development increases.

Some of the future areas of work of NSCOGI include reducing the length and complexity of procedures by working on country pairings between which interconnector projects might take place, identifying planning and consenting barriers to transnational projects including practical solutions relating to barriers and identifying good practice and share and review them with stakeholders. NSCOGI also aim to assist the respective competent authorities in taking all necessary steps for efficient and effective cooperation and coordination for projects of common interest which require decisions to be taken in two or more Member States as stated in Energy Infrastructure Regulation 347/2013.

North Seas Energy Cooperation & North Sea Energy Forum

In 2016 the North Seas (North Sea and Celtic Sea) region countries (Belgium, Denmark, France, Germany, Ireland, Luxembourg, the Netherlands, Norway and Sweden, and later also the UK) agreed to further strengthen their energy cooperation[2], to improve conditions for the development of offshore wind energy in order to ensure a sustainable, secure and affordable energy supply in the area. A political declaration and action plan were signed by member states. The initiative focuses on building of missing electricity links, allow more trading of energy and further integration of energy markets and reinforcing regional cooperation which will help reduce greenhouse gas emissions and enhance security of supply in the region.

Four specific energy cooperation work areas have been defined: Maritime Spatial Planning; Development and regulation of offshore grids and other offshore infrastructure; Support framework and finance for offshore wind projects; and, Standards, technical rules and regulations in the offshore wind sector. A Support Group has been established for each specific work area and a High Level Group will bring the outputs of the working groups to the political level.

In response to the recent initiatives on North Seas Energy Cooperation, the European Commission also organises the North Seas Energy Forum[3]. This event series brings together representatives of the public, private and non-governmental sectors in the Northern Seas region to discuss challenges and opportunities in the region and the role of all stakeholders in realising its full energy potential.

All project partners from the NorthSEE project are involved in the North Seas Energy Cooperation and there is an agreement in place to share the outputs of the NorthSEE project.

[2] https://ec.europa.eu/energy/en/topics/infrastructure/north-seas-energy-cooperation
[3] https://ec.europa.eu/energy/en/events/north-seas-energy-forum

EU Energy Initiative (Declaration)

On 6th June 2016, nine governments sharing the North Seas signed a historic Political Declaration for regional cooperation on offshore wind energy. The UK signed shortly afterwards. Since then considerable results have been achieved, for example the offshore wind energy industry has met its self-imposed cost reduction target of 100 EUR/MWh by 2020 ahead of time. On the first anniversary of the signing of the Political Declaration, 6th June 2017, the governments of leading offshore wind markets, Germany, Belgium and Denmark came together with industry captains in signing a Joint Statement to further the deployment of offshore wind energy in Europe4. The signing ceremony took place at the opening of Offshore Wind Energy 2017. The signatory governments reaffirmed their commitment of deploying a significant volume of offshore wind power in Europe between 2020 and 2030. They welcomed the cost reductions in offshore wind achieved to date and the intention of the industry that offshore wind keeps reducing its costs so that Europe remains the global leader in the sector.

Delivering further cost reductions will require the deployment of significant volumes of new offshore wind. But most governments in Europe have still to define clear plans for how much new offshore they intend to deploy, notably beyond 2023. The industry therefore calls on European governments to collectively ensure there is 60 GW, or at least 4 GW per year of new deployment in the decade after 2020.

To deliver on these volumes, government and industry signatories committed to build on public-private cooperation to facilitate investments in projects and associated infrastructure. Crucially, they pledged to work towards the necessary European framework supporting Europe's common renewable energy trajectories in part by calling on the European Commission to mobilise dedicated funding for strategic joint projects for offshore wind energy.

60 GW, which the industry intends to deploy between 2020 and 2030, represents only a fraction of the potential of offshore wind energy in Europe. According to a new resource assessment by BVG Associates released on the 6th of June 2017, offshore wind could in theory generate between 2,600 TWh and 6,000 TWh per year at a competitive cost – €65/MWh or below, including grid connection and using the technologies that will have developed by 2030. This economically attractive resource potential would represent between 80% and 180% of the EU's total electricity demand.

[4] https://windeurope.org/newsroom/press-releases/leading-energy-ministers-and-industry-captains-join-forces-for-significant-offshore-wind-volumes-in-europe-by-2030/

1.2. International organisations with transnational offshore energy links in the North Sea

CPMR North Sea Commission

The North Sea Commission is one of six geographical commissions under the Conference of Peripheral Maritime Regions (CPMR)[5]. It is a cooperation platform for regions around the North Sea (Figure **1**). The main objectives of the North Sea Commission are: To promote and create awareness of the North Sea region as a major economic entity within Europe; To be a platform for developing and obtaining funding for joint development initiatives; and, To lobby for a better North Sea region. Key achievements include the North Sea Regional Advisory Council, the Interreg North Sea Region Programme, North Sea Region 2020 strategy, and the North Sea Region preparatory action.

The Interreg North Sea region programme and the North Sea Commission both work to achieve regional development in the region and here complement each other's efforts. The North Sea Commission is a useful platform and network for establishing transnational project partnerships and the North Sea region programme is the primary source of financing of such projects. This facilitates knowledge transfer and collaborative working across all North Sea countries.

The North Sea Region preparatory action was funded in 2014 to look into the need to analyse the North Sea region's growth potential and the added value of having a future shared macro-regional strategy for the North Sea.

The current focus for the North Sea Commission's work is the North Sea Region 2020 strategy document[6]. The strategy aims to: Help the North Sea Region remain and improve the performance as a competitive, attractive and sustainable area of Europe; Address common transnational challenges and exploit opportunities related to sustainable economic growth, climate, energy, accessibility and management of the maritime space; Ensure a better governed region through cross-sectorial coordination and multi-level governance; and Provide a potential pilot for at different kind of macro-regional strategy than the EU strategies for the Baltic Sea and Danube areas.

The strategy is implemented through an action plan and five associated thematic working groups: Culture and tourism, Economic development, Energy and climate change, Marine resources and Transport. The focus of the strategy paper is on the major challenges and common characteristics of the North Sea, where there is added value in transnational action and collaboration.

[5] https://cpmr-northsea.org/
[6] http://cpmr-northsea.org/policy-work/north-sea-region-strategy-2020/

Figure 1: Regions within the NSR programme area

The 'Energy and Climate Change' Working Group has selected a limited number of measures in the North Sea Region 2020 strategy document to focus on the next 2–3 years (2017-20):

- Develop catalogue and action plan for climate adaptation
  The group will work with member regions to develop an action plan for climate adaptation that they can take forward in own organisations.
- Promote innovations and growth in low-carbon technology in various sectors
  Focus for the group will be on developing energy related project ideas in the fields of 'Gas in transition', 'Bio-based energy/economy', 'Smart cities and regions', 'Offshore wind and North Sea energy grid' and 'Tidal and blue energy.
- Develop a 'Hydrogen Strategy' for the North Sea Region
  The group will work closely with the Hydrogen Transport Economy (HyTrEc) project and develop a strategy document for Hydrogen within the North Sea region and develop a Hydrogen corridor. The group will also work to put the

issue on the EU agenda through dialogue with the EU Commission and European Parliament.

- North Sea grid
  The group will work in close partnership with the CPMR Energy group to safeguard the interest of peripheral areas in relation to a North Sea energy grid, for example by developing policy recommendations.

The 'Marine resources' Working Group has selected a limited number of measures in the North Sea Region 2020 strategy to focus on the next 2-3 years:

- Exchange good practice on Maritime Spatial Planning (MSP) and Integrated Coastal Zone Management (ICZM)
  The group will work on analysing existing MSP policies and management plans around the North Sea. It will furthermore seek to influence the development and implementation of the EU Maritime Spatial Planning (MSP) directive by establishing shared NSC position on ICZM/MSP and actively participating in relevant CPMR working groups.

- Promote sustainable and innovative exploitation of marine resources
  The group will carry out a study on the potential impact that a discard ban will have on coastal communities, ports and fish processors. The study will facility exchange of good practice and form the basis of shared policy positions. Furthermore, it will seek to influence the conception and check the implementation of the common Fisheries Policy (CFP) reform and European Maritime Fisheries Fund (EMFF). The group encourages partnership between industry and scientists to promote sustainable and innovative solutions and has initiated the establishment of a scientific working group on aquaculture between member regions that will exchange information with relevant R&D institutes and disseminate good practice to member regions.
- Promote dialogue between all users of the North Sea to facilitate policy integration
  The group encourages dialogue between stakeholders representing the different users of the North Sea basin. An early dialogue could help prevent conflicts between different user groups, and increase predictability in exploiting marine resources. It therefore supports the establishment of a North Sea Maritime Stakeholder Forum.

The Marine Resources Group (MRG) recently met in Brussels (24th-25th April) where the NorthSEE project was presented. The Marine Resources Group is developing a resolution on land/sea interaction which will be important input to the project. Brexit and its implications of the marine sector will be important for the group in the future.

WindEurope

WindEurope[7], formerly the European Wind Energy Association, is Europe's wind energy trade association promoting the use of wind power in Europe. WindEurope actively coordinates international policy, communications, research and analysis. Through effective communication and its engagement in the political decision-making processes, WindEurope seeks to facilitate national and international policies and initiatives which strengthen the development of European and global wind energy markets, infrastructure and technology.

WindEurope publishes European offshore wind statistics half yearly and these provide data on, for example, wind power capacity installed and grid-connected, future outlooks for the EU market, financing and investment trends and energy industry trends. These statistics are then fed into reports which are freely available online. WindEurope hosts a wealth of data which is valuable to a variety of members such as research institutes, national wind and renewables associations, developers, contractors, electricity providers, component suppliers and consultants.

Ocean Energy Europe

Ocean Energy Europe[8] (OEE) is the European ocean energy association of professionals that represent the interests of Europe's ocean energy sector. The association is made up of 117 organisations, including Europe's leading utilities, industrialists and research institutes. The aim of OEE is to create a strong environment for the development of ocean energy, improve access to funding and enhance business opportunities for its members. To achieve this, OEE engages with European Institutions such as the Commission, Parliament and Councils and national ministries on policy issues affecting the ocean energy sector. OEE has been largely successful in the past four years by significantly increasing the profile of ocean energy which in turn has encouraged the EU to be a major driver of the industry. OEE also participates in publicly funded projects such as ETIP Ocean – the Technology and Innovation Platform for Ocean Energy which is an officially recognised advisory body to the European Commission on research priorities. OEE works on four policy topics: Financing ocean energy farms, Funding research and innovations, EU energy and climate policy and Environment, planning and grid. Within the Environment, planning and grid policy topic, OEE has created an Ocean Energy Strategic Roadmap which makes a series of proposals aimed at improving knowledge and legislation to support new ocean energy developers.

Ocean Energy Forum

[7] https://windeurope.org/
[8] https://www.oceanenergy-europe.eu/

The Ocean Energy Forum[9] is a group of European countries (including North Sea countries) collaborating for developing technology in the ocean energy sector. It was created in 2013 by the European Commission in order to deliver a united strategy for the energy sector in Europe. The Ocean Energy Forum was formed of 3 work streams for Environment & Consenting, Finance and Technology; each work stream had a Steering Committee and Chair. The three work streams allowed consensus building to take place at a topic-specific level thus enabling pragmatic solutions to issues to be developed.

In 2016, the first main output of this Forum was the publication of the Ocean Energy Forum Strategic Roadmap[10], which proposed a series of actions to support the emergence of an ocean energy market in Europe. The Roadmap identifies a path forwards, building on European leadership in ocean energy, and developing technologies that can meet a significant amount of Europe's power demand over the next 35 years.

The final Forum event took place in November 2016 which presented the journey of the Forum in the production of the Strategic Roadmap and looked ahead at how stakeholders can help realise the Roadmap's ambitions.

OSPAR

OSPAR[11] is the mechanism by which 15 Governments (Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the UK) and the EU cooperate to protect the marine environment of the North-East Atlantic. OSPAR is so named because of the original Oslo and Paris Conventions ("OS" for Oslo Convention of 1972 and "PAR" for Paris Convention of 1974). There are 5 regions that have been defined in the North-East Atlantic, and one of these is Region II: Greater North Sea (Figure **2**) which is one of the busiest maritime areas.

[9] https://webgate.ec.europa.eu/maritimeforum/en/frontpage/1036
[10] https://webgate.ec.europa.eu/maritimeforum/en/node/3962
[11] https://www.ospar.org/

Figure 2: The 5 regions of the OSPAR Commission for the protection and conservation of the North-East Atlantic. Region II for the Greater North Sea is highlighted. Source: ospar.org

Since 2001, OSPAR has been noting that the offshore renewables sector has been rapidly expanding in the OSPAR maritime area. In order to help authorities to manage the potential spatial conflicts of the offshore energy installations, OSPAR agreed on a programme of work on the environmental impact of offshore renewable energy developments[12], which largely includes the cooperation of those countries surrounding the North Sea.

As part of this programme of work on offshore renewables, OSPAR has produced the OSPAR Database on Offshore renewable energy developments available on OSPAR's Data & Information Management System[13]. which constitutes an inventory of all planned, authorised, refused, operational, out of service and decommissioned installations. The database also includes other details such as number of devices, capacity, water depth, distance from coast, operator, foundation type, turbine height, links to EIA, and other remarks.

OSPAR has also developed guidance on environmental considerations for the development of offshore wind farms[14]. This recommends good practices to assess, minimise and manage the potential impacts of wind farms.

Also in the OSPAR maritime area, in particular the North Sea, major developments in the oil and gas industry have resulted in a large number of offshore installations. OSPAR monitors the development of offshore installations and maintains the OSPAR Oil and Gas Offshore inventory (Figure **3**). The database includes the name and ID number, location, operator, water depth, production start, current status, category and function of the installations. OSPAR Contracting Parties

[12] https://www.ospar.org/work-areas/eiha/offshore-renewables
[13] Most recent version of the OSPAR Offshore Renewable Energy Developments database is published in 2015 - http://odims.ospar.org/layers/geonode:ospar_offshore_renewables_2015_01
[14] http://www.ospar.org/documents?d=32631

with oil and gas industry offshore installations are: Denmark, Germany, Ireland, the Netherlands, Norway, Spain and the United Kingdom.

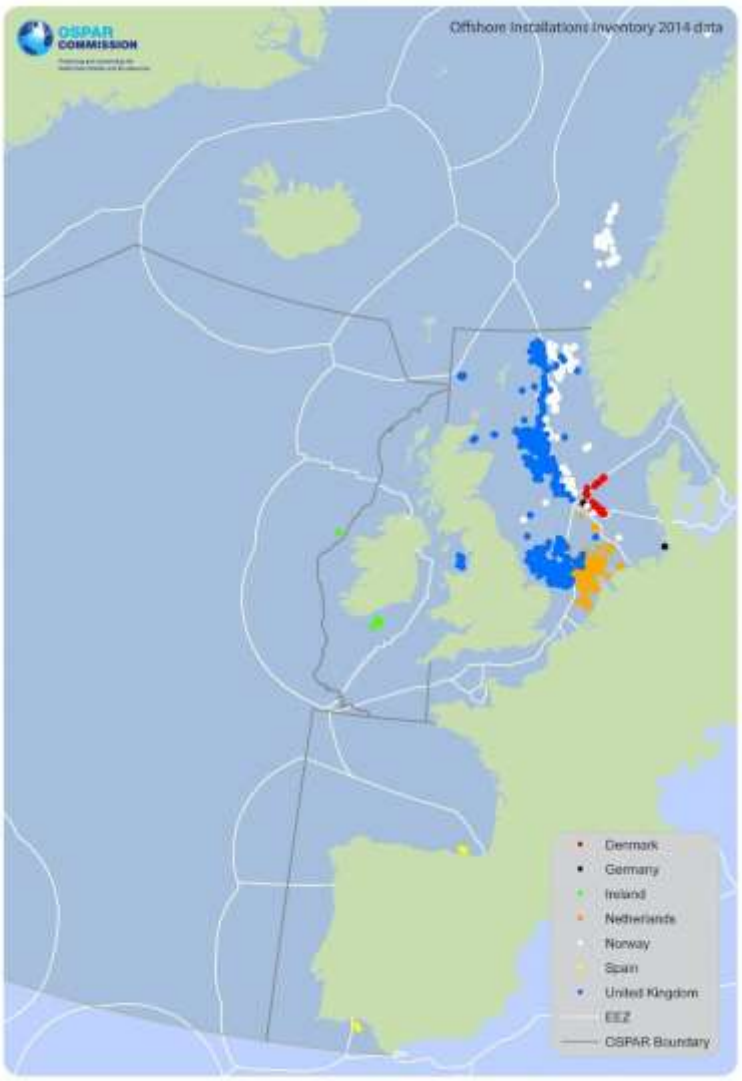

Figure 3: OSPAR Offshore Installations Inventory 2014 data. Source: ospar.org

ICES

The International Council for the Exploration of the Sea (ICES) is a global organisation that develops science and advice to support the sustainable use of the oceans. It is a network of more than 5,000 scientists across 20 member countries including all of those that border the North Sea. ICES plays a major role in coordinating oceanic and coastal monitoring and research, advising international commissions and governments on marine policy and management issues. ICES advice is divided by ecoregions[15], based on biogeographic and oceanographic features and existing political, social, economic, and management divisions. There are 17 ecoregions, including the 'Greater North Sea' (Figure 4). ICES has further standardised the division of sea areas for statistical analysis. The ICES Statistical

[15] http://www.ices.dk/community/advisory-process/Pages/ICES-ecosystems-and-advisory-areas.aspx

Areas delineates the divisions and subdivisions of FAO Major Fishing area 27. Both ICES Ecoregions and Statistical Areas can be accessed from the ICES Spatial Facility[16].

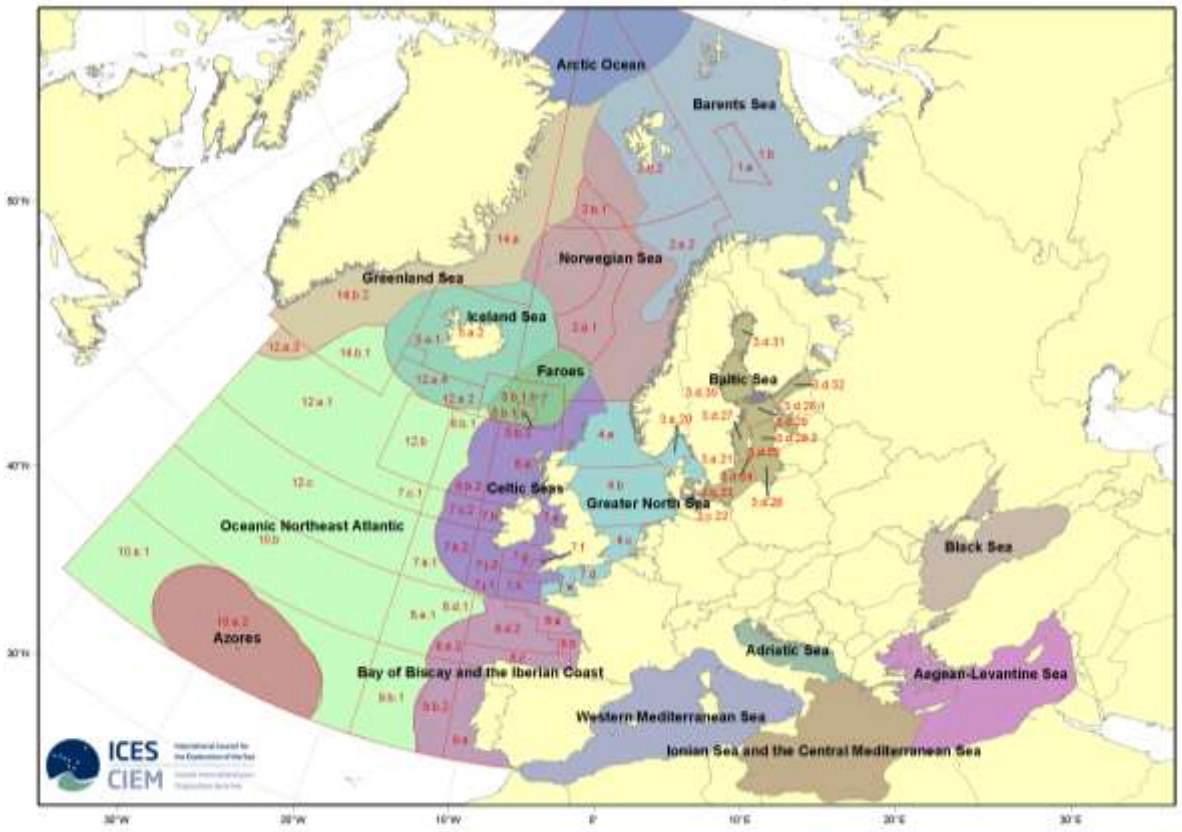

Figure 4: ICES ecoregions including ICES Statistical areas. Source: ices.dk

The work of ICES is accomplished by various committees, expert groups and workshops. The cooperation between countries and scientific organisations takes the form of joint working groups, co-sponsored theme sessions at annual science meetings, and co-sponsored science symposia.

In terms of international energy cooperation, the Working Group on Marine Renewable Energy (WGMRE) coordinates the flow of science between topic-based science working groups and its application in relation to offshore wind energy[17]. This work is then applied to planning, consenting and regulatory processes in relation to tidal, wave and offshore wind energy. The group provides summary information on the state of development of marine renewable energy, and identifies future issues that will require environmental assessment. The results of the working group showed that the main issue is cumulative impacts of commercial scale offshore wind in the North Sea Region. It was also determined that sharing information on different assessment methods, monitoring approaches and associated policy approaches that support good practice are valuable. The most effective means of achieving

[16] http://gis.ices.dk/sf/
[17] http://www.ices.dk/community/groups/Pages/WGMRE.aspx

collaboration across ICES groups, between member countries and more widely was considered in more detail. An output from the meeting is a set of topics/questions that can form the basis of further cross-sectoral interactions.

The ICES Working Group Marine Planning and Coastal Zone Management (WGMPCZM) discusses current developments around Marine Spatial Planning (MSP) and Coastal Zone Management (CZM) in the ICES area[18]. Today, increasing intensity and establishment of new sea uses, such as offshore wind farming, can be observed in coastal and marine waters. In order to deal with the resulting conflicts and cumulative impacts, new planning tools and integrated approaches to planning and management are being developed in Europe as well as in Canada and the US. MSP is currently evolving as one of the major tools for integration of different demands for marine space and resources. Based on current developments in marine planning practice and research, WGMPCZM focuses on knowledge gaps in MSP, risk analysis, quality assurance of a) advice for MSP and b) of mechanisms and processes in coastal and marine planning, social-cultural dimensions of marine ecosystem services and the use of fisheries data in plan decision making processes.

Also relevant is the ICES Working Group on Marine Benthal and Renewable Energy Developments (WGMBRED). This working group looks at related research, cause-effect relationships in the area and develops guidelines to aid future research[19]. The aim of the WGMBRED will be to increase scientific efficiency of benthal renewable energy related research, to specify the various cause-effect relationships resulting from the construction and operation of offshore renewable energy installations, and to develop guidelines and an overview of existing data for cumulative impact research by future international collaboration. The outcomes will assist in improving monitoring concepts in the context of offshore renewable energy constructions and will also be set within the context of marine spatial planning strategies and future ecosystem-based management approaches.

[18] http://www.ices.dk/community/groups/Pages/WGMPCZM.aspx
[19] http://ices.dk/community/groups/Pages/WGMBRED.aspx

1.3. EU projects with transnational offshore energy links

Windspeed – Spatial Deployment of Offshore Wind Energy in Europe

The 'Spatial Deployment of Offshore Wind Energy in Europe' (WindSpeed) project[20], ran between 2009 and 2011, aimed to assist in overcoming obstacles by developing a roadmap defining a realistic target and a development pathway up to 2030 or offshore wind energy in the Central and Southern North Sea (Belgium, Denmark, Germany, the Netherlands, Norway and the UK). The *Roadmap to the deployment of offshore wind energy in the Central and Southern North Sea 2020-2030* was delivered and identified barriers and potential surplus conditions in the North-European electricity grid along with policy recommendations on how to tackle these.

The project also delivered a decision support system (DSS) tool using geographical information system (GIS) software. The DSS tool produced overlaying maps, showing spatial representation of offshore wind energy potentials in relation to non-wind seas functions and environmental aspects. The tool aimed at facilitating the quantification of trade-offs between electricity generation costs from offshore wind and constraints due to non-wind sea functions and nature conservation. Furthermore, the tool was created in order to provide a better foundation for decision making by policy makers in terms of prioritising and allocating space of the development of offshore wind the Central and Southern North Sea.

Seanergy 2020

SEANERGY 2020 was an EU funded project[21] and ran from May 2010 to April 2012. It was coordinated by the European Wind Energy Association. The project aims to developing policy recommendations and remove obstacles and inconsistencies between international MSP processes that could hinder the development of offshore renewable plans in the EU.

The project provided an in-depth analysis of the national and international Maritime Spatial Planning (MSP) practices, policy recommendations for developing existing and potentially new MSP for the development of offshore renewable power generation, and promoted acceptance of the results. The policy recommendations have been promoted and addressed to different national, regional and European authorities; they have also been disseminated to the different maritime users through specific bilateral meetings and workshops organised in four different sea basins (Atlantic, Mediterranean, Baltic and North).

The deliverables were:

- Comparative analysis of Maritime Spatial Planning regimes, barriers and obstacles, good practices and national policy recommendations in some

[20] http://www.windspeed.eu/ & https://ec.europa.eu/energy/intelligent/projects/en/projects/windspeed
[21] http://www.seanergy2020.eu/ & https://ec.europa.eu/energy/intelligent/projects/en/projects/seanergy-2020

countries of the North Sea, Baltic Sea, Atlantic Coast and Irish Sea and Mediterranean Sea.

- Identify existing MSP instruments and inconsistencies between national energy plans and instruments.
- Develop recommendations for facilitating a better coordination of MSP between member states and for better European integration.

MAPMEP – Mapping & Communicating Marine Resource Potential

The 'Mapping & Communicating Marine Resource Potential' (MAP-MEP) project[22], ran between 2014 and 2015, and delivered an interactive energy map of the North Sea. The interactive map offers insight of the energy potential of the NSR for wind, wave and tidal renewable energy and fossil fuels. The benefits are easily accessible geographical and thematic data on energy potentials. This project involved the University of Oldenburg (Germany), Marine Scotland Science and Energy Valley (the Netherlands).

SEANSE - Strategic Environmental Assessment North Seas Energy as an aid for MSP.

The North Sea countries Denmark, Germany, the Netherlands, France and Scotland, in collaboration with the CPMR (Commission of Maritime Regions) and supported by Belgium and Ireland have proposed a project for funding by the European Commission to support the establishment and implementation of Maritime Spatial Plans in line with the EU Directive on MSP. The project is proposed to develop a coherent approach to SEA in support of the development and effective implementation of MSPs. This coherent approach will be tested on three case studies for large scale wind energy and evaluated to identify lessons learned. The project will be carried out by MSP authorities and appropriate institutes in the countries bordering the North Sea; these authorities are represented in the Support Group on Maritime Spatial Planning of the North Sea Energy Cooperation (SG1-MSP).

If agreed, this project will run for two years, starting by the end of 2017. The Project Coordinator is Leo de Vrees (the Netherlands).

PROMPOTioN - PROgress on Meshed HVDC Offshore Transmission Networks

A meshed European offshore transmission grid connecting offshore wind farms to shore could provide significant financial, technical and environmental benefits to the European electricity market. Launched in January 2016, PROMOTioN aims to explore and identify these potential benefits.

The main objective of PROMOTioN is the further development and demonstration of three key technologies:

[22] http://www.mapmep.eu/

- Diode rectifier offshore converters,
- Multi-vendor HVDC (high-voltage direct current) grid protection systems,
- Full power testing of HVDC circuit breakers.

Complementary to this end, a regulatory and financial framework will be developed for the coordinated planning, construction and operation of integrated offshore infrastructures, including an offshore grid deployment plan (roadmap) for the future offshore grid system in Europe.

Figure 5: The project consortium chaired by DNV GL includes 34 partners from 11 countries. All the major HVDC manufacturers or TSOs linked to the North Sea, along with several wind turbine suppliers, offshore wind developers, as well as leading academics and consulting companies, are part of the project consortium

Currently, the deployment of meshed HVDC offshore grids is hampered by the high cost of converter technology, and a lack of experience with protection systems and fault clearance components. In addition, deployment is hindered by limitations inherent to existing European regulations regarding the development of cross-border offshore infrastructures, national legal and regulatory barriers, and financing issues.

More information - https://www.promotion-offshore.net/

1.4. Industry Cooperation

ENTSO-E Ten-Year Network Development Plan 2016

The European Network of transmission system operators for electricity (ENTSO-E) has created a Ten-Year Network Development Plan 2016 (TYNDP 2016)[23]. The 2016 edition of the TYNDP builds on the 2014 edition and offers a view on what grid is needed where to achieve Europe's climate objectives by 2030. Even if local generation, demand response, storage and energy efficiency, will play an increasing role, the studies show that an extension of the current grid is needed to allow the shift of large quantities of renewables to the main consumption centers. The TYNDP 2016 foresees up to 150 billion euros of investments in grid infrastructure supporting 200 projects in transmission and storage. It also explores the possibility of a power system where 80% of the emissions will be cut by 2030.

The generation shift from coal to gas and from thermal to renewables is the main driver for increasing interconnection capacity between the different systems making up the North Sea region. Currently there is a boundary line between the UK and the other countries surrounding the North Sea but developing new interconnections across this boundary will be important to achieving the desired European market integration as well as the integration of renewable energy, preparing for a power system with lower CO_2 emissions for most of the Visions. Investments in the boundary play a key role in developing the Northern Seas Offshore Grid Infrastructure and will improve the security of supply in the whole region.

As part of the TYNDP 2016, Regional Investment Plans were developed from September 2014 to June 2015 for six regional groups for grid planning in Europe, including the North Sea region. These reports include the main infrastructure challenges and needs of every region in Europe by 2030.

The Regional Investment Plan for the North Sea region was published on 30th October 2015[24]. The Regional Group North Sea covers four separate synchronous power systems, which internally are linked by AC, and between the four systems by HVDC interconnectors. Regarding grid development and planning, the North Sea Region faces major challenges over the plan period, in determining the optimum solutions in facilitating an efficient European Energy market and in securing the European Network whilst accommodating connection of large volumes of renewable energy sources. These challenges lead the Transmission System Operator within the Region to evaluate, plan and conduct projects aiming at:

1. maintaining the security of supply;
2. a higher integration of the European energy market ; and
3. increasing integration of renewable energy sources (wind, solar and hydro) and as a result a lower CO2 emission.

[23] https://www.entsoe.eu/major-projects/ten-year-network-development-plan/ten%20year%20network%20development%20plan%202016/Pages/default.aspx

[24] https://www.entsoe.eu/Documents/TYNDP%20documents/TYNDP%202016/rgips/Regional%20Investment%20Plan%202015%20-%20RG%20NS%20-%20Final.pdf

Policies regarding the future energy mix in the region, especially regarding the future renewable energy sources generation are heavily influencing the required need for additional grid infrastructure. These policies and their influence on the future energy-mix are crucial, and subject to change over the years.

BEAGINS

BEAGINS[25] stands for Baseline Environmental Assessment for the Grid in the Irish and North Seas. The target countries for this study that are in the North Sea Region are Belgium, Denmark, Germany, the Netherlands and the United Kingdom. Ireland is also included for the Irish Sea.

To ensure that environmental concerns and impacts are appropriately considered in the development of such an offshore energy system, the European Commission has ordered a Baseline Environmental Assessment study aiming to compile an Environmental Baseline of impacts including maps, constraints, risks, impacts, ways of mitigation and alternatives. This study may be used to inform any future development of renewable energy generation, energy storage, power cables and associated equipment in the North and Irish Seas. It will be available as a resource to inform developers about this infrastructure regarding environmental assessment (SEA, AA, EIA). This will allow for environmental considerations to be incorporated into plans and projects early in the policy, design or planning processes.

Inn2POWER

Inn2POWER[26] is a four-year (October 2016 – October 2020) Interreg project consisting of eleven partners from five countries around the North Sea Region – Denmark, United Kingdom, Germany, Belgium, and the Netherlands.

The aim of the project is to expand the capacity for innovation and to improve access to the offshore wind industry for small and medium enterprises (SMEs) by connecting offshore wind businesses in the North Sea Region.

The objectives of the project are:

- Strengthening North Sea Region offshore wind clusters
- Supporting SMEs to collaborate and enter new markets
- Developing innovative concepts for port and harbour logistics
- Facilitating access to test and demonstration facilities
- Improving the skills and availability of personnel

The rationale behind the project is to secure growth in the offshore wind industry around the North Sea Region. In order to achieve this SMEs need to play a key role in tackling the challenges such as cost reductions, continuos innovation and improved acceptance of the industry. Inn2POWER offers targeted support measures to SMEs and supports collaborations on a regional, sectoral and transnational level.

[25] http://www.beagins.eu/
[26] http://northsearegion.eu/inn2power/about/

Thus Inn2POWER helps SMEs to overcome possible structural disadvantages and to realize their full innovation potential.