

SPATIAL STUDY NORTH SEAS 2030

Offshore wind development 2030 North Seas

Rijkswaterstaat

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Table of contents

EXECUTIVE SUMMARY	1
Item 1 – Assessment of Methodologies	1
Item 2 – Transboundary Wake Effects	4
Item 3 – Summary of Potential Capacity	6
Item 4 – Grid Connections	8
APPENDIX – COUNTRIES CAPACITY ADDITIONS.....	4

EXECUTIVE SUMMARY

DNV has undertaken a high level review on the projected offshore wind capacity additions as presented in the marine spatial plans or other similar relevant documentation as provided by the customer. This high level review is part of the 'Spatial study offshore wind North Seas 2030' (Commissioned at NSEC in 2022)

This review aims to describe the offshore wind farm and offshore grid developments according to national plans and visions. A regional overview of developments until 2030 (2040) for offshore wind energy and grid connections as represented in national MSPs and political visions has been created in the form of maps and tables to display differences, common grounds and areas for transboundary cooperation.

The overview on offshore wind development is supplemented by a comparative analysis of the methodology, on how the offshore wind potential is determined, e.g. which assumptions are made to calculate the capacity of an area.

The work is separated into 4 distinctive subtasks to accommodate the overview of the developments:

Item 1: The assessment of methodologies for determination of potential capacities in national marine spatial plans, comparison of different national approaches

Item 2: The influence on energy production by transboundary wake effects, identification of possible conflict areas

Item 3: Combining the conclusions of items 1 and 2 to estimate the potential capacities in the North Seas according to the national MSPs

Item 4: Grid connections for offshore wind farms and the potential for international cooperation

DNV has provided its main conclusions on the outputs on each respective item in the sections below

Item 1 – Assessment of Methodologies

DNV has reviewed the Marine Spatial Plans (MSP) provided by the Customer for each of the main countries of the North Sea and Celtic Sea (hereafter "North Seas"): Ireland, United Kingdom, France, Belgium, Netherlands, Germany, Denmark, Norway. The main focus of the review was the documentation provided by the Customer in a document "Bijlage Information Websites". DNV has occasionally used also further public resources where it was considered useful to expand on the information provided by the Customer. For an overview of applied source documents by country, see the titles in the appendices.

Specific or detailed information on how the capacity of the designated areas have been determined was not found within the MSP documentation. However, with the designated areas for offshore wind use well defined and the goals formulated for these areas available DNV could determine the power density of the areas. The power density can be seen as measure for the robustness and flexibility/freedom of the plans. Together with the country specific roadmaps, planning towards realization of the offshore wind goals an assessment has been made on the potential capacity and likelihood the goals will be met.

Overall, it was found that the methodology under which areas of seabed is allocated for offshore wind use under the various national MSP-s to be fairly similar. The MSP is commonly a document produced under a national regulatory framework for marine spatial planning typically under the remit of a ministry of planning, regional development or similar. The MSP integrates the interests and peyoratives of various stakeholders that may at times be of competing nature and aims to balance these into a common policy document that describes the current and future intended zoning of the marine space under the jurisdiction of each country. Typical stakeholders that are commonly consulted in this process are entities such as shipping companies and providers, environmental stakeholders, fisheries, infrastructure owners, tourism and recreation stakeholders and of course, energy policy makers, renewable energy developers and investors.

In terms of methodology for allocation of seabed for offshore wind there are common themes that can be observed in each MSP:

- Avoidance of critical shipping lanes
- Avoidance of environmentally sensitive areas
- Generally avoidance of other key infrastructure such as oil and gas infrastructure, communication infrastructure
- Prioritization of area that is closer to shore in the first rounds of development

The differences between different countries MSP allocation for offshore wind is primarily in the detail of the information provided which is also closely related to maturity of the respective market. For example, it is noted that the German MSP provides a lot more detail on each zone considered and the assumptions and dependencies to other activities. It is noted that the German MSP offshore wind allocation is also closely connected to the transmission grid development plan which determines the development of the grid capacity that would be required for connection of the projected offshore wind capacity additions. Another notable example is Ireland where it does not appear that particular areas are reserved for offshore wind. The Irish system was overhauled in December 2021 and establishment of a full maritime regulatory authority is expected by 2023 with the Ministry for the Environment, Climate and Communications overseeing the first development consenting process on an interim basis.

The following table provides the overview of capacity from each MSP per country showing the current installed capacity (operational), the projected capacity for 2030, and also for 2040 where available. Furthermore, the approximate power density of the designated areas provided are supplemented with DNV comments on actual targets and notable remarks. If no specific target is mentioned in the comments, the projected capacity should be read as target.

Table 1 – Overview of offshore wind capacity from each country’s MSP

Country	Operational (GW)	Projected 2030 (GW)	Projected 2040 (GW)	Approximate Power Density (MW/km ²)	DNV Comments
Ireland	0.025	7	n/a	n/a	The Irish policy for offshore wind is to achieve 7 GW by 2030. The combined capacity of applications for the first phase of consents will amount to 3.4 GW and opened in April 2021. To reach the 7GW target, the remaining capacity will be added in a second round of consents, with the allocations assumed to take place in 2023. It is expected that the 7GW target will be reached.
United Kingdom	11	30 - 60	50 - 100	5	The UK marine plan references to the UK state policy of achieving 50 GW of offshore wind by 2030. This policy is an aim that is contingent on factors such as seabed being released for auction and the projects achieving consent, as the developer carries the consenting risk and grid connection timing risk. The project areas currently in planning are relatively larger with lower power density as it

					is expected that they will reduce in size likely due to planning/environmental constraints. From the likelihood assessment in APPENDIX – COUNTRIES CAPACITY ADDITIONS it can be expected that the targets will be met.
France	0	5	40	7	France has a short term goal of achieving 2.3 GW by 2023 which is considered to be a stretch given the current status of its projects in the pipeline. By 2030 it is estimated that about 5 GW operational offshore wind capacity may be achieved. This is subject to uncertainty as the developer carries the consenting risk and the grid connection timing risk while regulations are not necessarily fixed.
Belgium	2.3	5.4-5.8	n/a	10	Belgium features a state driven offshore wind development program that is embedded into the MSP. The government provides site investigation data, leads the environmental and consenting and ensures the grid connection timeframe. It is considered that the anticipated offshore wind rollout will be achieved
Netherlands	2.5	21	n/a	8	Netherlands features a state driven offshore wind development program that is embedded into the MSP. The government provides site investigation data, leads the environmental and consenting and ensures the grid connection timeframe. It is considered that the anticipated offshore wind rollout will be achieved
Germany	7.7	30 ¹	~50 ²	10	Germany features a state led offshore wind development program that is embedded into the MSP. The government provides site investigation data, leads the environmental and consenting and

					ensure the grid connection timeframe. It is considered that the anticipated offshore wind rollout will be achieved
Denmark	2.3	12.8 ¹	n/a	1	Denmark has around 2.3 GW of operational capacity and has reserved areas for at least additional 10 GW of offshore wind capacity in its marine planning, where designated areas are not solely meant for use of offshore wind. With a power density of only 1, the areas are considered sufficient to accommodate Denmark's 2030 target of 12,8 GW ³ . It is planned that projects will be auctioned in a state lead process.
Norway	0	4.5	n/a	2	Norway has started a process to develop two areas for large scale offshore wind. It is understood that there will be additional plans for further capacities to be added to the pipeline. Although the current process is running in some delays, it is considered likely the targets for 2030 can be met.

¹ This target involve both North Sea and Baltic Sea.

² Target for 2035 is 40 GW, and for 2045 it is 70 GW.

³ This target is exclusive of another 3 GW towards 2032, around the North Sea Energy Island.

Item 2 – Transboundary Wake Effects

The wake effect is the aggregated, downstream reduction in wind speed, which is caused by the impact of the turbines extracting kinetic energy from the wind flow. With further offshore wind farm development throughout the North Seas, the number and size of offshore wind farms will increase. As the number and size of offshore wind farms increases, external wake impacts from clusters of offshore wind farms affecting each other will increase. This effect will occur in all areas of wind farm development but will be most significant in areas of high development activity, specifically the UK, Germany, Denmark and Netherlands. The magnitude of the impact on any specific project is highly project specific depending on the relative proximity and design of the neighbouring projects.

Offshore installed capacity targets set out in the nation MSPs do not explicitly take into account expected project capacity factors. There are many factors that affect the capacity factor for a wind farm including: wind speed, turbine technology, wake effects and other losses. An increase in wake losses due to the development of more offshore projects in the North Seas will decrease project capacity factors. However, this will be offset by increased wind speeds at sites further offshore; continuing development of turbine technology with larger rotor diameters and higher hub heights and improved wind farm control strategies, including wake steering to reduce wake losses.

Thus overall, no adjustments are recommended to the expected project capacities across the North Seas. It is expected any additional wake affects from future wind farm development will not impact the expected capacities as targeted in the national plans.

Explicitly looking at *Transboundary* (as in cross country borders) Wake Effects spots, the GIS model with all collected wind farm data shows a few regions with clusters wind farm projects. In Figure 1 below three areas are identified where Transboundary Wake Effects should be taken into account during project planning and design stages to ensure project wake losses are realistically taken into account.

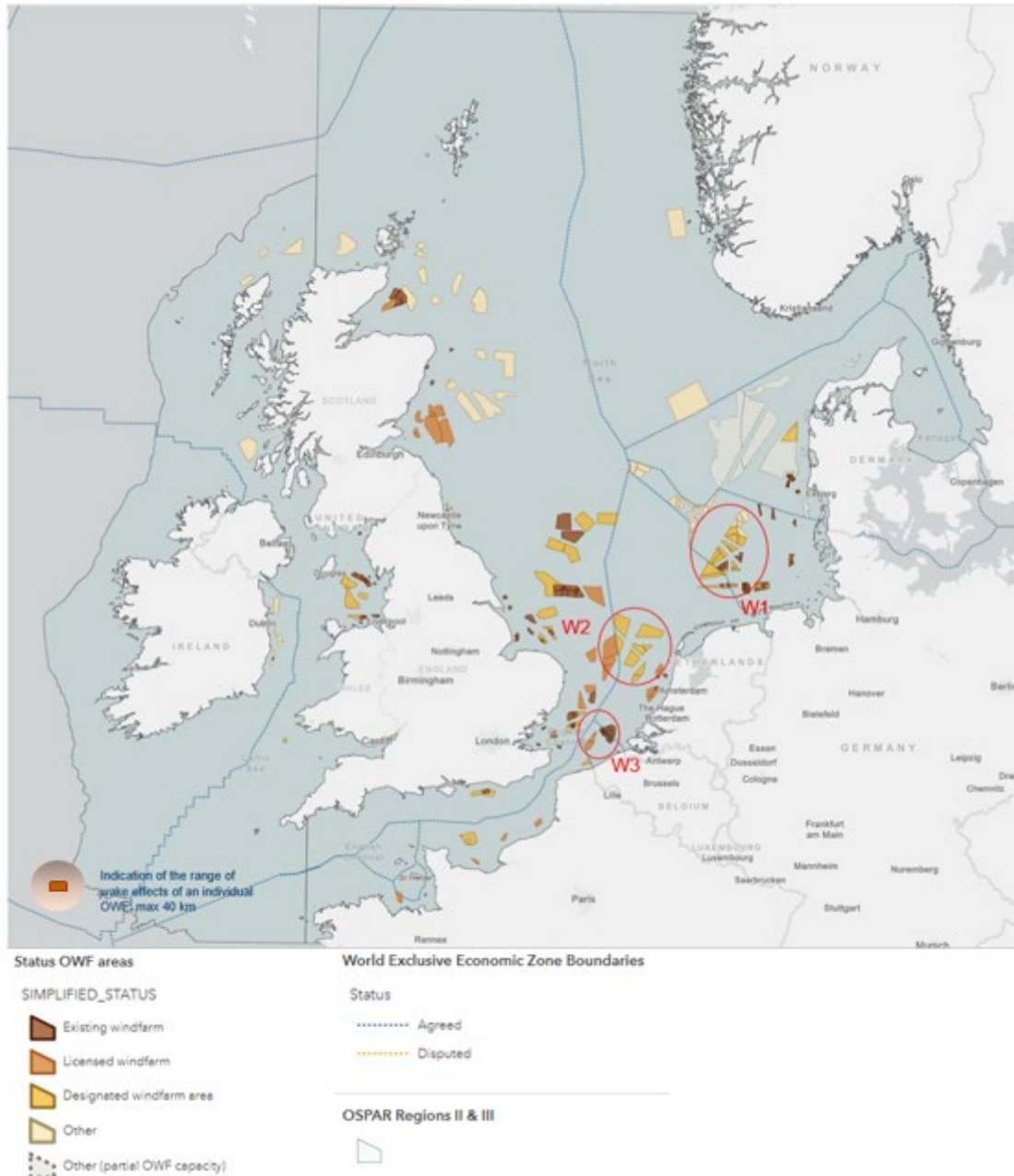


Figure 1 – Areas of Transboundary Wake Effects

W1 is the area around the Dutch-German border. Existing and newly planned projects in close proximity of each other. All these projects will influence Wake Effect losses in between each other.

W2 shows the area on the Dutch-British boarder, the IJmuiden Ver and East Anglia clusters. Very large wind farms (1GW+) are being developed there. Losses by the Wake Effects of neighbouring wind farms will have to be carefully take into account. The projected capacities will not be influenced by it.

W3 depicts the area at the Dutch-Belgian border. This area is already fully developed. Transboundary Wake Effects are incorporated in the project design, losses calculation and thus in the capacity factors of those projects.

The overall conclusion on this is that *Transboundary Wake Effects* are an existing phenomenon that is already taken into account, and it's effect will increase towards more dense populated areas up to 2030 and beyond. As a result of technological developments, such as larger wind turbines and smarter control systems, an significant effect on the anticipated overall energy yield (production) by country is not to be expected.

Item 3 – Summary of Potential Capacity

From the assessment on methodologies under item 1 insight is gathered on the designated areas in the MSPs by country and an overview is created for the capacities defined in combination with the countries' target for offshore wind deployment by 2030. Also the approximate power density of the designated areas has been determined, which gives an indication of the potential capacity within these areas. Further, the timelines for tenders or auctions of the various projects/development areas have been reviewed. With these elements an assessment has been made on whether the countries are likely to meet there ambitions for 2030. DNV considers it likely that most of the countries will meet their targets, as shown and commented in Table 1. The potential *Transboundary Wake Effects* as described under item 2 are expected to have no significant impact on the anticipated overall energy yield per country.

With the current state of technology, optimized cost levels (Levelized Cost of Energy, LCoE) will be found by density numbers of 8 to 10 MW/km². Looking at the GIS map with all areas together and hold them against the power density numbers as presented in Table 1 above, it can be seen that Belgium, Germany and the Netherlands have already tried to optimize the usage of see space for the targeted capacity. For Germany a note should be made that the MSP already foresees offshore wind farm development areas for beyond 2030.

Figure 2 below depicts the targeted amount for 2030 and gives an indication whether this should be considered the potential capacity of the designated areas from the spatial plans, or if more capacity is available. ('>' = more capacity available; '>>' = much more capacity available)

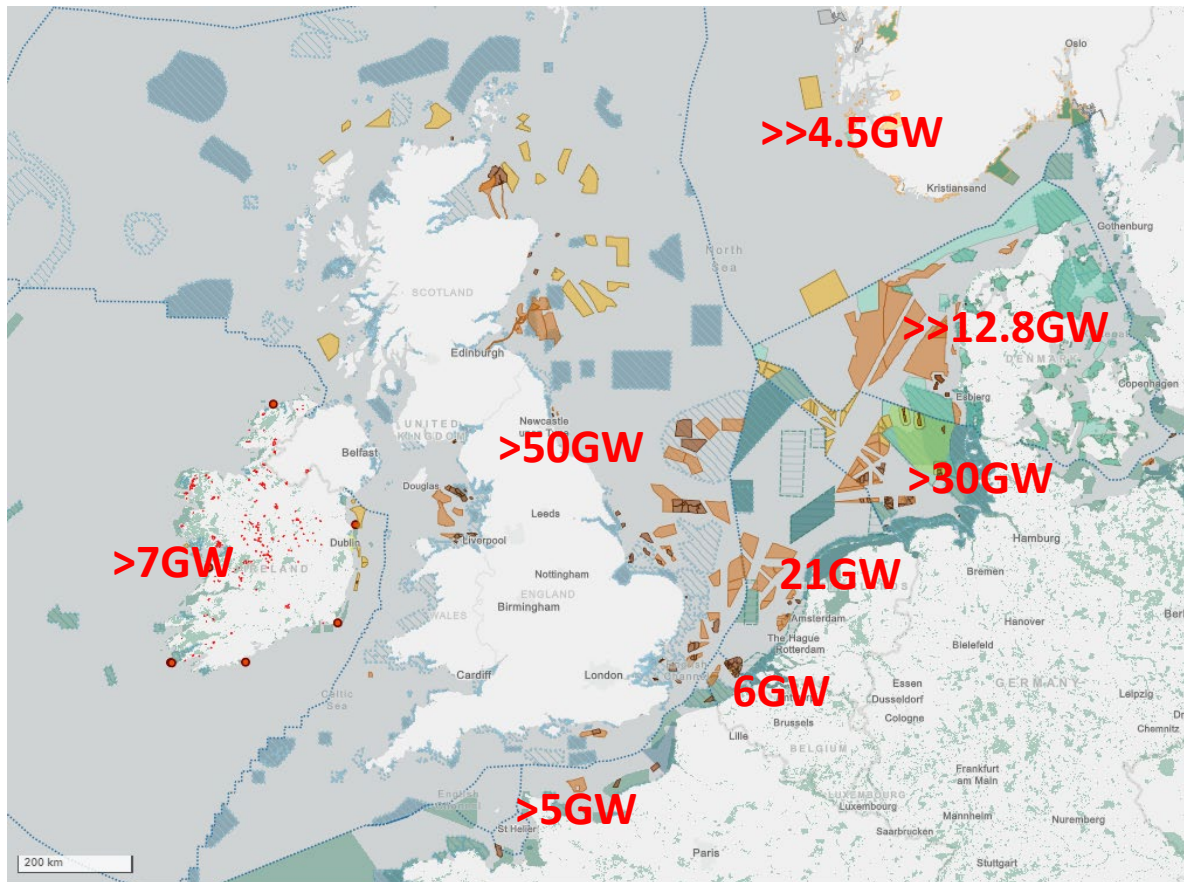


Figure 2 – target capacity 2030 with indication of potential capacity in the designated areas

For countries with an approximate power density below 5 MW/km² the potential capacity of offshore wind within the designated areas is much larger than the current target for 2030. The countries with an approximate power density between 5 and 7 MW/km² do have more space for additional offshore wind on top of the current 2030 target. Ireland has so far used the several individually developed plans for offshore wind project to set the target, while from the available sea area it might be concluded that much larger area could be used for offshore wind. As no particular areas have been designated in the MSP other than the already defined projects, it can be assumed further capacity additions could be achieved, subject to observing the relevant environmental and stakeholder consultation processes.

In summary, it could be concluded that the potential capacity for offshore wind projects in the designated areas within the countries' MSP is in total significantly higher than the total currently stated target for 2030. However, an actual number is hard to derive as many more aspects will influence the actual space that can be used for offshore wind in those areas.

In Table 2 below a comparison is shown between the (known) MSP capacities and the targets set by the countries complemented with DNV's comments on the considered actual capacity available within the Exclusive Economic Zones (EEZs) of the respective countries.

Table 2 – Target 2030 and MSP capacities

Country	MSP Target 2030	MSP Capacity	DNV comments
Belgium	5.4-5.8 GW	5.4-5.8 GW	This is considered the maximum possible within EEZ
Denmark	12.8 GW	12.8 GW	Much more achievable within designated areas
France	5 GW	5 GW	More achievable within EEZ
Germany	30 GW	45 GW	Tightly planned; more achievable in EEZ
Ireland	7 GW	7 GW	Much more achievable within EEZ
The Netherlands	21 GW	21 GW	Tightly planned, but new areas in EEZ possible
Total EU countries	81.2 GW	96.2 GW	
Norway	4.5 GW	4.5 GW	Much more achievable within designated areas and EEZ
United Kingdom	50 GW	100 GW	More achievable within EEZ
Total North Seas countries	135.7 GW	200.7 GW	This is not considered the full potential capacity of the North Seas

Item 4 – Grid Connections and international cooperation

The pressure on the marine space becomes bigger with the growth of offshore wind developments. The accompanying grid connections have found their way through all restrictions so far, following the offshore wind planning. In most cases a project-by-project solution is found, while in some cases a central “power socket” has been built to connect several projects (Germany and Belgium, for some projects). The latter solution entails less connection cables from shore to land and less substations onshore and offshore, minimizing social and ecological impact at the landfall and onshore, as well as allowing to achieve cost efficiencies.

For the development and build out of projects towards and beyond 2030, grid connection options need to be considered at an early planning phase of the projects, if not before. And with the creation of offshore wind farm development zone clusters across marine borders, the international cooperation and coordination become even more important.

In this section DNV elaborates on some aspects around grid connection development in the North Seas and the opportunities (and needs) for international cooperation. In the following picture, Figure 3, various ongoing initiatives of grid related projects are shown. Most are interconnectors between two countries, not necessarily directly related to offshore wind. For practically all of these projects there are opportunities to closely coordinate, and collaborate with offshore wind developments.

Two particular projects could be highlighted as potential starting point for North Seas countries to further cooperate and develop a coordinated offshore grid. Both in Belgium and Denmark concrete plans are made to build an offshore island (the yellow arrows in Figure 3) to accommodate multiple grid connections at a single point, facilitating interconnection of

countries and creating multiple options for wind energy evacuation to shore. Seeing that links connecting such islands to shore will cross at least two different EEZs, international cooperation is required. To find the technical and economical most optimal solution it will be important that countries collaborate in further planning of marine spatial use and other developments in these areas, including offshore wind.

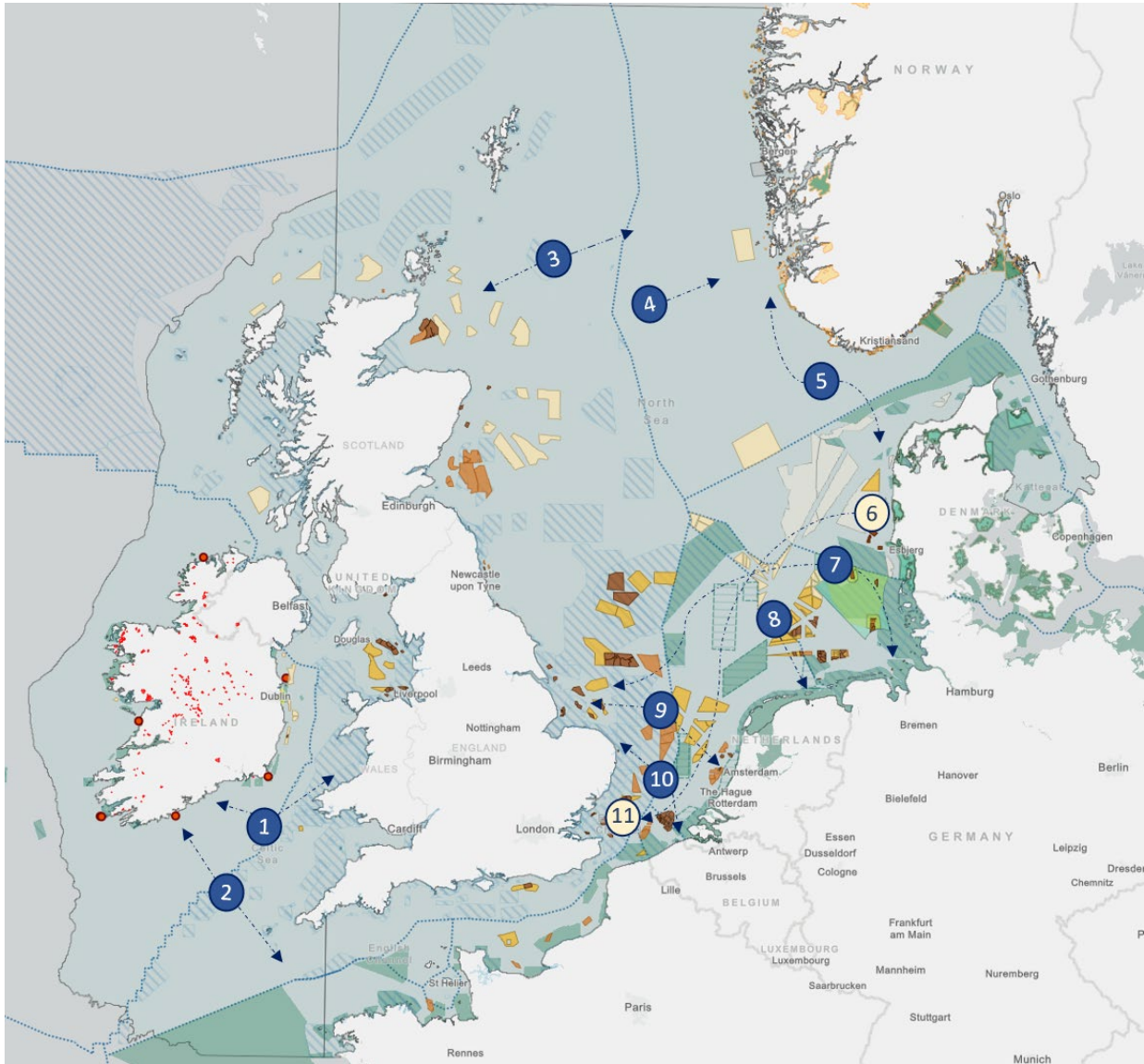


Figure 3 – Existing Interconnection initiatives in the North Seas

- | | |
|--|-----------------------------|
| 1: Greenlink (IE & WSL) | 7: NeuConnect (DE & GB) |
| 2: Celtic (FR & IE) | 8: PAWOZ (NL) |
| 3: NorthConnect Easternlink (SCO & NO) | 9: WindConnector (UK & NL) |
| 4: CMS & Maali Link (NO) | 10: Nautilus Link (UK & BE) |
| 5: Nordlink (NO & DE) | 11: Energy Island Belgium |
| 6: North Sea DK Energy Island | |

An overarching message to the decision makers for an internationally cooperated offshore grid planning could be formulated as follows: *“National governments, regulators and TSOs need to understand, create and enforce incentives to plan offshore wind farms and transmission systems coordinated and well ahead to maximize benefits / minimize cost for consumers in EU/North Seas states”.*

A long-term spatial vision on a regional scale is important for an efficient and optimized space use and to avoid unnecessary conflicts and missed 'no regret' actions for the short-term. Building offshore power hubs, such as energy islands, is considered to be one of the possible ways to create a coordinated offshore grid and enable the future flexibility to make use of potential new ways of transmitting the energy.

Key action points for the development and planning of an optimized grid are:

- Create common cross-border forum for the involved stakeholders (TSOs, NRAs, ministries, offshore wind developers, OEMs, Oil and Gas infrastructure developers, fisheries, environmental groups, defence, shipping, etc)
- Coordinate planning and realization of wind farms and interconnectors across different EEZs in space and time
- Align transmission/interconnection planning with other marine users
- Explore where combining different infrastructure functions (such as wind energy evacuation, reinforcement, and trading) is possible
- Manage cable corridors to minimize number of cables and crossing, and optimize utilization of cable capacity; collocate offshore substations to minimize the number of offshore support structures; collocate onshore substations to minimise onshore reinforcements and construction works
- Ensure expandability and compatibility of offshore transmission infrastructure in different EEZs by standardising and doing anticipatory investments where optimal
- Assign governance/ownership and develop supporting economic frameworks

Technical considerations to maintain option value of future expansions/connections need to be considered. This requires a change in approach. As illustration, below are some of the current practices and what is required.

- Now, on North Seas level:
 - o Separate national plannings for OWF, transmission and interconnection
 - o TSOs & private developers develop projects independently
 - o O&G planning is independent
 - o In some cases countries have bilateral agreements
 - o Coordination is happening on a national level
 - o Different technical standards applied
 - o Project-by-project optimisation
- Desired future:
 - o Multi-lateral process for offshore planning, e.g. TYNDP (EU)
 - o Coordinated process, e.g. Offshore Coordination (UK)
 - o Option to identify and mandate to steer towards realizing synergies
 - o Involvement of all offshore transmission stakeholders
 - o Inclusion of marine spatial constraints
 - o Inclusion of onshore transmission constraints
 - o Regional / multi-state co-optimisation

To summarise, in order to develop a long-term spatial vision of how wind energy will be brought onshore, a coordinated vision should pay attention to:

- anticipating future scale of offshore wind developments following from Eu-level and national targets and ambitions (e.g. REPower EU)
- Individual national initiatives and projects (e.g. Danish energy islands)
- development of offshore grid for interconnection and reinforcement purposes and coordination therewith
- avoiding spatial conflicts with other marine uses
- role of hybrid projects and projects involving Oil and Gas and hydrogen industry
- landfall and incorporation of the onshore grid constraints
- spatial aspects of energy production related to energy demands
- supply chain limitations for the manufacturing, transportation, and delivery of the needed equipment and resources

APPENDIX – COUNTRIES CAPACITY ADDITIONS

In this appendix the MSP information from the different countries is put together in a table including links to the used references, websites and overview of development status and maps.

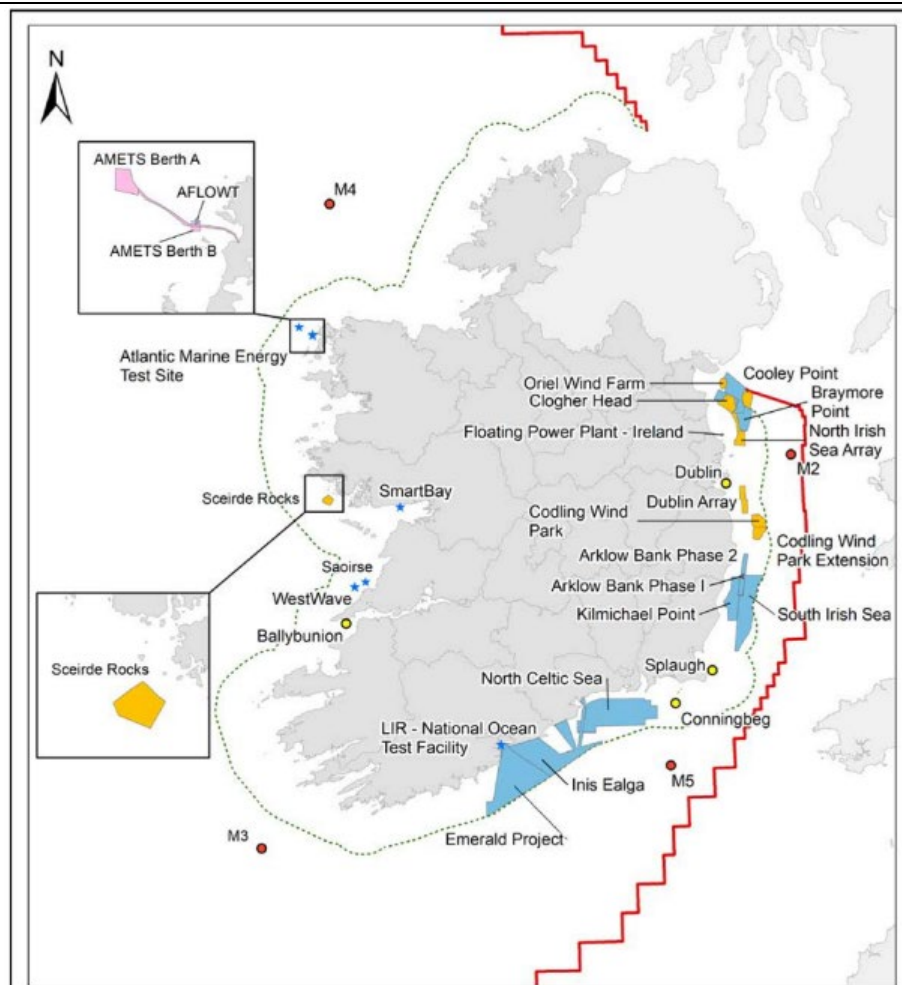
The countries' MSPs are tabulated in the following order:

- Ireland
- United Kingdom
- France
- Belgium
- Netherlands
- Germany
- Denmark
- Norway

IRELAND

Item	Content
Marine Spatial Plan Source (MSP) (link etc)	Ireland's Marine Spatial Plan is known as the National Marine Planning Framework (NMPF) gov.ie - National Marine Planning Framework (www.gov.ie) In 2021, the Government also passed the Maritime Area Planning Act, setting up a new legal regime for consenting and extending the permission system to cover the entire maritime area gov.ie - Maritime Area Planning Bill (www.gov.ie) An Offshore Renewable Development Plan (OREDPA), published in 2014 and reviewed in 2018, detailed the key policy actions required to support the development of offshore wind: gov.ie - Offshore Renewable Energy Development Plan (OREDPA) (www.gov.ie)
MSP date of release and validity	Published: 30/06/2021, Last updated: 30/07/2021
Overview of the development of the MSP: - Stakeholders involved - High level summary of the process involved in development and sign off of the MSP	The NMPF was approved by the Irish Government, following public consultations, after issuing a roadmap in 2017. Developed by a team within the Department of Housing, Local Government and Heritage, the NMPF underwent a public and stakeholder engagement process. This included public engagement events in almost all coastal counties and direct engagement with: <ul style="list-style-type: none"> • Port authorities • Local authorities • Sport and recreation organisations • Inshore and sea fisheries organisations • Environmental groups • Renewable energy sector • Tourism sector
Summary of projected offshore wind capacity additions (Capacity, Acreage, Power density, etc)	Approximately 3.4 GW across 7 projects have been granted "Relevant Project" status. These will be the first projects assessed under the new Marine Area Consents (MAC) regime established by the Maritime Area Planning Act. Many other projects are at an earlier stage. Given that these projects have overlapping areas, it is assumed by DNV that these projects will take part in a later competitive consenting process. If the largest projects within an overlapping area assumed to be granted consent, the 7GW target can be achieved.

Drawings of the development areas



This map is to be used for reference only. Please refer to the www.marineplan.ie to explore the most up to date National Marine Planning Framework data.

Marine Renewable Energy and Infrastructure

0 25 50 100
Kilometres

Wind Farms (Foreshore Process)

- Site Investigations (Applications Pending)
- Relevant Projects*
- Fully Commissioned

Energy and Buoy Infrastructure

- ★ Marine and Renewable Energy Test Site
- Wave Buoy
- Weather Buoy

■ Atlantic Marine Energy Test Site

*Offshore wind projects that were either applied for, or were granted a lease under the Foreshore Act 1933; and/or offshore wind projects that are eligible to be processed to receive a valid grid connection offer (see NMPF Offshore Renewable Energy chapter for more information).

Credits: MaREI; Eirwind Project: Offshore Windfarms (2021); Marine Institute, Commissioners of Irish Lights, Ireland's Digital Ocean (digitalocean.ie); Wave Buoys (2021); DHLGH: Foreshore Planning Applications (2020).

Red line shows the border of the maritime area. (source: gov.ie - National Marine Planning Framework (www.gov.ie))

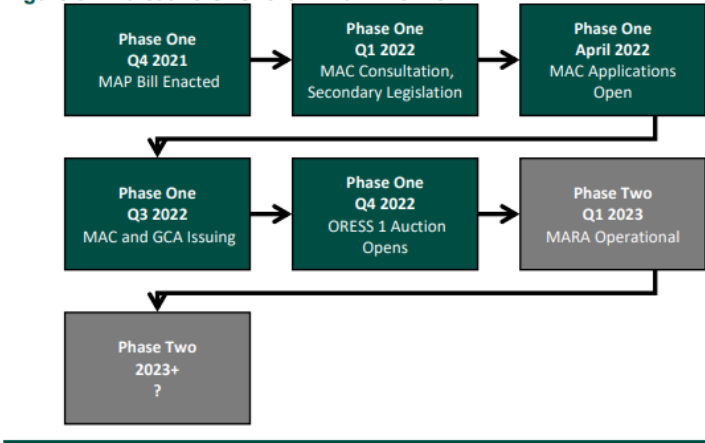
Note: The blue areas labelled 'site investigations' depict foreshore applications that have been made by developers for the purpose of environmental surveys/site investigations. Such surveys or investigations precede any applications for MACs or development permission from the planning authority. Therefore, these areas are merely proposed projects.

Anticipated timeline for the offshore wind developments:

- Seabed lease
- Consenting / Building permit, etc
- Development (surveys,

The Irish government increased its targeted installed capacity to 7GW by 2030. (source: gov.ie - [Government announces sectoral emissions ceiling, setting Ireland on a pathway to turn the tide on climate change](https://www.gov.ie/en/news/2021-06/government-announces-sectoral-emissions-ceiling-setting-ireland-on-a-pathway-to-turn-the-tide-on-climate-change))

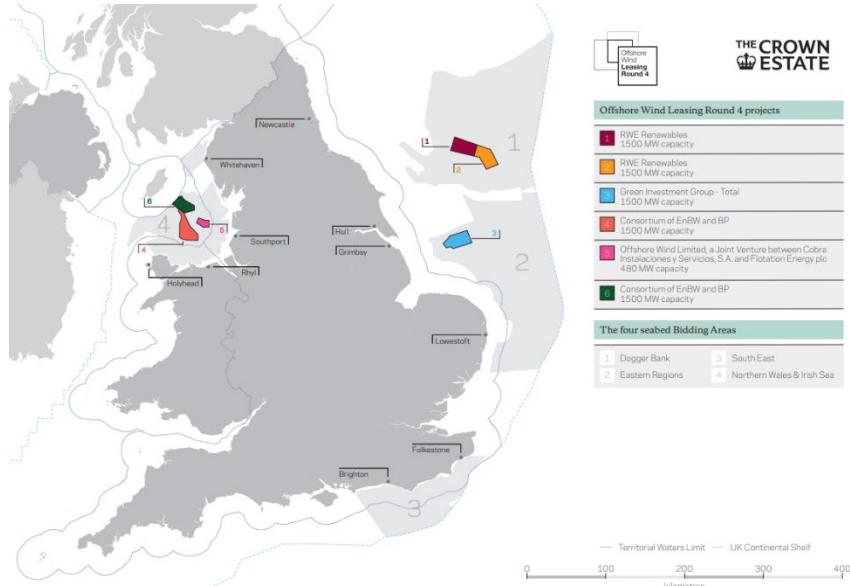
In 2021, a policy statement was issued detailing a three-phased approach to offshore wind development in Ireland. Further detail was also provided by ongoing consultation for Offshore Wind - Phase 2 Further detail on the timeline is provided by the ongoing consultation for Offshore Wind - Phase 2 (gov.ie - [Policy Statement on the Framework for Ireland's Offshore Wind](https://www.gov.ie/en/news/2021-06/policy-statement-on-the-framework-for-ireland-s-offshore-wind))

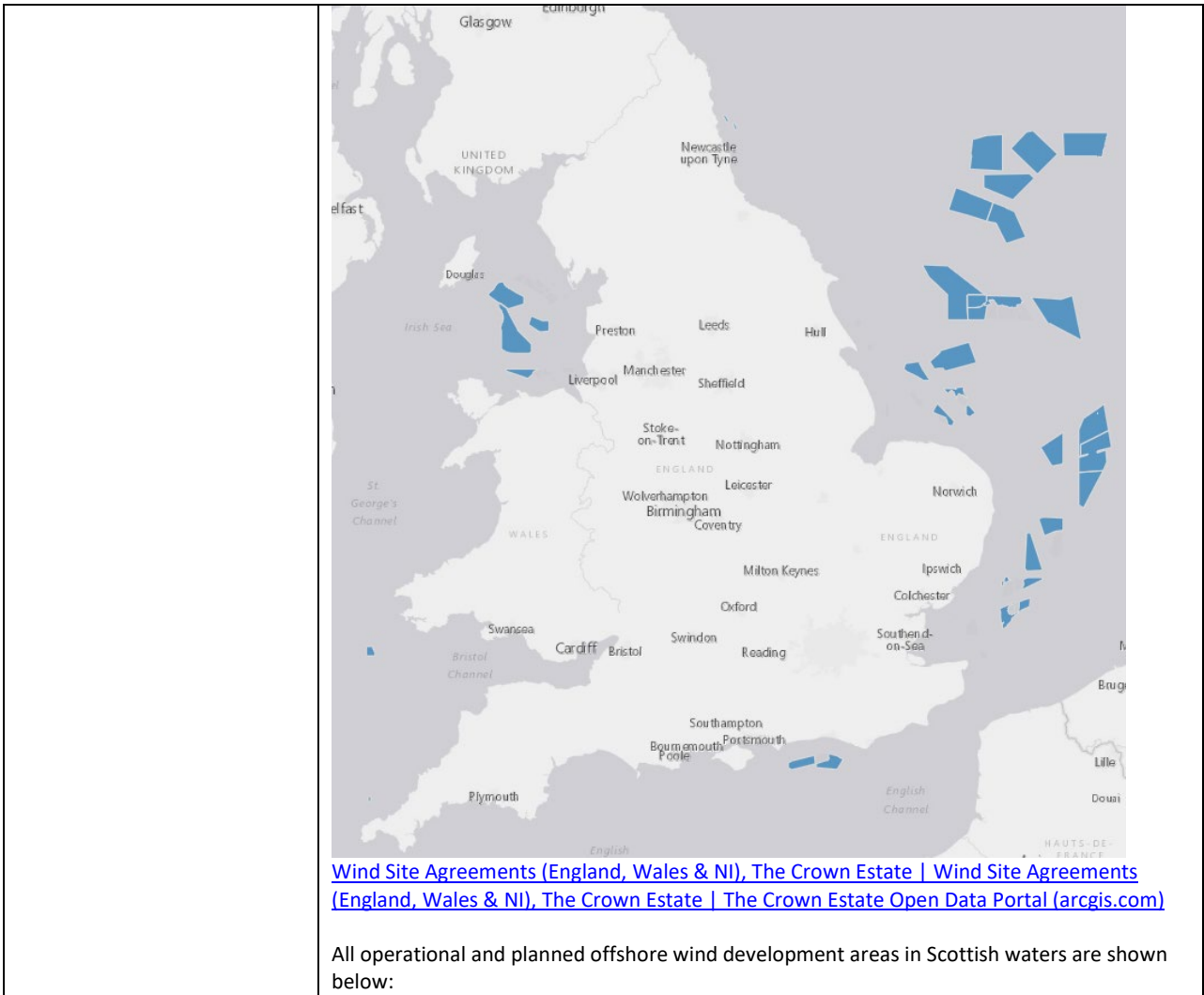
<p>design, procurement) - Construction</p>	<p>www.gov.ie, gov.ie - Offshore Wind – Phase Two Consultation (www.gov.ie)</p> <p>Phase 1 (2021-2024): To deliver approximately 2GW by 2028, with the primary route to market assumed to be the offshore wind specific auction ORESS-1, which plans to open in Q4 2022. Under this phase, only projects that have been granted "Relevant Projects" status will be considered.</p> <p>Phase 2 (2025-2030): To deliver a further 3GW aiming by 2030, with the primary route to market assumed to be ORESS-2.</p> <p>Phase 3 (2030- Onwards): To take advantage of up to 30GW of offshore wind potential post 2030.</p> <p style="text-align: center;">Figure 3 - Indicative Offshore Wind Timeline</p>  <p>MAP - Maritime Area Planning Bill/Act MAC - Maritime Area Consents MARA -Maritime Area Regulatory Authority GCA - Grid Connection Assessment ORESS - Offshore Renewable Energy Support Scheme.</p>
<p>Summary of the main assumptions provided in setting out the offshore wind development areas</p>	<p>Assumed all projects given "Relevant Project" status will be given full consent. In reality, for the tendering process to be competitive at least one project must be rejected. No attrition assumed (i.e. all projects successful at the ORESS-1 and ORESS-2 auctions will be constructed, no reduction in capacity of projects from consent to construction) Assumed that in earlier stage projects where areas are near/overlapping that the largest project will be granted concept. Therefore it is assumed that the Inis Ealga, North Celtic Sea and South Irish Sea projects will be given concept.</p>

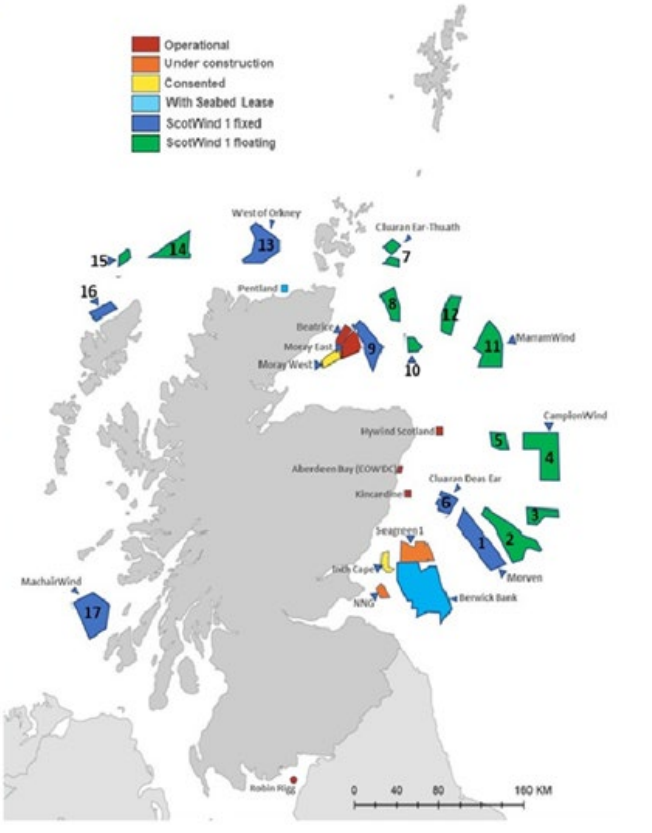
UNITED KINGDOM

Item	Content
<p>Marine Spatial Plan Source (MSP) (link etc)</p>	<p>The UK's national marine planning is devolved into its constituent regions, governed by a framework established in the UK Marine Policy Statement (10164_Marine Statement_Cov.indd (publishing.service.gov.uk))</p> <p>The national marine plans of the devolved governments are:</p> <ul style="list-style-type: none"> • National Marine Plan of Scotland: Scotland's National Marine Plan (www.gov.scot) • Welsh National Marine Plan: Welsh National Marine Plan (gov.wales) • Draft of Marine Plan for Northern Ireland (The final report is yet to be published): Marine Plan for Northern Ireland Department of Agriculture, Environment and Rural Affairs (daera-ni.gov.uk) <p>England's regional plans are:</p>

	<ul style="list-style-type: none"> • North East Marine Plan: The North East Marine Plans Documents - GOV.UK (www.gov.uk) • East Marine Plan: East Marine Plans - GOV.UK (www.gov.uk) • South East Marine Plan: The South East Marine Plan Documents - GOV.UK (www.gov.uk) • South Marine Plan: The South Marine plans documents - GOV.UK (www.gov.uk) • South West Marine Plan: The South West Marine Plans Documents - GOV.UK (www.gov.uk) • North West Marine Plan: The North West Marine Plans Documents - GOV.UK (www.gov.uk)
<p>MSP date of release and validity</p>	<p>The UK's National Marine Policy Statement was published (30/09/2011).</p> <p>The national marine plans of the devolved governments were published:</p> <ul style="list-style-type: none"> • National Marine Plan of Scotland: (27/03/2015) • Welsh National Marine Plan: (12/11/2019) • Draft of Marine Plan for Northern Ireland: (01/04/2018) (The final report is yet to be published) <p>England's regional plans were published:</p> <ul style="list-style-type: none"> • North East Marine Plan: (23/06/2021) • East Marine Plan: (11/06/2014) • South East Marine Plan: (23/06/2021) • South Marine Plan: (17/07/2018) • South West Marine Plan:(23/06/2021) • North West Marine Plan: (23/06/2021)
<p>Overview of the development of the MSP:</p> <ul style="list-style-type: none"> - Stakeholders involved - High level summary of the process involved in development and sign off of the MSP 	<p>The National Marine Policy Statement was approved by the UK Government in 2011, building upon measures introduced Marine and Coastal Access Act 2009 (Marine and Coastal Access Act 2009 (legislation.gov.uk))</p> <p>The regional plans developed following the National Marine Policy Statement were developed in consultation with a large number of stakeholders. For example, England's North East Plan, published by the Department of Environment, Food and Rural Affairs, was developed in iterative 9-month development blocks followed by 3-month consultation periods. These stakeholders included:</p> <ul style="list-style-type: none"> • Defence authorities • Local authorities • The Department for Business, Energy and Industrial Strategy • Representatives of devolved administrations and neighbouring countries <p>Under the Marine planning - statement of public participation (Marine planning - statement of public participation - GOV.UK (www.gov.uk)) The UK Government stated it was interested in engaging with a wide number of groups in the development of its regional marine plans. This included, but was not limited to, representatives from:</p> <ul style="list-style-type: none"> • academic institutes • energy production • fisheries • historic environment • infrastructure development • land and seabed owners and managers • local communities and elected members • local councils and other public authorities • marine conservation • non-governmental organisations • partnerships and interest groups • ports and shipping

	<ul style="list-style-type: none"> • seascape and landscape • tourism and recreation 																										
<p>Summary of projected offshore wind capacity additions (Capacity, Acreage, Power density, etc)</p>	<p>As of January 2022, the UK had a total approximately 11GW of operational and another 9GW either under construction or have government support on offer (e.g. CFD), 9.5 GW of projects that have received consent. In addition to this, the Crown Estate (the UK entity that manages the UK seabed and is responsible for tendering seabed lease for uses such as offshore wind and other infrastructure) have recently awarded seabed lease rights to projects that could realize up to 32 GW (7 GW in England and Wales and 25 GW in Scotland). In addition, the Crown Estate estimates that there is a further of 37 GW of leasing potential.</p> <p>This adds up to a total potential offshore wind capacity of 98.5 GW that may be realized by 2040.</p> <p>The most recent leasing rounds by the Crown Estate and Crown Estate Scotland have accepted proposals for a total installed capacity of 32 GW (7 GW for England and 25GW for Scotland) This 32 GW additional capacity includes 23 project with a total acreage of 9800km² and average power density of 3.36MW/km² (weighted by installed capacity) (Offshore Wind Leasing Round 4 The Crown Estate , ScotWind - Our projects - Crown Estate Scotland)</p>																										
<p>Drawings of the development areas</p>	<p>The Crown Estate round 4 selected projects are shown below.</p>  <p>Offshore Wind Leasing Round 4 projects</p> <table border="1"> <tr> <td>1</td> <td>RWE Renewables</td> <td>1500 MW capacity</td> </tr> <tr> <td>2</td> <td>RWE Renewables</td> <td>1500 MW capacity</td> </tr> <tr> <td>3</td> <td>Green Investment Group - Total</td> <td>1500 MW capacity</td> </tr> <tr> <td>4</td> <td>Consortium of EnBW and BP</td> <td>1500 MW capacity</td> </tr> <tr> <td>5</td> <td>Offshore Wind Limited, a Joint Venture between Cobra Instalaciones y Servicios, S.A. and Flotation Energy plc</td> <td>480 MW capacity</td> </tr> <tr> <td>6</td> <td>Consortium of EnBW and BP</td> <td>1500 MW capacity</td> </tr> </table> <p>The four seabed Bidding Areas</p> <table border="1"> <tr> <td>1</td> <td>Dogger Bank</td> <td>3</td> <td>South East</td> </tr> <tr> <td>2</td> <td>Eastern Regions</td> <td>4</td> <td>Northern Wales & Irish Sea</td> </tr> </table> <p>the-crown-estate-offshore-wind-leasing-round-4-selected-projects.pdf (thecrownestate.co.uk)</p> <p>All non-operational development area in English and Welsh Waters (e.g. Pre-planning, Under Construction, Consented etc). This includes round 4 lease areas.</p>	1	RWE Renewables	1500 MW capacity	2	RWE Renewables	1500 MW capacity	3	Green Investment Group - Total	1500 MW capacity	4	Consortium of EnBW and BP	1500 MW capacity	5	Offshore Wind Limited, a Joint Venture between Cobra Instalaciones y Servicios, S.A. and Flotation Energy plc	480 MW capacity	6	Consortium of EnBW and BP	1500 MW capacity	1	Dogger Bank	3	South East	2	Eastern Regions	4	Northern Wales & Irish Sea
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<p>Anticipated timeline for the offshore wind developments:</p> <ul style="list-style-type: none"> - Seabed lease auction - Consenting / Building permit, etc - Development (surveys, design, procurement) - Construction 		<p>The UK government has committed to a target of 50GW of offshore wind by 2030, of which 5 GW will be floating.</p> <p>Energy White Paper (publishing.service.gov.uk) https://www.great.gov.uk/international/content/investment/sectors/offshore-wind/</p>																																				
<p>Summary of the main assumptions provided in setting out the offshore wind development areas</p>		<p>It is noted that there is no information available to back that the 50 GW target will be met with certainty. In the UK the developers carry the consenting risk and this is not deemed likely to change in the near term. As such it should be assumed that the capacities which have seabed lease only are not going to be fully realized as not all projects will receive consent, or the projects may be reduced in size during the consenting process. DNV proposes that categories of projects with seabed lease should be assumed with a factor of 50% and the 37GW capacity noted by the Crown Estate as 'Seabed leasing potential' should be assumed with a factor of 20%. Consented and other projects that are earlier in the development phase are assumed to be fully realized.</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Capacity</th> <th>Completion probability</th> <th>Net Capacity</th> </tr> </thead> <tbody> <tr> <td>Operational</td> <td>11</td> <td>100%</td> <td>11</td> </tr> <tr> <td>With CFD or other support</td> <td>9</td> <td>100%</td> <td>9</td> </tr> </tbody> </table>	Category	Capacity	Completion probability	Net Capacity	Operational	11	100%	11	With CFD or other support	9	100%	9																								
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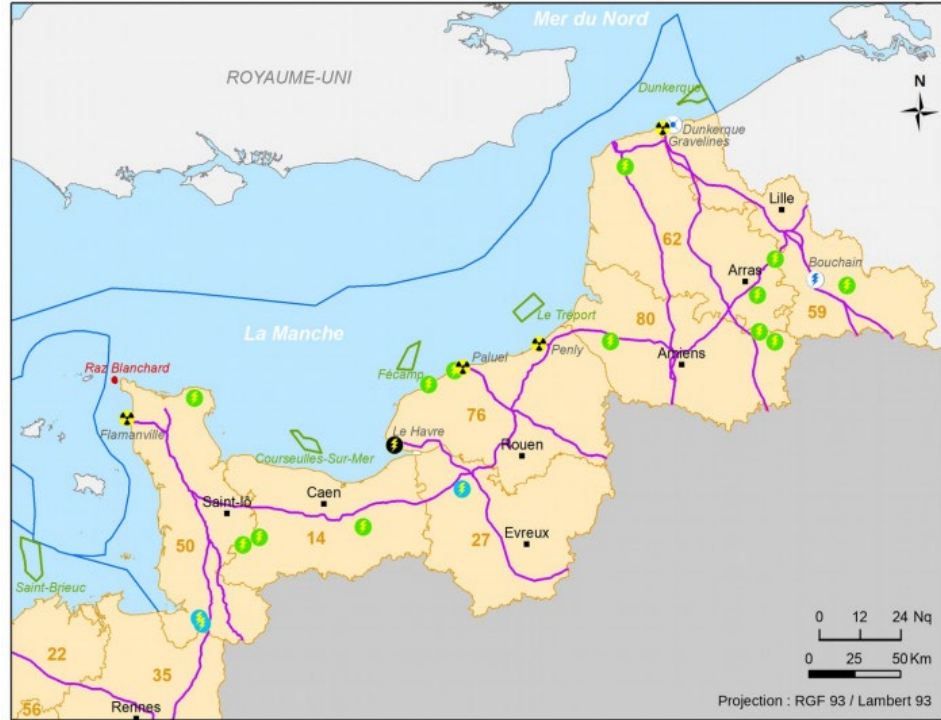
	Consented	9.5	100%	9.5
	Seabed lease awarded	32	50%	16
	Seabed leasing potential	37	20%	7.4
	Total Capacity	98.5		52.9

FRANCE



Item	Content
Marine Spatial Plan Source (MSP) (link etc)	<p>National Strategy for the Sea and Coast (17094_strategie-nationale-pour-la-mer-et-le-littoral_en_fev2017.pdf (developpement-durable.gouv.fr))</p> <p>Regional coastal strategy (ongoing): Façade Strategies (merlittoral2030.gouv.fr)</p> <p>Sea Basin Strategy documents (all regions, French): Documents Stratégiques de Façade (Métropole) - GéoLittoral (developpement-durable.gouv.fr)</p> <p>Sea Basin Strategy Document Eastern Channel - North Sea and Eastern English Channel (English) (en_dsfsynthetique_memnor_v1-4_vu_dirm.pdf (developpement-durable.gouv.fr))</p>
MSP date of release and validity	National Strategy for the Sea and Coast : 23/02/2017
<p>Overview of the development of the MSP:</p> <ul style="list-style-type: none"> - Stakeholders involved - High level summary of the process involved in development and sign off of the MSP 	<p>In February 2017, the French Government published the National Strategy for the Sea and Coast, which set out its long-term vision for its marine area.</p> <p>Each maritime region has then developed a regional strategy consisting of a strategic and operational component. In 2019 the strategic components were adopted. The operational components, which includes both socio-economic and environmental objectives, is still being developed. As part of this process a thorough consultation process occurred including engagement with:</p> <ul style="list-style-type: none"> • Elected officials • Unions • Companies <p>In addition to this, public consultations occurred, the most recent over which was over the summer of 2021 for the operational components of the regional strategies.</p>
Summary of projected offshore wind capacity additions (Capacity, Acreage, Power density, etc)	<p>France currently has no large-scale offshore wind capacity. By 2023, the French Government expects its operational capacity to be approximately 3GW as the projects from its round 1 and round 2 leasing rounds become operational. This 3GW of additional capacity consists of 6 projects with a total acreage of 429km² and average power density of 6.79MW/km² (weighted by installed capacity) (Eoliennes en mer : lutter contre le changement climatique et assurer notre sécurité d'approvisionnement électrique)</p>

Drawings of the development areas



Production d'énergie sur la façade maritime Manche Est - mer du Nord



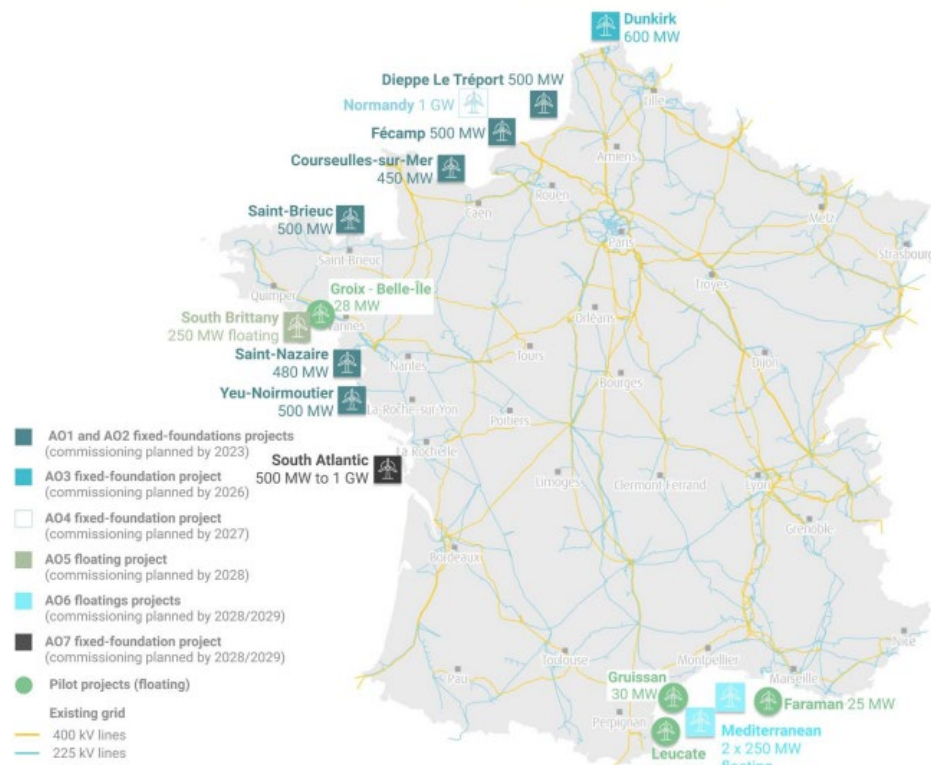
Projets d'énergies marines renouvelables

-  Eolien posé: site attribué ou en projet
-  Ferme pilote hydrolienne

Limites administratives

-  Limite de la façade maritime MEMN
-  Limite administrative

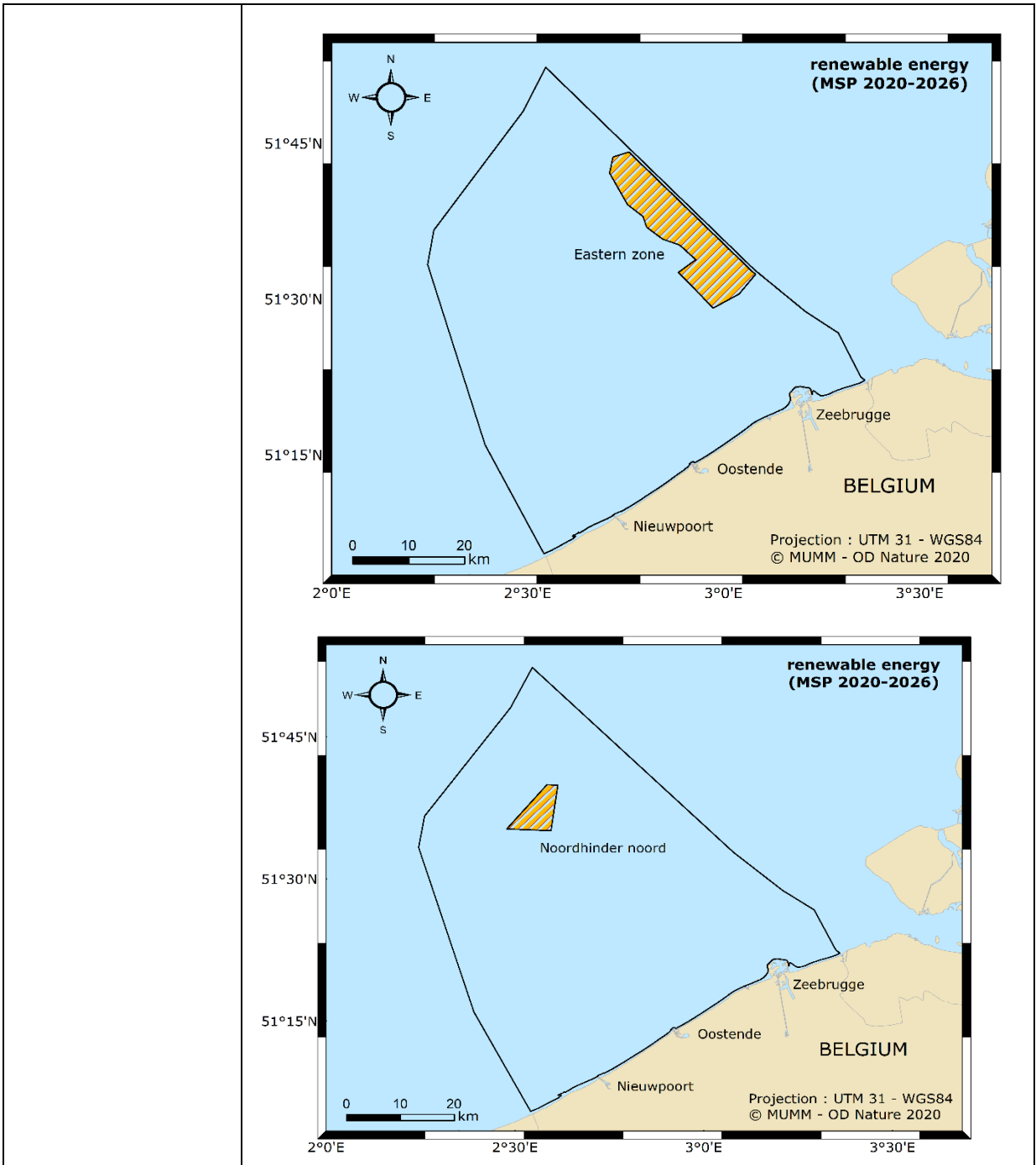
Offshore windfarm projects under development on the French coastlines by 2029

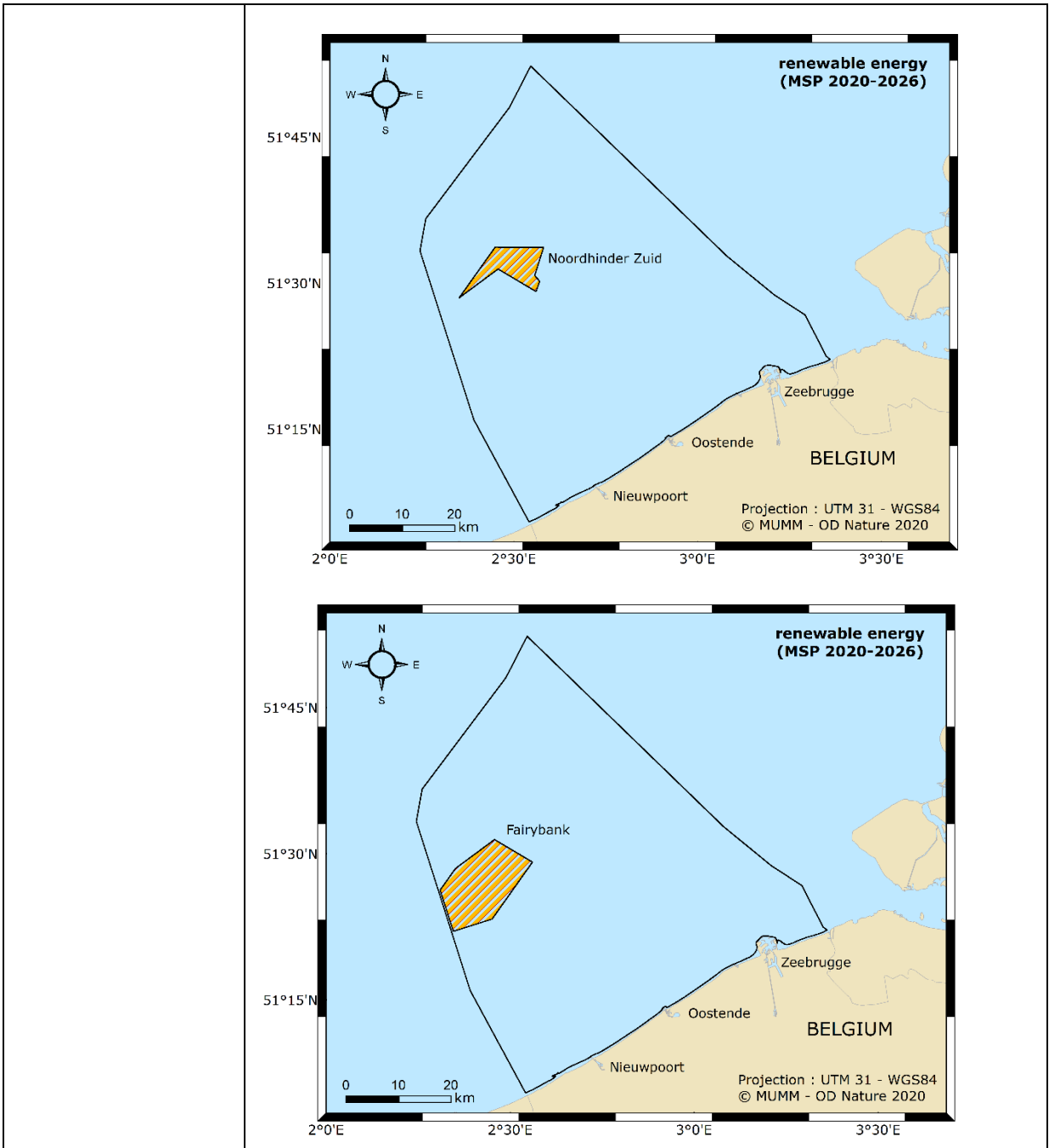


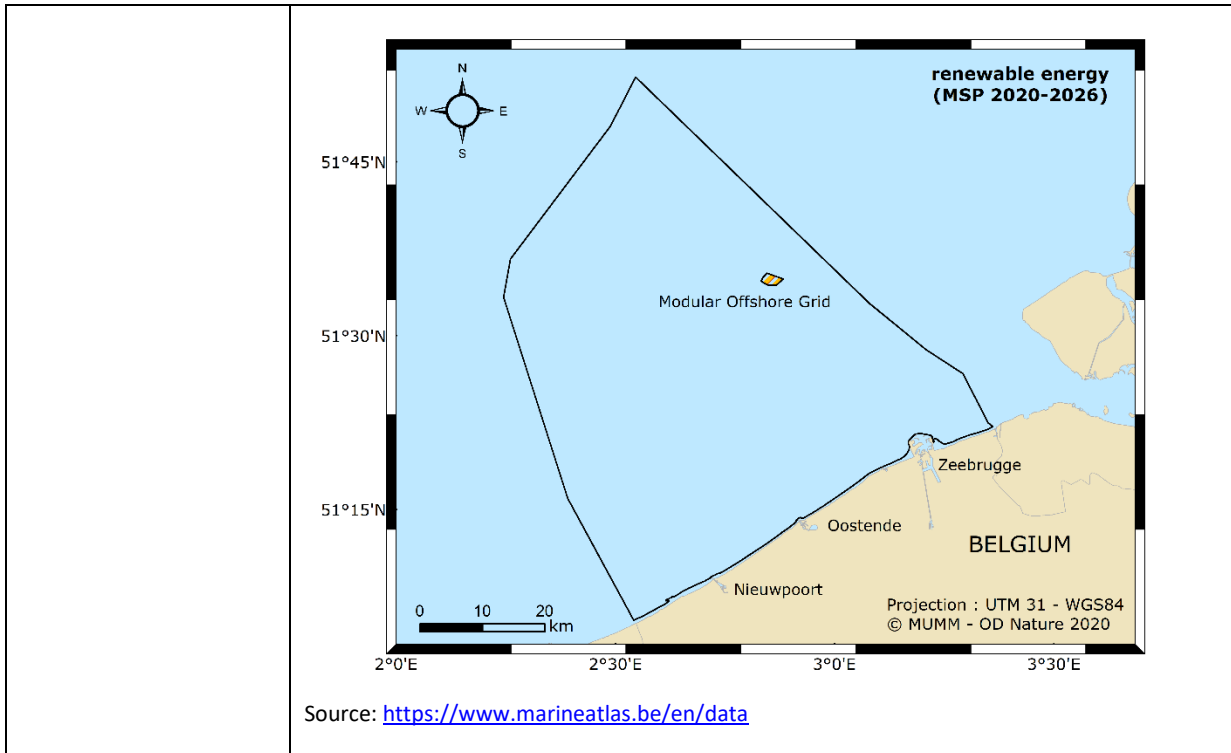
	https://energie-fr-de.eu/fr/manifestations/lecteur/conference-en-ligne-sur-leolien-offshore.html?file=files/ofaenr/02-conferences/2021/210908_Offshore/Presentations/03_Martin_Salmon_MTE_OFATE_DFBEW.pdf																								
<p>Anticipated timeline for the offshore wind developments:</p> <ul style="list-style-type: none"> - Seabed lease auction - Consenting / Building permit, etc - Development (surveys, design, procurement) - Construction 	<p>In March 2020, the French Government released its multiannual energy plan. Within this document, France has set a goal of 2.4GW of installed capacity by 2023 and 4.7-5.2GW by 2028. PPE-Executive summary (ecologie.gouv.fr).</p> <p>Overview of tendering timeline up to 2028.</p> <p>In February 2022, French President Emmanuel Macron announced an ambition to create 40GW of offshore wind capacity by 2050. France sets 40 GW by 2050 offshore wind goal 4C Offshore News</p> <table border="1"> <thead> <tr> <th>Grant date for the call for tenders</th> <th>2019</th> <th>2020</th> <th>2021</th> <th>2022</th> <th>2023</th> <th>2024</th> <th>>2025</th> </tr> </thead> <tbody> <tr> <td>Floating wind turbine</td> <td></td> <td></td> <td>250 MW <i>Bretagne</i> (€120/MWh)</td> <td>250 MW <i>Méditerranée</i> (€110/MWh)</td> <td></td> <td>250-500 MW depending on prices</td> <td>1 project of 500 MW per year, fixed or floating depending on prices and resources</td> </tr> <tr> <td>Fixed wind</td> <td>500 MW <i>Dunkirk</i> (<€70/MWh)</td> <td>1000 MW <i>English Channel</i> (€65/MWh)</td> <td></td> <td></td> <td></td> <td>1000 – 1500 MW (€60/MWh)</td> <td></td> </tr> </tbody> </table>	Grant date for the call for tenders	2019	2020	2021	2022	2023	2024	>2025	Floating wind turbine			250 MW <i>Bretagne</i> (€120/MWh)	250 MW <i>Méditerranée</i> (€110/MWh)		250-500 MW depending on prices	1 project of 500 MW per year, fixed or floating depending on prices and resources	Fixed wind	500 MW <i>Dunkirk</i> (<€70/MWh)	1000 MW <i>English Channel</i> (€65/MWh)				1000 – 1500 MW (€60/MWh)	
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Summary of the main assumptions provided in setting out the offshore wind development areas	<p>DNV comment: It is considered that the 2023 target of 2.4GW will not be fully met as the projects in the pipeline that are realistically estimated to achieve full commissioning by 2023 are approx. 1.5GW.</p> <p>Future targets may be achievable subject to the projects being efficiently moved through the consenting process and achieving typical procurement and construction timeframes.</p>																								

BELGIUM

Item	Content
Marine Spatial Plan Source (MSP) (link etc)	Marine Spatial Plan for 2020-2026 : 2020 MSP Brochure
MSP date of release and validity	Published in July 2019 and implemented on 20 March 2020. Source: https://www.marineatlas.be/en/marine-spatial-plan
Overview of the development of the MSP: <ul style="list-style-type: none"> - Stakeholders involved - High level summary of the process involved in development and sign off of the MSP 	<p>Zone distribution:</p> <ul style="list-style-type: none"> - Nature conservation - Shipping - Dredging activities - Fishing and aquaculture - Tourism - Military activities - Research - Commercial and industrial activities <p>Coastal protection</p>
Summary of projected offshore wind capacity additions (Capacity, Acreage, Power density, etc)	<p>As of 2021, the Belgian offshore wind capacity is spread over 8 wind farms totalling up to 2.26 GW. (Source: https://www.belgianoffshoreplatform.be/en/news/first-offshore-wind-energy-zone-in-the-belgian-north-sea-fully-and-on-time-completed/)</p> <p>As per the MSP 2020-2026, three new zones are identified for Belgian offshore wind development with an objective to produce 3.15 GW-3.5 GW. The additional zone area is understood to be 285 km2. Bringing the overall capacity up to 5.4 to 5.8 GW by 2030. (Source: https://economie.fgov.be/en/themes/energy/belgian-offshore-wind-energy)</p>
Drawings of the development areas	Below are the maps to the zones for Renewable energy generation in the Belgian North Sea. Noordhinder Noord, Zuid and Fairybank are the new zones for offshore wind, while the Eastern zone contains the operational projects







Source: <https://www.marineatlas.be/en/data>

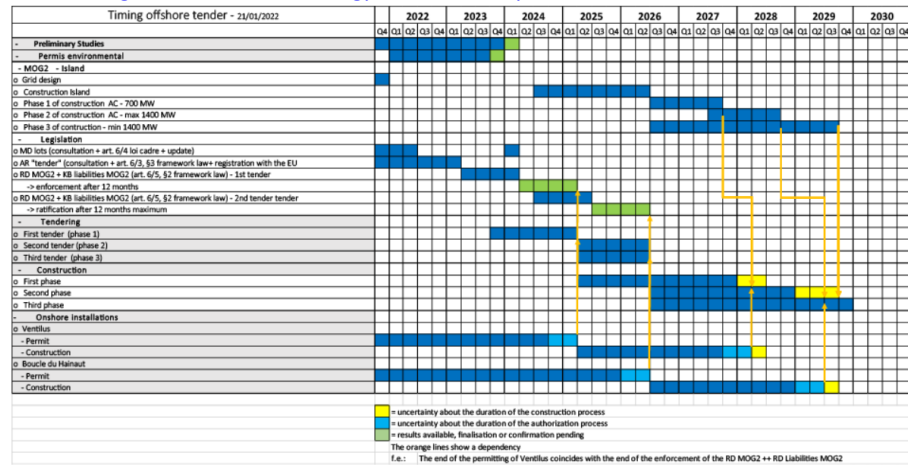
Anticipated timeline for the offshore wind developments:

- Seabed lease auction
- Consenting / Building permit, etc
- Development (surveys, design, procurement)
- Construction

The ‘first’ call for competition is planned for the fourth quarter of 2023 with the aim of putting the first new offshore installations for the production of electricity based on renewable energy sources into service in the “Princess Elisabeth Zone” in 2027-2028.

To that end, preliminary studies will firstly be carried out in 2020-2023, and draft versions of the implementing orders in 2022 will be published for final approval in 2023 and 2024. The meeting of the deadline for putting the first wind farm into service depends in particular on the assurance that all permits for the necessary reinforcement of the onshore network have been obtained.

Source: [Belgian offshore wind energy -5.4-5.8 GW by 2030](#)



Summary of the main assumptions provided in setting out the offshore wind development areas

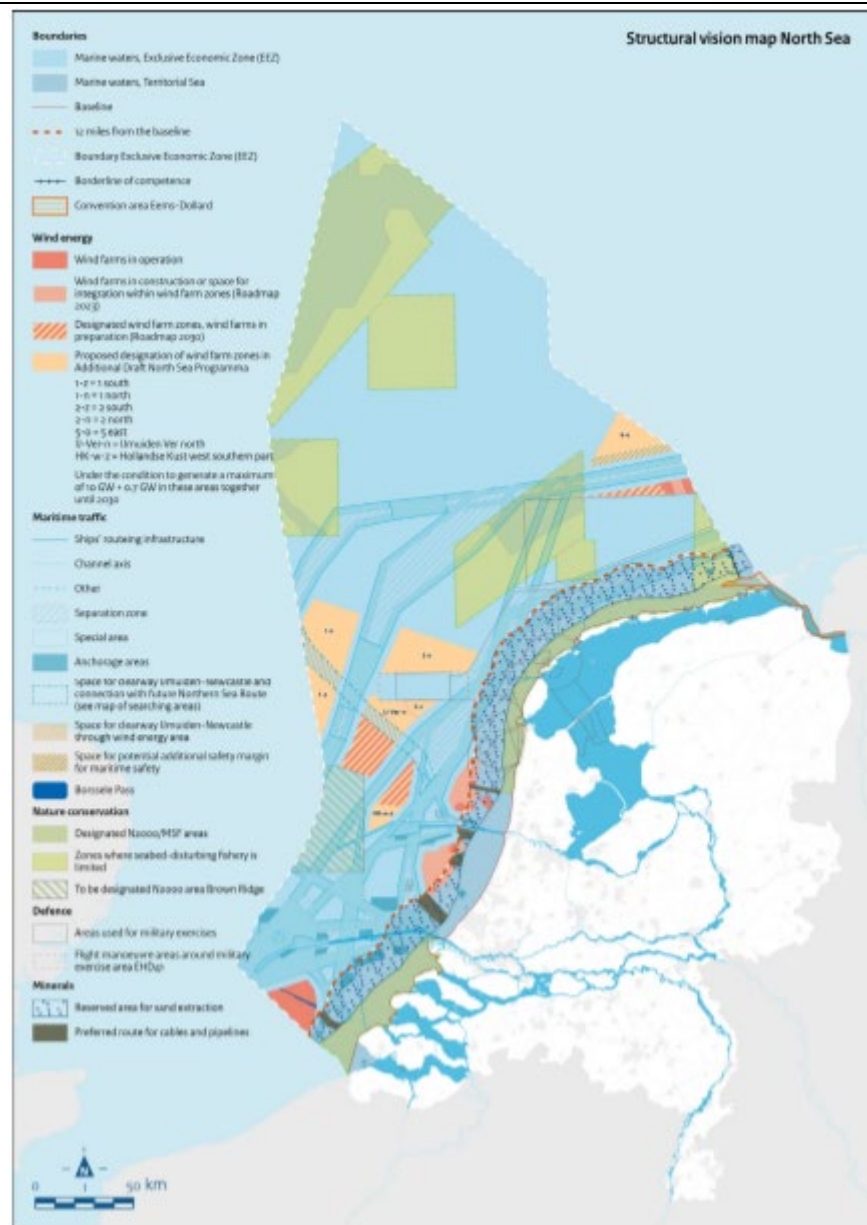
Assuming that the Belgium government will be providing site investigation data and all consenting issues are fully cleared, the program provided for above can be considered realistic.

NETHERLANDS

Item	Content
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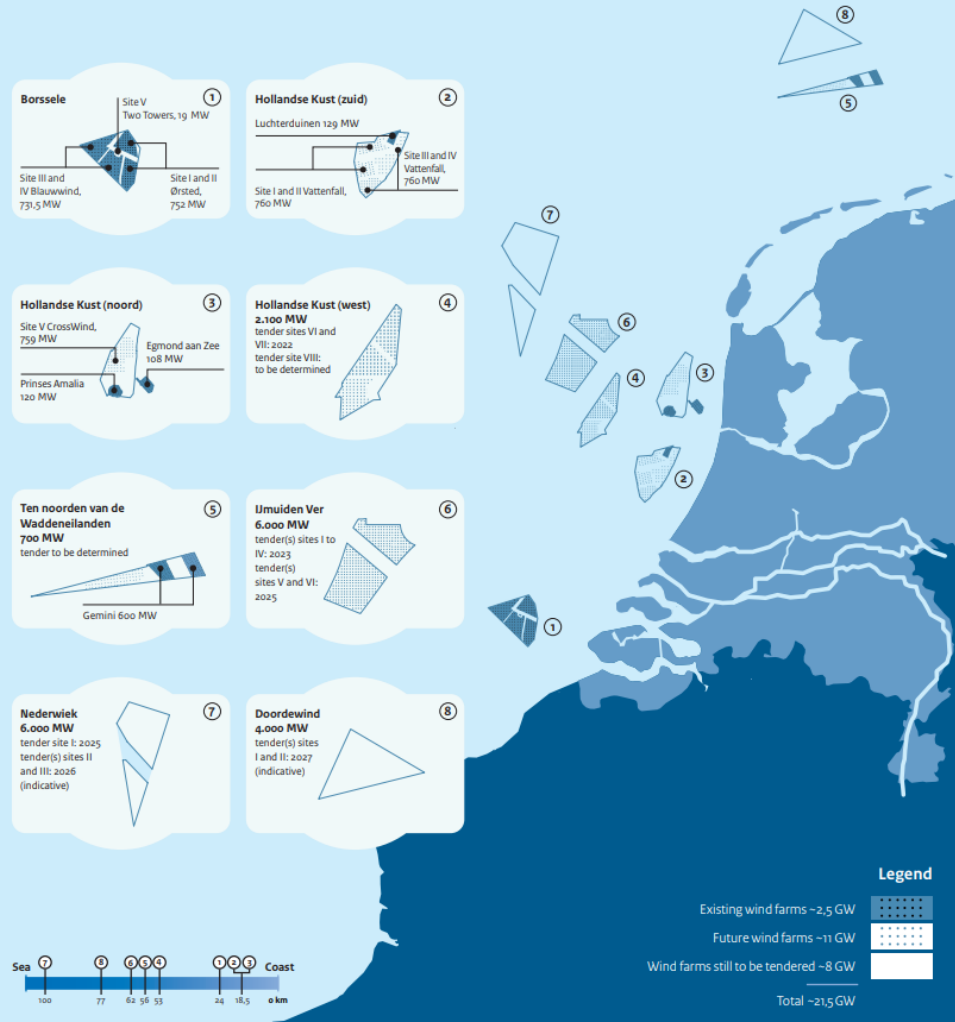
<p>Marine Spatial Plan Source (MSP) (link etc)</p>	<p>The North Sea Programme, including the Marine Strategy is an integral part of the National Water Program (NWP) 2022-2027. Draft North Sea Programme 2022-2027 Additional draft North Sea Programme 2022-2027 Offshore wind search areas 2030-2050 North Sea 2050 spatial agenda</p>
<p>MSP date of release and validity</p>	<p>Implemented in 2016</p>
<p>Overview of the development of the MSP:</p> <ul style="list-style-type: none"> - Stakeholders involved - High level summary of the process involved in development and sign off of the MSP 	<ul style="list-style-type: none"> - The Dutch Ministries of Economic Affairs and Climate, - Infrastructure and Water Management, - Agriculture, - Nature and Food Quality, and the - Ministry of the Interior and Kingdom Relations - the coastal authorities and residents. <p>(Source : https://www.noordzeeloket.nl/en/functions-and-use/offshore-wind-energy/)</p>
<p>Summary of projected offshore wind capacity additions (Capacity, Acreage, Power density, etc)</p>	<p>As of February 2022, the Dutch offshore wind farm capacity is at 2.46 GW approximately spread across 7 projects.</p>

Drawings of the development areas



(Source: [Additional draft North Sea Programme 2022-2027](#))

Offshore Wind Energy Roadmap



(Source : [WOZ-Routekaart-June-2022.pdf \(rvo.nl\)](https://www.rvo.nl/sites/default/files/2022/06/woz-routekaart-juni-2022.pdf))

Zone / Site	MW	Area	Density
Offshore wind farm Egmond aan Zee (OWEZ)	108	27	4.00
Borssele	1502	344	4.37
Hollandse Kust (zuid)	1520	214	7.10
Luchterduinen	129	16	8.06
Hollandse Kust (noord)	759	88	8.63
Prinses Amalia	120	14	8.57
Hollandse Kust (west)	2100	176	7.95
Ten noorden van de Waddeneilanden	700	120	5.83
Gemini	600	70	8.57
IJmuiden Ver	6000	400	10.00
Nederwiek	6000	n/a	n/a
Doordewind	4000	n/a	n/a





















Anticipated timeline for the offshore wind developments:




- Seabed lease auction
- Consenting / Building permit, etc
- Development (surveys, design, procurement)
- Construction

In the process of the new approach and roadmap for offshore wind, we are working towards three important milestones:

- 2021: a letter to parliament from the new cabinet with the main points of the new approach and the roadmap 2040;
- 2022: decision-making on a possible acceleration target for 2030 and publication of the associated extension to the 2030 roadmap;
- 2023: defining a new approach and roadmap for offshore wind energy 2040.

(<https://www.rvo.nl/onderwerpen/duurzaam-ondernemen/duurzame-energie-opwekken/windenergie-op-zee/nieuwe-routekaart#programma-noordzee-2022-2027>)

Capacity (GW)	Wind Farm Zone, Site(s)	Tender for sites	(Expected) commissioning date of wind farm	Status
0.75	Borssele, Sites I and II	Implemented in 2016	2020	
0.75	Borssele, Sites III, IV and V	Implemented in 2016	2020	
0.76	Hollandse Kust (zuid), Sites I and II	Implemented in 2017	(2022-2023)	
0.76	Hollandse Kust (zuid), Sites III and IV	Implemented in 2019	(2022-2023)	
0.76	Hollandse Kust (noord), Site V	Implemented in 2020	(2023)	
approx. 0.7	Hollandse Kust (west), Site VI	Implemented in 2022	(2025-2026)	
approx. 0.7	Hollandse Kust (west), Site VII		(2025-2026)	
approx. 1.0	IJmuiden Ver, Site III	Fourth quarter of 2023	(2028)	
approx. 1.0	IJmuiden Ver, Site IV		(2028)	
approx. 1.0	IJmuiden Ver, Site I		(2029)	
approx. 1.0	IJmuiden Ver, Site II		(2029)	
approx. 1.0	IJmuiden Ver (noord), Site V	Second quarter of 2025	(2029)	
approx. 1.0	IJmuiden Ver (noord), Site VI		(2029)	
approx. 2.0	Nederwiek (zuid), Site I		(2030)	
approx. 2.0	Nederwiek (noord), Site II	2026*	(2030)	
approx. 2.0	Nederwiek (noord), Site III		(2031)	
approx. 0.7	Hollandse Kust (west), Site VIII	2026/2027**	TBD**	
approx. 0.7	Ten noorden van de Waddeneilanden, Site I	2026/2027*	(2031)	
approx. 2.0	Doordewind, Site I	2027*	(2031)	
approx. 2.0	Doordewind, Site II	2027*	(2031)	

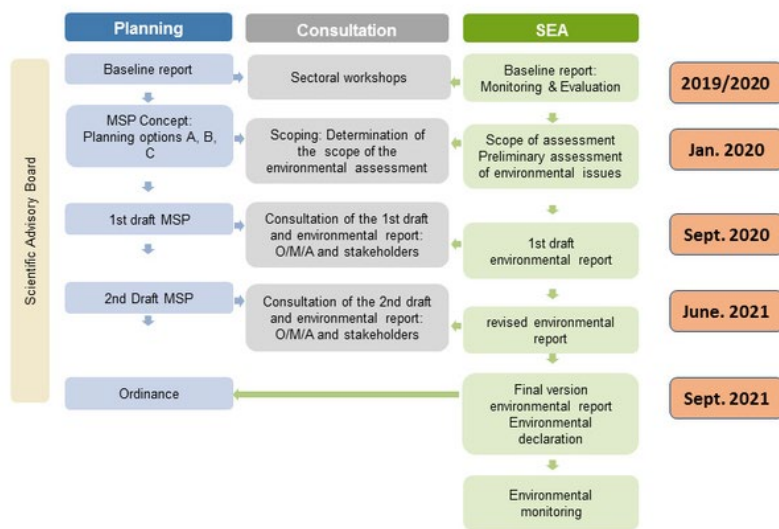
Realised:  Under construction:  Scheduled: 

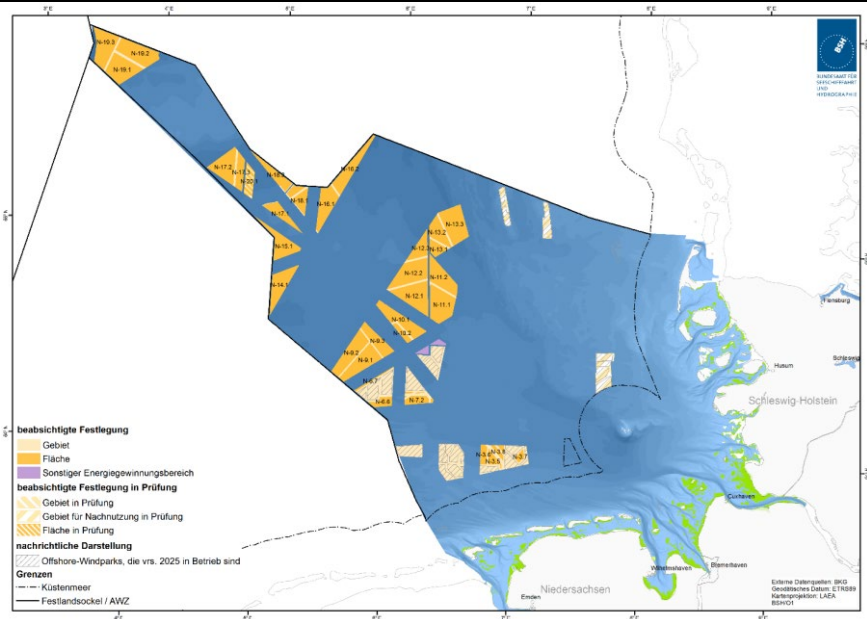
Source: [Development Framework for Offshore Wind Energy \(rvo.nl\)](#)

Summary of the main assumptions provided in setting out the offshore wind development areas

The program is deemed achievable as the Dutch government is providing site investigation data and carries out the consenting work.

GERMANY

Item	Content
Marine Spatial Plan Source (MSP) (link etc)	https://www.bsh.de/EN/TOPICS/Offshore/Maritime_spatial_planning/Maritime_Spatial_Plan_2021/maritime-spatial-plan-2021_node.html
MSP date of release and validity	1 September 2021
Overview of the development of the MSP: <ul style="list-style-type: none"> - Stakeholders involved - High level summary of the process involved in development and sign off of the MSP 	<p>The MSP was developed in accordance with the law on spatial planning. The MSP is developed by the Federal Ministry of Interior, Building and Community (BMI) and the Federal Maritime and Hydrographic Agency (BSH).</p> <p>The Marine Spatial Plan is a result of a multistage consultation process with relevant stakeholders at national and international level. A summary of the process is shown in the diagram below:</p>  <p>The justification for adding offshore wind sites is based on the updated Offshore Wind Energy Act (WindSeeG). The targets set out in the WindSeeG are 30 GW by 2030, 45 GW by 2035, and 70 GW by 2045.</p>
Summary of projected offshore wind capacity additions (Capacity, Acreage, Power density, etc)	<p>North Sea:</p> <p>The starting point for defining priority areas for wind energy are initially the areas EN1 to EN3 and EN6 to EN13. EN 13 North shall be also designated as a priority area as of 1 January 2030 unless the Federal Ministry responsible for shipping proves to the Federal Ministry responsible for spatial planning by 31 December 2025 that this area is required for shipping for compelling reasons of safety and efficiency of shipping</p>
Drawings of the development areas	



Area		Area			Grid	
Designation Territory	Designation area	Area [km ²]	vs. Installable power [MW]	corrected power density [MW/km ²]	Designation network connection	Capacity grid connection [MW]
N-3	N-3.5	29	420	9,5	NOR-3-2	900
	N-3.6	33	480	9,5	NOR-3-2	900
	N-3.7	17	225	9,5	NOR-3-3	900
	N-3.8	23	433	9,3	NOR-3-3	900
N-6	N-6.6	44	630	10,0	NOR-6-3	900
	N-6.7	16	270	5,7	NOR-6-3	900
N-7	N-7.2	58	980	9,3	NOR-7-2	980
N-9	N-9.1	158	2,000	10,7	NOR-9-1	2000
	N-9.2	157	2,000	10,6	NOR-9-2	2000
	N-9.3	106	1,500	11,2	NOR-9-3	2000
N-10	N-10.1	148	2,000	10,6	NOR-10-1	2,000
	N-10.2	31	500	10,2	NOR-9-3	2,000
N-11	N-11.1	192	2,000	8,9	NOR-11-1	2,000
	N-11.2	148	1,500	8,3	NOR-11-2	2,000
N-12	N-12.1	193	2,000	8,7	NOR-12-1	2,000
	N-12.2	187	2,000	9,1	NOR-12-2	2,000
	N-12.3	80	1,000	9,4	NOR-12-3	2,000
N-13	N-13.1	50	500	7,5	NOR-11-2	2,000
	N-13.2	92	1,000	8,6	NOR-12-3	2,000

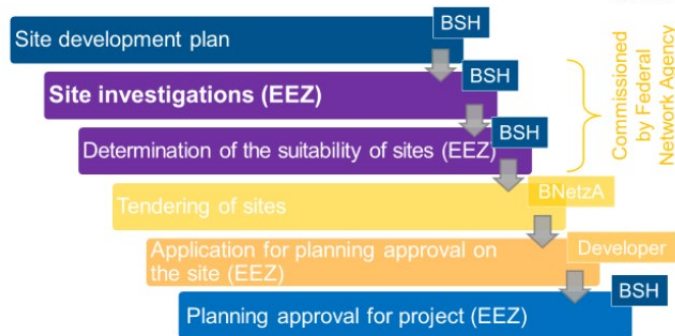
	N-13.3	195	2,000	8,7	N/A	N/A
N-14	N-14.1	145	2,000	10,4	N/A	N/A
N-15	N-15.1	138	2,000	10,5	N/A	N/A
N-16	N-16.1	146	2,000	10,7	N/A	N/A
	N-16.2	140	2,000	10,3	N/A	N/A
N-17	N-17.1	81	1,000	8,1	N/A	N/A
	N-17.2	152	2,000	10,5	N/A	N/A
	N-17.3	70	1,000	10,2	N/A	N/A
N-18	N-18.1	58	1,000	11,3	N/A	N/A
	N-18.2	112	2,000	11,2	N/A	N/A
N-19	N-19.1	170	2,000	9,7	N/A	N/A
	N-19.2	180	2,000	9,1	N/A	N/A
	N-19.3	167	2,000	9,7	N/A	N/A
N-20	N-20.1	67	1,000	10,6	N/A	N/A
Sum			45,438			

The Priority areas until N-12.2 are expected to become operational by 2030. Further areas until N-13.3 are expected to be in operation by 2031-32.
The Reservation Areas N14 to N19 are expected to be operational by 2035.

Anticipated timeline for the offshore wind developments:

- Seabed lease auction
- Consenting / Building permit, etc
- Development (surveys, design, procurement)
- Construction

No specific timeline is provided in the MSP. It is understood that areas are provided in tranches and the BSH undertakes site investigations which are then provided to the developers to bid for the seabed lease rights. This process is outlined at a high level in the Site Development Plan



It is therefore to be concluded that the areas designated for offshore wind development will be tendered and eventually built only after they pass through the determination of suitability by the BSH. DNV understands that for the priority areas the process is leading up to tendering of the sites is low risk and it is anticipated that all sites will progress to consenting and realization. It is understood that the timeline specified in the Site Development Plan is driven by the grid availability which then informs the time anticipated for commissioning of the relevant project per the programme below:

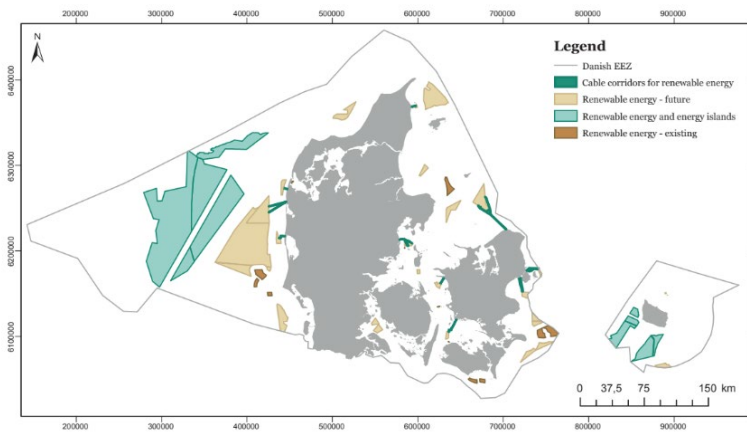
Network connection system	Transmission capacity [MW]	Commissioning of grid connection	Site designation	Installation of inner park cabling of the subsidised	Commissioning of the subsidised WT on the respective sites
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			WT in platform		
NOR-3-3	900	n/a	N-3.7	n/a	3rd quarter 2026
			N-3.8	n/a	3rd quarter 2026
NOR-7-2	930	4th quarter 2027	N-7.2	3rd quarter 2027	4th quarter 2027
NOR-3-2	900	3rd quarter 2028	N-3.5	1st quarter 2028	3rd quarter 2028
			N-3.6	2nd quarter 2028	3rd quarter 2028
NOR-6-3	900	3rd quarter 2029	N-6.6	1st quarter 2029	3rd quarter 2029
			N-6.7	2nd quarter 2029	3rd quarter 2029
NOR-9-1	2,000	3rd quarter 2029	N-9.1	1st quarter 2029	3rd quarter 2029
			N-9.2	2nd quarter 2029	3rd quarter 2029
NOR-9-2	2,000	3rd quarter 2030	N-9.3	1st quarter 2030	3rd quarter 2030
			N-9.4	2nd quarter 2030	3rd quarter 2030
NOR-10-1	2,000	3rd quarter 2030	N-10.1	1st quarter 2030	3rd quarter 2030
			N-10.2	2nd quarter 2030	3rd quarter 2030
<p>For the 'Reservation areas' DNV considers that there is greater uncertainty and it relates primarily to the grid connection as these sites are not embedded in the grid connection plan yet. However, given the political resolve to implement increasing capacities, DNV estimates that the likelihood is that the 'Reservation areas' sites will be also consented and realized in full within the 2040 timeframe.</p>					
Summary of the main assumptions provided in setting out the offshore wind development areas					

DENMARK

Item	Content
Marine Spatial Plan Source (MSP) (link etc)	<p>MSP https://havplan.dk/portalcache/api/v1/file/en/30a6ed4a-e332-4d2e-8389-dd20c13c1494.pdf</p> <p>Interactive map in English: https://havplan.dk/en/page/info</p>
MSP date of release and validity	<p>The Havplan (MSP) was published March 2021.</p> <p>The maritime spatial plan also does not affect the right to extend existing permits granted before March 31, 2021.</p>

	<p>https://havplan.dk/en/about</p> <p>The MSP is based on the provisions of the <i>Maritime Spatial Planning Act</i> [https://www.retsinformation.dk/eli/lta/2020/400] from 2016. The law implements the EU Directive 2014/89/EU establishing a framework for maritime spatial planning, which obliges EU countries to prepare a MSP.</p>
<p>Overview of the development of the MSP:</p> <ul style="list-style-type: none"> - Stakeholders involved - High level summary of the process involved in development and sign off of the MSP 	<p>The Maritime Spatial Plan must include the following sector:</p> <ol style="list-style-type: none"> 1. Offshore energy sector 2. Maritime transport 3. Transport infrastructure 4. Fisheries and aquaculture 5. Extraction of raw materials at sea 6. Preserving, protecting and improving the quality of the environment <p>The MSP may also promote sustainable tourism, recreational activities, outdoor life and land reclamation.</p> <p>The preparation of the MSP is coordinated by the Danish Maritime Authority under the Ministry of Industry, Business and Financial Affairs.</p> <p>The authorities involved in the work of the MSP:</p> <ul style="list-style-type: none"> • The Ministry of Industry • Business and Financial Affairs • Ministry of Finance • Ministry of Defence • Ministry of Climate and Energy • Ministry of Environment • Ministry of Food • Agriculture and Fisheries • Ministry of Transport • Ministry of the Interior and Housing • Danish Business Authority • Danish Fisheries Agency • Danish Geodata Agency • Coastal Authority • Danish Environmental Protection Agency • Danish Housing and Planning Authority • Agency for Culture and Palaces • Danish Civil Aviation • Railway Authorities
<p>Summary of projected offshore wind capacity additions (Capacity, Acreage, Power density, etc)</p>	<p>As a result of the energy pact of 2018 a screening was conducted of the territorial waters in order to assign good, vacant locations. Area of just over 11,000 km² estimated to accommodate up to 12.8 GW of offshore wind in both the North and Baltic Seas was designated for in the MSP. The areas designated also include existing offshore wind projects.</p> <p>Currently, Denmark has 2.3 GW of operating offshore wind.</p> <p>Effectively, this results in a very low power density of 1.13 MW/km². It is acknowledged in the MSP that the areas are not expected to be fully utilised and are sized so that they allow for flexibility.</p>
<p>Drawings of the development areas</p>	<p>https://havplan.dk/portalcache/api/v1/file/en/30a6ed4a-e332-4d2e-8389-dd20c13c1494.pdf</p>



Gray line – Danish Exclusive Economic Zone

Dark green – Cable corridors for renewable energy

Cables to shore

Beige – Renewable energy – future

Areas possible to use for renewables energy. Not limited to offshore wind.

Light green – Renewable energy and energy islands

Energy islands can contribute to more efficient utilisation of offshore wind far from the coast. Allocations make it possible to designate one or more contiguous locations with space for energy islands, including at least one energy island in the North Sea with a capacity of at least 10 GW.

Dark brown – Renewable energy existing

Current operating offshore wind farms.

[\[https://havplan.dk/en/page/info\]](https://havplan.dk/en/page/info)

MSP designated development zones for the following purposes:

- Renewable energy (Ev)
- Renewable energy and energy islands (Ei)
- Oil and gas exploration and extraction (Eo)
- CO₂ storage (Ec)
- Cultivation and transplantation banks for the production of mussels and oysters (Ak)
- Farming of mussels and oysters in the water column (Ao)
- Marine aquaculture (Ah)
- Natural resource extraction (R)

Zones Reset ^

Development zones

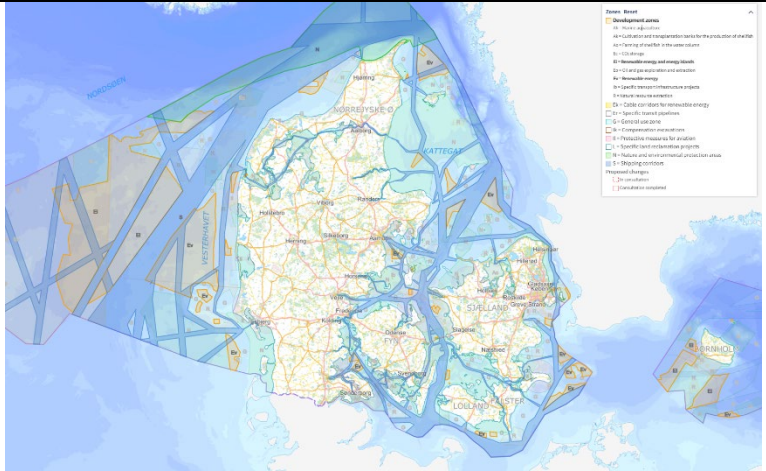
- Ah = Marine aquaculture
- Ak = Cultivation and transplantation banks for the production of shellfish
- Ao = Farming of shellfish in the water column
- Ec = CO₂ storage
- Ei = Renewable energy and energy islands
- Eo = Oil and gas exploration and extraction
- Ev = Renewable energy
- Ib = Specific transport infrastructure projects
- R = Natural resource extraction

Other zones

- Ek = Cable corridors for renewable energy
- Er = Specific transit pipelines
- G = General use zone
- Ik = Compensation excavations
- Il = Protective measures for aviation
- L = Specific land reclamation projects
- N = Nature and environmental protection areas
- S = Shipping corridors

Proposed changes

- In consultation
- Consultation completed

	
<p>Anticipated timeline for the offshore wind developments:</p> <ul style="list-style-type: none"> - Seabed lease auction - Consenting / Building permit, etc - Development (surveys, design, procurement) - Construction 	<p>No exact plan with milestones for the years ahead is presented in the MSP.</p>
<p>Summary of the main assumptions provided in setting out the offshore wind development areas</p>	<p>A plan covering the entire Danish EEZ is presented in the MSP. Significant areas are reserved or planned to use for renewable energy, however, it is not restricted to offshore wind. No complete overview of the coming leases is provided for the targeted capacity of 12.8 GW by 2030.</p>

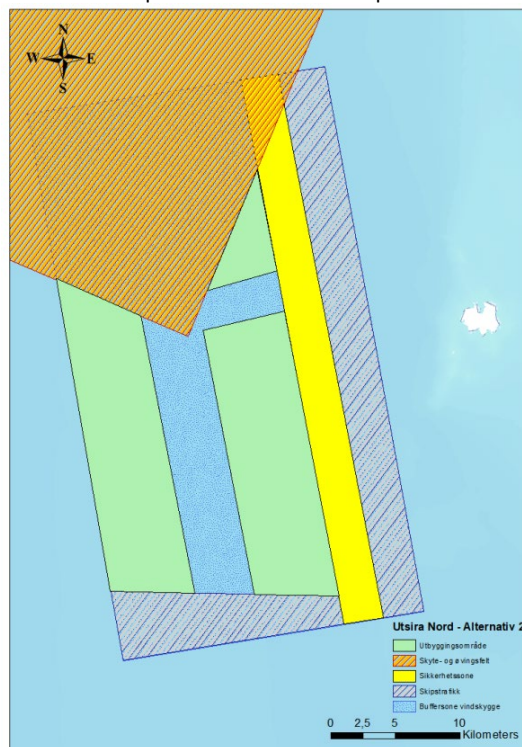
NORWAY

Item	Content
<p>Marine Spatial Plan Source (MSP) (link etc)</p>	<p>Notes from governmental hearing (gives the updated overview of Utsira Nord and Sørilige Nordsjø II)</p> <p>https://www.regjeringen.no/contentassets/6f7a46a7244d4f4cb5b27adc1e759b53/hoyringsnotat_inndeling-av-dei-opna-omrada-i-mindre-utlysingsomrade.pdf (2021)</p> <p>ROYAL RESOLUTION (statement that Utsira Nord and Sørilige Nordsjø II will start the process to open for applications for licensing for offshore wind)</p> <p>https://www.regjeringen.no/contentassets/aaac5c76aec242f09112fddceabd6c64/kgi.res-12.-juni-2020-opning-av-omrade-for-fornybar-energiproduksjon-til-havs.pdf (2020)</p> <p>Message to Parliament (Comprehensive management plans for the Norwegian sea areas)</p> <p>https://www.regjeringen.no/contentassets/5570db2543234b8a9834606c33caa90/no/pdfs/stm201920200020000dddpdfs.pdf (2019-2020)</p> <p>HAVVIND (strategic consequence assessment)</p> <p>https://publikasjoner.nve.no/rapport/2012/rapport2012_47.pdf (2012)</p> <p>HAVVIND (Suggestion to areas to be assessed for offshore wind)</p> <p>https://www.regjeringen.no/globalassets/upload/oed/rapporter/havvind_ver02.pdf (2010)</p>
<p>MSP date of release and validity</p>	<p>https://www.regjeringen.no/contentassets/5570db2543234b8a9834606c33caa90/no/pdfs/stm201920200020000dddpdfs.pdf Klima- og miljødepartementet 24. april 2020 (2019-2020)</p>

<p>Overview of the development of the MSP:</p> <ul style="list-style-type: none"> - Stakeholders involved - High level summary of the process involved in development and sign off of the MSP 	<p>Stakeholders:</p> <ul style="list-style-type: none"> • NVE (Norges Vassdrag og Energidirektorat) - Norwegian Water Resources and Energy Directorate • Olje og energidepartementet - Oil and Energy Department • Fiskeridirektoratet – Fishery Directorate • Miljødirektoratet - Environmental Directorate • Klima- og miljødepartementet - The Climate and Environmental Department • The local municipality • Kystverket - The Norwegian Coastal Administration • Luftfartstilsynet - The Norwegian Civil Aviation Authority • Forsvaret - Norwegian Armed Forces 																																																																																				
<p>Summary of projected offshore wind capacity additions (Capacity, Acreage, Power density, etc)</p>	<p>Utsira Nord: 1500 MW – Floating Sørlige Nordsjø II: 3000 MW (Two phases) - Bottom fixed</p>																																																																																				
<p>Drawings of the development areas</p>	<p>Utsira Nord:</p> <table border="1"> <thead> <tr> <th colspan="2">UN – Alternativ 1</th> <th colspan="2">UN – Alternativ 2</th> </tr> </thead> <tbody> <tr> <td colspan="2"><i>Felt Vest</i></td> <td colspan="2"><i>Felt Vest</i></td> </tr> <tr> <td>N 59°19'16"</td> <td>E 4°18'51"</td> <td>N 59°20'0"</td> <td>E 4°18'34"</td> </tr> <tr> <td>N 59°6'58"</td> <td>E 4°23'18"</td> <td>N 59°7'1"</td> <td>E 4°23'17"</td> </tr> <tr> <td>N 59°6'57"</td> <td>E 4°32'12"</td> <td>N 59°6'58"</td> <td>E 4°30'5"</td> </tr> <tr> <td>N 59°16'27"</td> <td>E 4°27'39"</td> <td>N 59°18'28"</td> <td>E 4°25'29"</td> </tr> <tr> <td colspan="2"><i>Felt Øst</i></td> <td colspan="2"><i>Felt Øst</i></td> </tr> <tr> <td>N 59°27'37"</td> <td>E 4°24'47"</td> <td>N 59°17'54"</td> <td>E 4°30'35"</td> </tr> <tr> <td>N 59°19'2"</td> <td>E 4°29'2"</td> <td>N 59°6'57"</td> <td>E 4°34'54"</td> </tr> <tr> <td>N 59°16'3"</td> <td>E 4°38'14"</td> <td>N 59°6'54"</td> <td>E 4°41'43"</td> </tr> <tr> <td>N 59°28'19"</td> <td>E 4°33'25"</td> <td>N 59°18'45"</td> <td>E 4°37'10"</td> </tr> <tr> <td colspan="2"><i>Felt FOU Nord</i></td> <td colspan="2"><i>Felt FOU</i></td> </tr> <tr> <td>N 59°26'52"</td> <td>E 4°16'2"</td> <td>N 59°24'37"</td> <td>E 4°34'50"</td> </tr> <tr> <td>N 59°24'46"</td> <td>E 4°16'51"</td> <td>N 59°19'35"</td> <td>E 4°30'50"</td> </tr> <tr> <td>N 59°25'11"</td> <td>E 4°21'33"</td> <td>N 59°20'25"</td> <td>E 4°36'31"</td> </tr> <tr> <td>N 59°27'16"</td> <td>E 4°20'48"</td> <td></td> <td></td> </tr> <tr> <td colspan="2"><i>Felt FOU Sør</i></td> <td></td> <td></td> </tr> <tr> <td>N 59°9'10"</td> <td>E 4°35'54"</td> <td></td> <td></td> </tr> <tr> <td>N 59°6'56"</td> <td>E 4°36'47"</td> <td></td> <td></td> </tr> <tr> <td>N 59°6'54"</td> <td>E 4°41'45"</td> <td></td> <td></td> </tr> <tr> <td>N 59°9'34"</td> <td>E 4°40'41"</td> <td></td> <td></td> </tr> </tbody> </table> <p>Alternative 1: Two areas of up to 500 MW and two areas of up to 250 MW – total of 1500 MW</p>	UN – Alternativ 1		UN – Alternativ 2		<i>Felt Vest</i>		<i>Felt Vest</i>		N 59°19'16"	E 4°18'51"	N 59°20'0"	E 4°18'34"	N 59°6'58"	E 4°23'18"	N 59°7'1"	E 4°23'17"	N 59°6'57"	E 4°32'12"	N 59°6'58"	E 4°30'5"	N 59°16'27"	E 4°27'39"	N 59°18'28"	E 4°25'29"	<i>Felt Øst</i>		<i>Felt Øst</i>		N 59°27'37"	E 4°24'47"	N 59°17'54"	E 4°30'35"	N 59°19'2"	E 4°29'2"	N 59°6'57"	E 4°34'54"	N 59°16'3"	E 4°38'14"	N 59°6'54"	E 4°41'43"	N 59°28'19"	E 4°33'25"	N 59°18'45"	E 4°37'10"	<i>Felt FOU Nord</i>		<i>Felt FOU</i>		N 59°26'52"	E 4°16'2"	N 59°24'37"	E 4°34'50"	N 59°24'46"	E 4°16'51"	N 59°19'35"	E 4°30'50"	N 59°25'11"	E 4°21'33"	N 59°20'25"	E 4°36'31"	N 59°27'16"	E 4°20'48"			<i>Felt FOU Sør</i>				N 59°9'10"	E 4°35'54"			N 59°6'56"	E 4°36'47"			N 59°6'54"	E 4°41'45"			N 59°9'34"	E 4°40'41"		
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Alternative 2:
Two areas of up to 600 MW and one up to 300 MW



Sørlige Nordsjø II:

Three areas of up to 1500 MW, but only two out of the three will be available in two phases for the lease auction. The process of which two areas, and the timeline is still not clear.



Sørliche Nordsjø II

Felt Nord-vest

N 56°49'21"	E 4°20'42"
N 56°58'40"	E 4°48'54"
N 56°47'51"	E 4°58'34"
N 56°40'40"	E 4°31'26"
N 56°42'57"	E 4°31'54" (Korrigert 17.02.22)
N 56°46'57"	E 4°22'48"

Felt Sør-vest

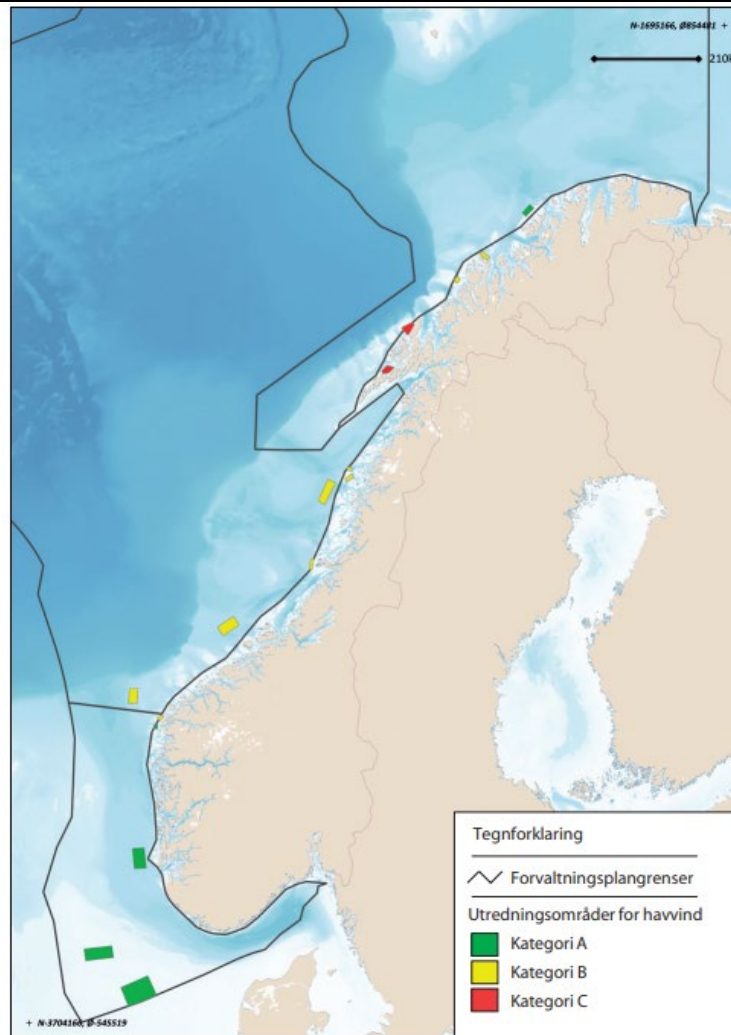
N 56°38'2"	E 4°30'34"
N 56°45'33"	E 5°1'2"
N 56°37'38"	E 5°8'51"
N 56°28'58"	E 4°38'21"

Felt Øst

N 56°57'48"	E 4°54'60"
N 56°57'48"	E 5°0'0"
N 56°56'0"	E 4°59'60"
N 56°55'52"	E 5°19'5"
N 56°44'15"	E 5°29'47"
N 56°39'7"	E 5°13'22"

Areas of interest:

NVE identified and categorized 15 areas of interest for offshore wind in 2010. The areas were selected based on their suitability: few conflicting interests, not in a protected area, power grid, investment costs, and wind resources. The report focuses on finding the areas to be opened first, but also to highlight other interesting areas for the future.



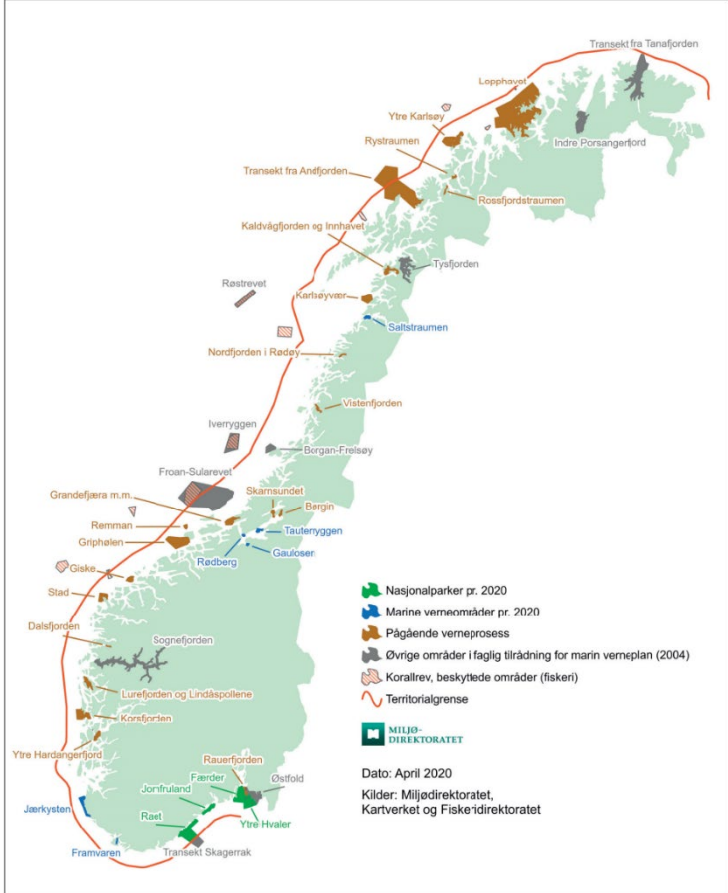
Green – Category A
 Yellow – Category B
 Red – Category C

Category A: Areas of interest that are well technically and economically suitable have relatively few conflicts of interest and can be connected to a grid without major challenges by 2025. NVE considers that these can be opened for leasing without significant challenges.

Category B: Areas of interest that have challenges related to either technical aspects and / or conflicting interests or vulnerable environment. The challenges are assumed to be solved by future technology development, network measures and / or mitigating measures. NVE considers that these areas can be opened when the technology is mature enough, when the network measures have been implemented, and / or if the conflicts of interest can be resolved.

Category C: Areas of interest that have many and / or large conflicts of interest that cannot be easily resolved by mitigating or consequence-reducing measures. NVE believes that the area conflicts are nevertheless not so great that an opening of the areas is not possible, but recommends not to prioritize opening these in favour of areas in categories A and B.

Map of existing and planned marine protected areas, and marine protected areas.

	 <p>Dark Green – national park Blue - marine protected area Brown - ongoing protection process Grey – Other areas connected to the marine protective plan (2004) Red/white - Coral reef (protected areas, fishery) Orange line - Territorial limit</p>
<p>Anticipated timeline for the offshore wind developments:</p> <ul style="list-style-type: none"> - Seabed lease auction - Consenting / Building permit, etc - Development (surveys, design, procurement) - Construction 	<p>A new Government won the election and started their period in October 2021. They have stated a large-scale investment in offshore wind, however a clear timeline and specific goals for capacity is not yet established. The method will be auction, and the first round of leases will be Utsira Nord and Sørilige Nordjø II, however, the timing and further details are to be decided.</p>
<p>Summary of the main assumptions provided in setting out the offshore wind development areas</p>	<p>Utsira Nord (1500 MW – Floating) and Sørilige Nordsjø II (3000 MW in two phases of 1500MW - Bottom fixed) to open for auction soon. However, it is still unclear when it will be held and further requirements to the process are still to be decided. Several other areas are evaluated, but the area’s considered the easiest are prioritized to build on.</p>



About DNV

DNV is the independent expert in risk management and assurance, operating in more than 100 countries. Through its broad experience and deep expertise DNV advances safety and sustainable performance, sets industry benchmarks, and inspires and invents solutions.

Whether assessing a new ship design, optimizing the performance of a wind farm, analysing sensor data from a gas pipeline or certifying a food company's supply chain, DNV enables its customers and their stakeholders to make critical decisions with confidence.

Driven by its purpose, to safeguard life, property, and the environment, DNV helps tackle the challenges and global transformations facing its customers and the world today and is a trusted voice for many of the world's most successful and forward-thinking companies.