Planning & Permitting study for North Sea Windpower Hub – concerning the Norwegian sector

Analysis of regulations that are applicable to the Norwegian EEZ,
in relation to neighbouring foreign sectors

Client: **North Sea Wind Power Hub consortium**

Consultants: **team Plan-AE ▫ WindFarmDesigns ▫ Xrgia ▫ Multiconsult**

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* Translations between the English and Norwegian terminology are provided on the two last pages of this report.

1 Executive Summary

1.1 Main findings from the report

The regulatory framework was assessed for the development of potential OWFs*, export cables and interconnectors connected to the NSWPH from the Norwegian EEZ*. Regulatory authorities, NGO's and industry stakeholders were consulted for the assessment.

The Ocean Energy Act introduced in 2010 regulates the development of OWFs and its export cables. Suitable areas for OWFs were presented in 2013. The government is expected in the coming year to open up 2-3 areas for OWFs along with more detailed regulations for the permit applications.

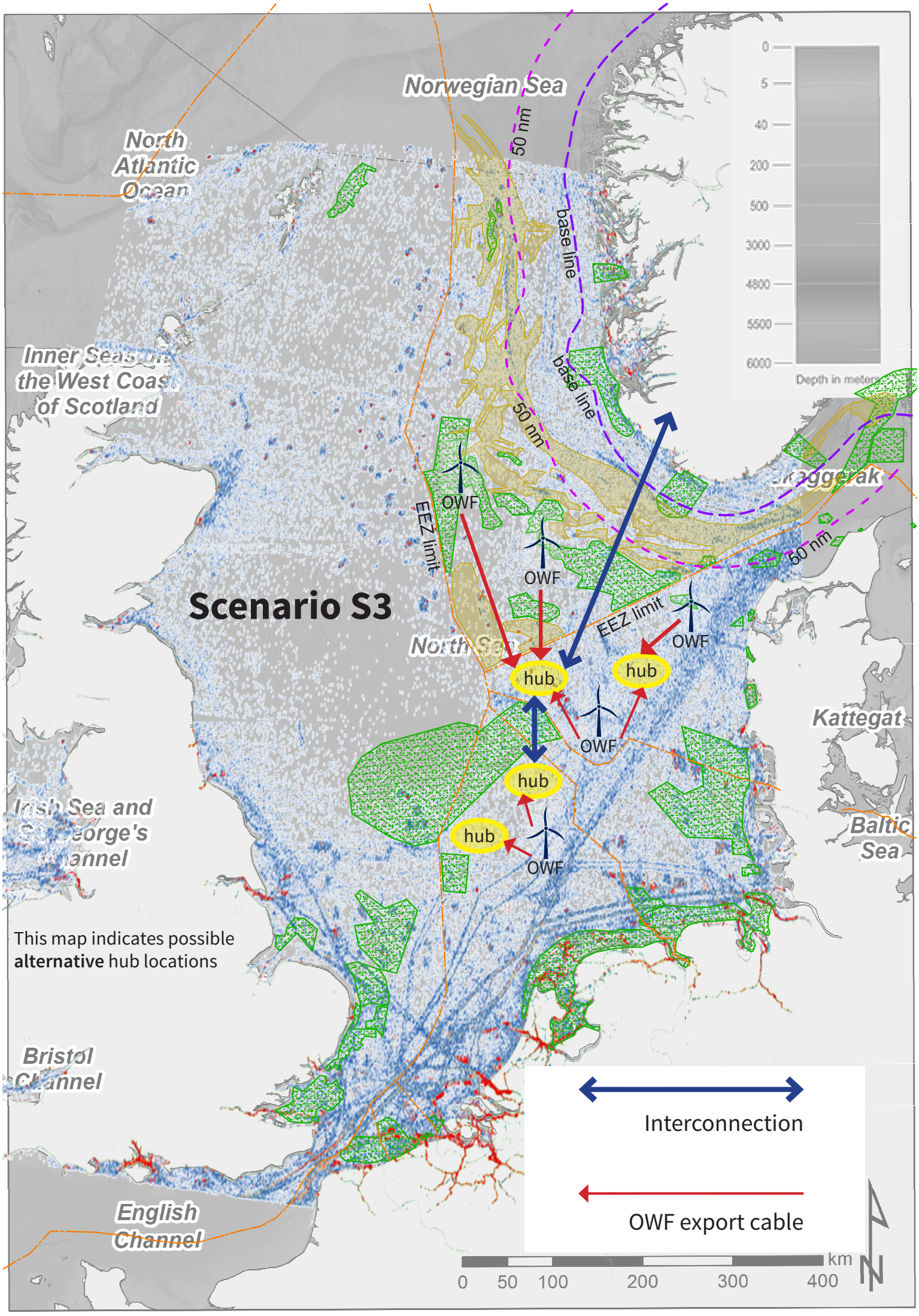
The selection criteria for areas emphasized distance to onshore grid connection, rather than electrification of offshore plants, or the possibility of direct export to foreign EEZs. However, of the three proposed shortlisted areas, two areas are situated in the south, bordering adjacent EEZs.

Interconnectors are subject to the Energy Act, where only the Norwegian TSO may own and operate interconnectors. When connected to Norway, interconnectors provide excellent storage opportunities due to hydropower.

Governmental support for OWF deployment is not likely, but several support mechanisms for R&D and demonstration projects exist. Electrification of offshore platforms may however provide a market for OWFs, as current operating costs exceed 109 €/MWh, due to high emission taxes.

The EU's Gas Directive ensures third party access to Norway's upstream gas pipeline network, if this becomes available for future hydrogen transport at some point in the future.

This report has focussed on Scenario S3, as illustrated on the following map:


Norwegian Sea
North Atlantic Ocean
50 nm
base line
Inner Seas off the West Coast of Scotland
Skagerrak
Scenario S3
North Sea
EEZ limit
OWF
hub
Kattegat
Baltic Sea
Irish Sea and St George's Channel
Bristol Channel
English Channel
This map indicates possible **alternative** hub locations
Interconnection
OWF export cable
Depth in meters
0
5
40
200
500
3000
4800
5500
6000
km
0
50
100
200
300
400

1.2 Structure of the report

Chapters 2 - 6 describe the essential observations and recommendations from this consulting task.
The appendices A - E provide more in-depth information and background information on the subject.

2 Permit schemes for Offshore Wind Farms

2.1 Introduction

This chapter describes the Norwegian legislation and regulations for offshore wind farms (OWFs), relevant for NSWPH including both ground-fixed and floating installations, national permitting regimes and related policies.
The Ocean Energy Law* (see Appendix **Feil! Fant ikke referansekilden.**) applies to OWFs outside the Norwegian base line*, while the Energy Law* applies to OWFs inside the base line (see Figure I). The Petroleum Law* applies to energy export from OWFs to offshore platforms.

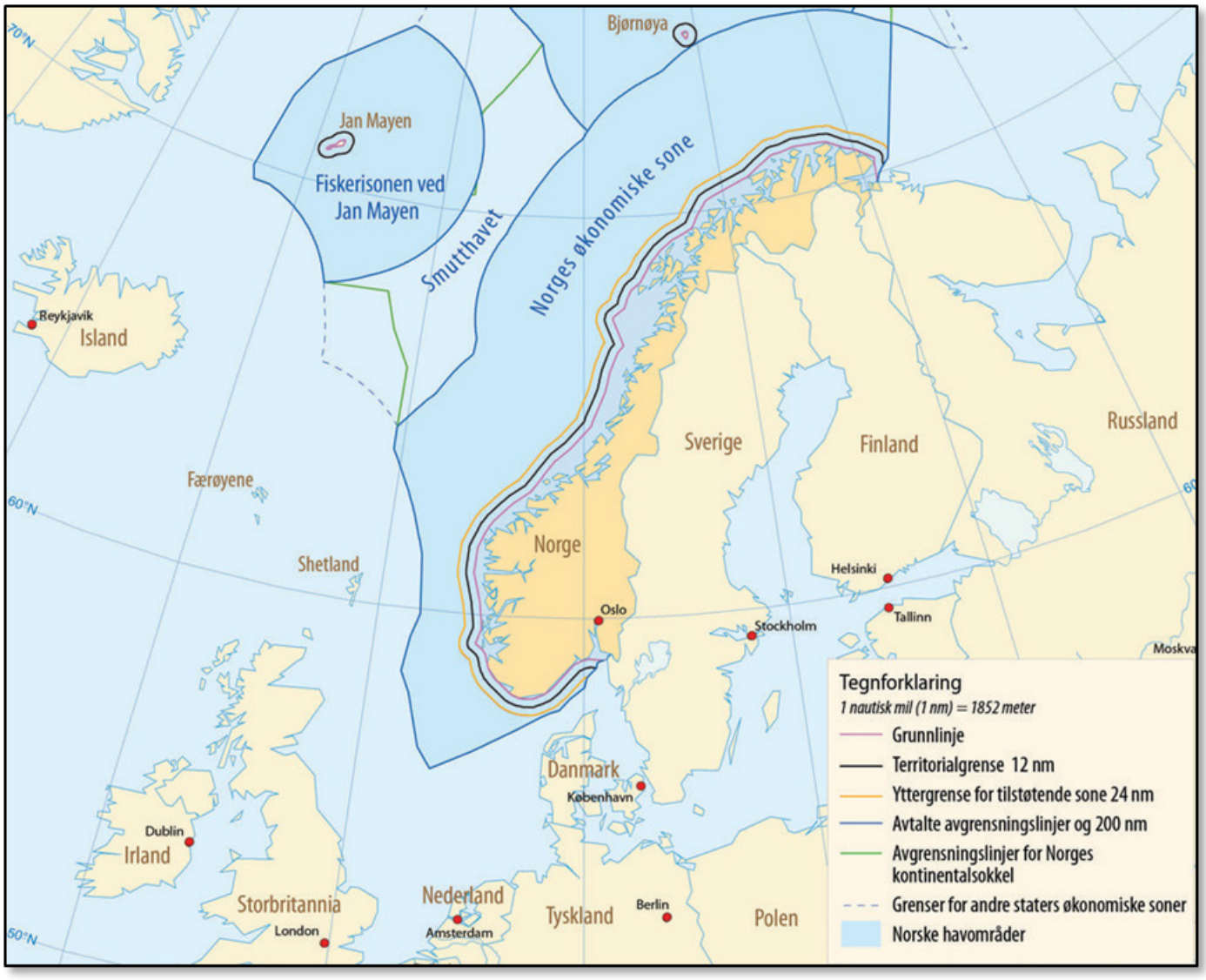


Figure I. Maritime zones of Norway
In South-Norway, the base line *(grunnlinjen)* is at a distance of approximately 1 nm to 5 nm from the coast. The territory border *(territorialgrensen)* is at a fixed distance of 12 nm from the coast.

2.2 National regulation and permitting processes for OWFs inside the Norwegian baseline

OWFs that are constructed inside the baseline and connected to the mainland transmission grid follow the same rules as onshore WFs. The permitting process is lead by NVE*, generally in the same manner as for onshore wind farms. The Developer has to apply for a licence to construct and operate the wind farm, in accordance with the provisions in the Norwegian Energy Act. It is a one-stop-shop process, meaning that NVE is the single point of contact for the licensing, and grants all necessary permissions and expropriation rights. Currently, one large OWF has been granted a valid license to construct and operate (Havsul I in Møre and Romsdal County).

2.3 National regulation and permitting processes for OWFs outside the Norwegian baseline

The Ocean Energy Law* of 2010 stipulates that, as a main rule, renewable energy generation at sea – outside the Norwegian baseline – can only occur after OED* has opened up an area for license applications. Strategic impact assessments shall be made before an area can be opened up. One important objective with this regulation was to lay predictable regulation for any development well ahead, i.e. before it becomes applicable, and to have effective control over sea area allocations.

According to the Ocean Energy Law, it is possible to make exceptions from the rule on the opening of an area, if it concerns demonstration projects. In addition, it is not necessary to open an area for applications for an OWF to supply petroleum installations, as such projects must develop in close co-operation with the petroleum operator and be placed close to what is to be connected. For this reason, smaller pilot OWFs that are supposed to supply petroleum installations can be exempted from the provisions regarding the opening of areas.

As of today, there is no basis for establishing an absolute limit on what can be expected to come under the exception rule on special cases. At present, Hywind Tampen is a possible project under this exemption rule; this is a 88 MW floating OWF pilot project currently planned to supply 35 percent of the electricity demand on the Tampen offshore oil platform.

The Ministry has not yet determined how large an OWF project will have to be, in order to open an area before a license application can be assessed. However, the Ministry has noted that, on average, the wind power projects that were in operation in the North Sea were close to 400 MW in 2016.

Other relevant laws and regulations:

The Planning & Building Act's provisions regarding EIA's and Municipal Land Use Plans apply only to OWFs within 1 nm from the baseline. Further offshore, these laws and regulations have no relevance (provisions regarding Environmental Impact Assessments are included in the Ocean Energy Law*).

The Harbour and Fairways Act* applies only to OWFs in territorial waters (i.e. inside the territorial boundary in Figure **I**). For OWFs located further offshore, this act is of no relevance.

The Cultural Heritage Act* also applies to OWFs outside the Norwegian baseline: see the description hereabove.

2.4 Political support for OWFs

The Parliament endorses fairly strong support for OWFs, and requested the government in 2017 to submit a support scheme for the realisation of demonstration projects for floating offshore wind and other forms of ocean-based energy. The decision was followed up by a new governance agreement between the Ministry of Petroleum and Energy and Enova, which will apply from 2017 to 2020. The agreement entails that Enova will support increased innovation within ocean-based energy.

In the Statement to Parliament's *Meld. St.* 27 (2016–2017) on the Government's policy for the industry, it was announced that a strategy for export and internationalisation of Norwegian OWF technology should be implemented.

In 2016, the Ministry of Petroleum and Energy signed a political agreement on energy cooperation between the North Sea countries. The object is to work together to promote cost-effective development of renewable energy at sea through area planning, grid development and development of standards and regulations.

3 Permit schemes for export cables

3.1 Introduction

For the purpose of this NSWPH study, export cables are grouped into the following three categories.

- The most relevant category being: export from OWFs to a foreign EEZ.
- The second most relevant category is: export cables to offshore platforms and/or OWFs connected to offshore platforms, because these depend on national policies for the electrification of offshore installations. Offshore installations constitute ¼ of Norwegian CO_2 emissions and contribute to ⅓ of domestic NO_x for which there are support mechanisms. This is subject to the Gøteborg Protocol
- The third category is: export cable from OWFs to the Norwegian mainland. Although this is the most relevant case for other countries, there are no support mechanisms in place for offshore wind in Norway, as our onshore electricity supply is 100% renewable and foreseeable electricity prices are lower than cost of offshore wind farms.
- A quick calculation of whether electrification of offshore installations from OWFs are economically feasible:
  NO_x taxes : GT 1 kg NO_x / MWh * 22,7 NOK / kg = 2,2 € / MWh
  CO_2 taxes : 650 kg CO_2 / MWh * 400 NOK / tonn = 26 € / MWh
  Total taxes : 28,2 € / MWh generation from gas turbines

Operational costs for gas turbines onshore in Germany are now around 40 € / MWh of higher efficiency (55%).

Gas turbines onshore are of lower efficiency, but it needs to be examined if offshore installations consider the operational costs of offshore turbine. The cost of buying electricity from land is at least 30 € / MWh (Norway), while the operational cost of gas turbines offshore is 40 – 50 € / MWh.

The total alternative cost of electrification is then minimum 40 + 28,2 = 68,2 € / MWh - 78,2 € / MWh which should make OWFs competitive.

3.2 Permitting regimes for export cables

The Ocean Energy law distinguishes between the facility for energy production § 3-1 (OWF) and § 3-2 the electrical grid infrastructure*, of which export cable is a component. § 3-2 where the export cable is included. Areas for OWFs have already undergone an Environmental Impact Assessment (EIA), according to § 2-2T however, the export cable must apply for permit to MOPE including EIA and a detailed project plan. The EIA follows the standard procedure of application process as for OWFs. Permits are obtained for 30 years, with possibility for extension.

3.3 Export cable from OWF to a foreign EEZ

As outlined in 1.2 above, Ocean Energy Law specifies a permit application for grid infrastructure* following the standard application process procedure and the provision of a full EIA. The Ocean Energy Law explicitly states that the permit also regulates the exchange of electricity out of Norwegian territory according to § 8-1.

Whenever the cable may impact on other countries environment, the foreign country should be contacted in order to influence the scope of the EIA as there may be transboundary impacts according to § 4-2.

The law also reserves MoPE the option to impose additional requirements as part of the permits. There can be exceptions given to this law, in the case of demonstration or R&D projects, or when the export cable is connected to offshore oil and gas installations subject to the Petroleum Law.

At the time of writing there are no planned or existing export cables from OWFs in Norwegian EEZ to another zone.

3.4 Export cable(s) departing from an OWF and/or a offshore installation

Export cables in connection with offshore installations, either from the NSWPH or in combination with OWFs are relevant for the Norwegian zone.

Offshore installations for oil and gas stand for 28 % of Norwegian CO_2 emissions, primarily from its yearly 17 TWh / yr electricity generation from gas turbines. Moreover offshore gas and oil increased CO_2 emissions by 78 % since 1990, and pose a problem to fulfill national CO_2 goals. Development in emissions are very much dictated by the maturity of wells, especially the tail production's need for pressure support (i.e increased requirement for pressure support towards end of life-time).

Offshore installations also provide 1/3 of total NO_x emissions (Proposal to the Parliament *St.prp.* 1, 2018) and are subject to the Gøteborg protocol for the reduction of NO_x emissions.

If OWF provides an offshore installation with electricity, the project falls under the Petroleum Law. Tampen Hywind offshore wind farm is such a case, where Equinor intends to supply two platforms with 30-35% of the electricity from an 80 ~ 88 MW floating OWF.

Export cables can however serve various purposes such as partially exporting electricity to platforms and partially importing excess electricity from offshore installations connected with OWFs. Any import / export outside Norwegian territory is subject to the Ocean Energy Law as described above.

Currently electrification of offshore platforms from the mainland is implemented on two of Equinor's platforms, with three additional platforms in planning. However, Tampen Hywind is the first project to power an offshore platform with OWFs. For these types of projects, support schemes for R&D (EnergiX, Innovation Norway) and pilots (ENOVA) are applicable. Furthermore, the alternative costs of platform electrification concern either the export cables from the mainland, or the costs for operating gas turbines on the offshore platform with emission taxes (petroleum taxation of 48 € / tCO_2 and payments to the NO_x fund, set to 2,32 € / kg NO_x).

3.5 Export cable(s) connected to the Norwegian shore

Export cables connected to the Norwegian shore are considered less relevant for the NSWPH project, and are only briefly touched upon here.

For export cables connected to the Norwegian shore, the Ocean Energy Law applies outside the baseline. A connection point to the Norwegian grid is subject to the Energy Act and the Planning & Building Act, including a dispensation from the municipality of use of the land areas, and landowner agreements.

4 Permit schemes for interconnectors

As stated hereabove, national regulation follows European legislation closely. This includes system operation and market access for interconnectors. License permitting for interconnectors are however under national jurisdiction, as it is for other countries in Europe. An ongoing discussion in the Parliament and media in Norway is whether building and operating interconnectors shall be available for the national TSO exclusively, or if it should be open for private entities. As of now, it is possible for private entities to apply and construct interconnectors.

The Ministry is processing the application for NorthConnect, which is a private interconnector between Norway and UK. It is expected that NVE will submit its recommendation for the license within this year and NorthConnect's planned start of operation of the cable is 2024.

As in most European countries, regulation regarding a meshed offshore HVDC-grid is not in place. Regulation regarding system operation, metering and billing, quality of supply, income regulation, etc, is not in place. However, as part of the European Electricity Market, EU legislation on these areas will most likely be applicable to the Norwegian power market as well.

- Relationship with foreign cables:
  - » The Norwegian Parliament has decided (in connection with ACER) that Statnett will own and operate foreign connections, and that there will be a legislative amendment that will reflect this.
  - » It is not clear whether this will also apply to an export cable from an offshore wind farm to an offshore hub in another economic zone.
  - » The Norwegian Ocean Energy Act points out that an international license must be applied for (under the Energy Act) if electrical power is to be imported / exported to another economic zone. It is not yet clear which criteria will form the basis for the socio-economic analysis in connection with such a project. It is assumed that it will be possible to provide input to the hearing about this.

4.1 Synopsis of interconnectors leading through the Norwegian EEZ

This paragraph describes the legislation and regulations for an interconnector connected to the Norwegian electricity grid. Construction and operation of the interconnector is to be regulated according to the following Norwegian legislation:

- The Norwegian Energy Act*: § 3.1 - Construction license *(Konsesjon på anlegg)* and § 4.2 – Foreign trade license of electric energy *(konsesjon for å eie eller drive utenlandsforbindelser)*,
- The Norwegian Ocean Energy Law* (applicable for grid installations between the Norwegian Baseline and a foreign EEZ),
- The Norwegian Planning & Building Act* (as applicable for onshore structures),
- The Norwegian Expropriation Act* (as applicable for onshore structures),
- The Norwegian Nature Diversity Act*,
- Other relevant laws:
  - » The Public Administration Act* provides framework for how NVE will handle the license applications *(konsesjonssøknader)*, etc.
  - » The Public Procurement Act*,
  - » Sectoral laws: Cultural Heritage Act*, the Pollution Control Act* (only applicable if there may be a risk for contaminated soil), etc.
  - » the Harbour and Fairways Act* (requires permission from the Norwegian Coastal Administration* for cable installations* laid in the sea).

A permit for construction and operation of an interconnector will be given by the Ministry of Petroleum and Energy (MoPE) and provides the applicant with necessary rights according to the legislation mentioned above. MoPE will base their decision on the recommendation from the Norwegian Energy and Water Resources Directorate (NVE), which controls the permitting process. NVE will typically request a package which contains the following documentation:

- Application for a "construction license" (§ 3.1)
- Application for a "foreign trade license" (§ 4.2)

The application process and typical application content are described in paragraph 8.1. It shall be noted that NVE can request needed consequence studies to provide a recommendation to MoPE. NVE may request studies which describe the impact an interconnector will have on the Norwegian electricity grid (will the interconnection trigger domestic grid reinforcement?) and, the operation of the transmission system (such as increased losses, grid constraints and / or frequency balancing) and on the energy market (such as impact on wholesale price, export / import and hydro reservoir utilisation). For these studies, the TSO (Statnett) has to provide information and in many cases, conduct the studies entirely. They are obliged to do so in a timely manner, and the applicant can file a complaint to NVE in case of Statnett stalling the application process.

The "foreign trade license" has been a public and political sensitive legislation the last decade. In 2013 the Norwegian Energy Act was amended so that only the TSO (Statnett), or its subsidiaries, could be granted concession for developing interconnector projects. Three years later, in 2016 (effective from the 1st of January 2017), the Norwegian Energy Act was amended and opened for non-TSO entities to develop interconnectors. However, in May 2018 the Norwegian Parliament decided that the Norwegian Energy Act shall be changed after MoPE has completed the processing of licensing application for NorthConnect. MoPE will then introduce ownership restrictions on future interconnectors from Norway, i.e. Statnett shall control the ownership of the Norwegian part of future interconnectors.

The legislation and regulations relevant for the connecting state, for instance a North Sea wind power hub in the Netherlands, has not been described in this document, i.e. the presented permit regime is only applicable for construction and operation of interconnectors between the Norwegian shore landing and the Norwegian EEZ.

4.2 Interconnectors and regulatory changes

The "foreign trade license" has been a public and politically sensitive legislation topic in the last decade. In 2013 the Norwegian Energy Act was amended so that only the TSO (Statnett), or its subsidiaries, could be granted concession for developing interconnector projects. Three years later, in 2016 (effective from 1st of January 2017), the Norwegian Energy Act was amended and opened for non-TSO entities, to develop interconnectors. However, in May 2018 the Norwegian Parliament decided to change the that the Norwegian Energy Act shall be changed after MOPE has completed the processing of licensing application for NorthConnect. This has to do with capacity evaluation; they first want to see if there still is a need for more interconnector capacity after the NorthConnect project is finished. much again. MoPE will then re-introduce ownership restrictions on future interconnectors from Norway, where only i.e. Statnett shall can control the ownership of the Norwegian part of future interconnectors.

An ongoing discussion in the Parliament and media in Norway is whether building and operating interconnectors shall be available for the national TSO exclusively, or if it should be open for private entities. As of now, Norwegian politics is discussing about whether it is going to be possible for private entities to apply and construct interconnectors.

The Ministry is processing the application for NorthConnect, which is a private interconnector between Norway and UK. It is expected that NVE will submit its recommendation for the license within this year and NorthConnect's planned start of operation of the cable is 2024.

4.3 Interconnectors and hydro storage

Norway hydropower system allows for unique storage capabilities and can serve as "green battery" for both short term and long term balancing by means of responsive hydropower generators from millisecond (ancillary services), to hourly, daily, weekly and even yearly time scales. While battery technologies may offer future competitive solutions for short term storage, hydro reservoirs are unprecedented in terms of long term storage and scale.

Norway's 80 TWh reservoir storage capacity accounts for 50% of Europe's total storage capacity. Installed hydropower capacity is 30 GW, and can be upgraded by extra 10 - 20 GW capacity of *existing* plants according to CEDREN (2018)

Connecting Norway to the NSPWH hub would add value, because Norwegian reservoirs can balance the hub, smooth out fluctuations of offshore wind, and to some extent reduce the effect of lower prices during windy periods, using already existing hydropower and reservoir capacity.

In contrast to pumped storage, Norwegian hydropower reservoir storage is almost loss-free. Hydropower operates like a swing producer. Instead of pumping hydro, hydro generation is just reduced correspondingly during windy periods, thus saving reservoirs for later use. During calm periods, hydropower generation picks up using the stored water. Pumped hydro results in hydraulic and efficiency losses, of about 25%, whereas using hydropower as swing producer does not incur additional losses.

Norwegian hydropower can potentially balance out large portions of offshore wind, in the order of 10 to 20 GW, the limitations being the capacity of the interconnector(s)

4.4 Gas pipelines for energy transport

EU's gas market directive (Directive 2009/73/EC), has been incorporated in the *Petroleum Act* and *Regulation of the Petroleum Act* secures companies 3rd party access to existing upstream gas pipelines for transmission to EU.
The Norwegian continental shelf comprises a large network of oil and gas pipelines, transporting hydrocarbons from offshore facilities via onshore facilities for processing and further to market (UK and continental Europe).

The gas network is operated by the state owned company Gassco, and owned by the joint venture company Gassled

All the gas pipelines are currently allocated for Natural gas, and typically planned for several years ahead.

The gas network operator Gassco has studied the possibility of blending hydrogen into natural gas transport[1], as well as participating in related research programmes.

For further details on the Gassled pipeline network, see ch **Feil! Fant ikke referansekilden.**

5 Permitting requirements regarding the environment and spatial planning

OWFs must have a permit (license) for construction and operation, either pursuant to the Ocean Energy Act (outside the baseline) or the Energy Act (within the baseline). No separate permit is required from the environmental authorities in Norway, ie the Climate and the Ministry of the Environment or the Environment Agency.

[1] Up to 15% Hydrogen could be blended into natural gas transports according to NREL (2013)

The authorities (NVE / OED) can, through the license terms that follow the license decision, impose mitigation measures or monitoring to minimize the project's consequences for biodiversity and to learn more about the actual effects of the wind power plant. However, it is not given that this will be required (our experience from onshore project is that this varies from project to project). If the measure affects marine protected areas, which in Norway only exist in coastal areas, a derogation will normally be required under the Nature Diversity Act. The latter is considered to be of little relevance to OWFs, since there are no conservation areas outside the North Sea, but possibly somewhat more relevant to sea cables towards the Norwegian coast.

The Port and Waters Act and the Cultural Heritage Act, mentioned earlier, and the requirements that must also be fulfilled before the development can start (i.e. that the municipality or the Coastal Administration, depending on how far the offshore project lies and what interests it affects, must approve the detailed plans for OWFs within the territorial limit, and that the Maritime Museum must confirm that the duty of investigation in the Cultural Heritage Act has been fulfilled for the entire wind power plant and associated infrastructure). The relationship with the Nature Diversity Act has also been discussed earlier (ie, the NVE / OED must make an assessment of the measure compared to § 8, 9 and 10, and justify this).

5.1 Strategic Impact Assessment

The report from NVE "Strategic Impact Assessment of Renewable Energy Production at Sea" (→ **R15**) of June 2012, under § 1.1, states the following:

In a letter of June 2012, the NVE has been commissioned by MoPE to carry out strategic impact assessments for offshore wind power, based on the plan program determined in this letter.

Among the issues to be examined further, through the strategic impact assessment, are:

Connection to laws, spatial plans and conservation areas

- It shall be assessed how an OWP project relates to relevant legislation, including the Nature Diversity Act, the Marine Resources Act, the Port & Water Act, the Aquaculture Act, the Petroleum Act, the Planning & Building Act, the Pollution Control Act and the Cultural Heritage Act.
- The relationship with local, regional and national spatial planning shall be accounted for.
- The relation to any protected areas, proposed protected areas and particularly valuable areas (SVO) shall be described.
- Any effects in accordance with international conventions and agreements, to which Norway has subscribed, shall be accounted for.

As general guidelines, MoPE has indicated that these impact assessments shall examine which effects the allocation of sea area to OWP can have for industrial and environmental conditions. In addition, MoPE states that the range of impact to be analysed shall consist of significant effects.

These investigations shall be carried out with the purpose of providing part of the basis for decision-making on the allocation of sea areas to OWP.

5.2 Requirements for environmental impact analysis

As mentioned earlier, the Ocean Energy Law* (applying outside the baseline) or the Energy Act with related provisions in the Planning & Building Act (§4-2) and associated Regulations on impact assessments (within the baseline) state that an announcement*, license application* and en environmental impact assessment* shall be prepared for all wind power plants over 10 MW and a license application and a simplified impact assessment for wind turbines below 10 MW:

OWF capacity > 10 MW	OWF capacity < 10 MW
requirements: ▪ announcement ▪ license application ▪ environmental impact assessment	requirement: ▪ simplified impact assessment

In the environmental assessment report, the developer shall prepare a proposal for an investigation program, which covers all relevant topics / subject areas, including fisheries, aquaculture, navigation / shipping, birds, fish, marine mammals, etc. NVE will send the message with proposals for investigation program on consultation to relevant parties / organisations (government agencies, business organisations, environmental organisations, etc.), and then prepare a final investigation program based on the developers' proposals and incoming consultation statements. The requirements in the final investigation program, and scope of field surveys, may vary from project to project, depending on which interests / values are assumed to be affected by the wind power plant.

When the impact assessment is completed, it will be sent for consultation to the same parties / organisations. Based on incoming consultation statements, the NVE will conclude whether 1) the impact assessment satisfies the requirements of the investigation program or 2) whether further investigations are needed. If the requirements are met, the NVE will be able to make a decision in the case (yes or no to the license). If the requirements are not met, NVE will instruct the developer to carry out new investigations before NVE makes a decision.

Aquaculture and fisheries - fish farming, shellfish, oyster culture

Environmental requirements, as set by the Norwegian Environment Agency, will be analysed as part of an environmental impact analysis*. These include, amongst others, requirements for nature monitoring and nature protection.

Factors to consider in the permit process for offshore wind power:
The relationships to aquaculture, fishing, etc. must be thoroughly investigated in connection with the license application / impact assessment for offshore wind turbines.

Subsea cable installation in areas with fishing activity requires close cooperation the fisher men. The cable owner will need to protect the cable to minimize cable fault risk. The protection method shall be designed to minimise effect on trawling activities. If rock placement is needed it must be designed to withstand trawling over time.

In shrimp fishing areas cables a normally protected by means of jet- trenching to minimise impact on shrimp fishing areas. If the cable cannot be protected by means of jet-trenching the protection method shall be designed to minimise any effect on shrimp trawling.

If subsea cables are to be installed in areas with spawning fish this will influence installation schedule and probably limit the months available for cable installation.

See also References:

The types of preliminary GIS information are:

- Fishery areas, aquaculture, oysterbanks, seafarming, e.g. fish and weeds, etc.

5.3 Consequences for the geographical localisation for the applicable regulations

In view of the proposed scenarios, we have analysed if the geographical localisation has consequences for the permitting process. We conclude that the permitting process is independent of the geographical localisation, but the socio-economic impact may vary according to the siting that will be chosen.

5.3.1 OWF siting

- Offshore wind farms can be located in shallow sea areas, in which case they could have fixed foundations.
- or: Offshore wind farms can be located in deeper sea areas, in which case they could have floating foundations.

There is no difference in the permitting process of OFW's in the Norwegian sector regarding the choice of foundation. The two areas suggested for opening in the south, bordering Danish/Dutch/German/UK EEZ, have depths that may include both floating and fixed foundations.

5.3.2 Cable and interconnector siting

The hub(s) can be located on the Danish sector and/or on the Dutch sector.

1) The choice of location for the hub will not have consequences for the formal permitting process regarding the export cables (whether it be purely for export or for more balanced import/export). However, the solution (technical and geographical) may impact the socio-economic impact in the Norwegian Energy Market, which may affect the permitting process.

Does it make any difference for the required permissions/concessions if the export cables go:

- from the Norwegian sector to the Danish sector,
- or from the Norwegian sector to the Dutch sector?

Answer: No. The permitting process is the same. However, the socio-economic impact will change.

2) The choice of location for the hub will not have consequences for the permitting process regarding the interconnector.

Does it make any difference for the required permissions/concessions if the interconnector goes:

- from the Danish sector to the Norwegian coast,
- or from the Dutch sector to the Norwegian coast?

Answer: No. The permitting process is the same. However, the socio-economic impact will change.

6 Appendix A – Relevant international directives and treaties

6.1 Paris agreement

Norway's has ratified and committed to the Paris Agreement with an emission target of 40% within the year 2040.

7 Appendix B – Relevant European laws and treaties

7.1 The EU's 3rd energy market package

The EU's third energy market package was adopted on the 13th of July 2009, and consists of five legislative acts. Four of these amended existing legislative acts are:

- the Electricity Market Directive III (2009/72/EC),
- the Gas Market Directive III (2009/73/EC),
- the Cross-Border Exchanges Regulation II (Regulation (EC) No. 714/2009) and
- the Gas Transmission Regulation II (Regulation (EC) No. 715/2009).

The fifth is Regulation (EC) No. 713/2009, which lays down new rules establishing ACER*.

The third energy market package has not yet been incorporated into the EEA Agreement. A new regulation has also been adopted on the inter-transmission system operator compensation mechanisms. This replaces the EU Regulation No. 774/2010, but like the previous regulation it is not part yet of the current EU package.

In addition to ACER, the third package established an organisation for national transmission system operators: ENTSO-E. Norway is an observing member of ACER, and a member of ENTSO-E.

Although the third package has not been incorporated in the EEA Agreement, Norway has adopted most of the regulations, which ensures a free and competitive European Electricity Market. The existing regulation is in line with the European regulation, and is constantly reviewed and aligned according to regulation processes in the EU.

7.1.1 Renewable Energy Directive

Norway adopted the Renewable Energy Directive 2009/28/EC) of 20% renewables within 2020 under the EEA agreement, resulting in a Norwegian target of 67.5%. The Norwegian share of EU's revised Renewables Target (2018/2001/EU) for 2030 of 32% has not been decided upon yet, but it is evident that the major contribution of Norway's fulfilment of the new climate and renewable will be through electrification of offshore platforms and transport.

The EU's Renewable energy directive (2009/28/EC)
Renewable Energy – Recast to 2030 (RED II)

https://ec.europa.eu/jrc/en/jec/renewable-energy-recast-2030-red-ii
http://www.ewea.org/fileadmin/files/library/publications/position-papers/EWEA-response-to-RED-II-consultation.pdf
https://ec.europa.eu/energy/en/topics/renewable-energy/renewable-energy-directive

7.1.2 The European Gas Directive & European hydrogen policies

Directives and strategies regarding hydrogen / P2G.
https://hydrogeneurope.eu/news/hydrogen-roadmap-europe-has-been-published
https://www.waterstofnet.eu/_asset/_public/powertogas/Conference/10-Nicolas-Brahy_Hydrogen-Europe-HyLaw-_Regulation-Overview.pdf
http://www.haeolus.eu/
https://www.sintef.no/en/projects/haeolus/

A Norwegian case study on the production of hydrogen from wind power
https://www.researchgate.net/publication/223170646_A_Norwegian_case_study_on_the_production_of_hydrogen_from_wind_power

7.2 EU directives of Environmental Impact Assessment 2014/52/EU

The purpose of EU's directive on environmental impact assessment 2014/52/EU has been incorporated into Norwegian regulation *"Forskrift om konsekvensutredninger"* to ensure a transparent process of new plans and permitting processes in accordance with environmental and public health standards.

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0052
http://ec.europa.eu/environment/eia/eia-legalcontext.htm
http://ec.europa.eu/environment/eia/review.htm
https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0052&from=EN

7.3 SEA Directive

Strategic Environmental Assessment (Directive 2001/42/EC) in Europe:

http://ec.europa.eu/environment/eia/sea-legalcontext.htm
https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32001L0042:EN:HTML
https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Al28036

7.4 Gøteborg protocol

Norway has committed to the Gothenburg Protocol, a multi-pollution protocol that sets ceilings for SO_2, NO_x, VOC and ammonia. The Gothenburg Protocol was recently revised, with new emission ceilings for the period 2018 - 2025.

8 Appendix C – National laws and regulations relevant to NSWPH

The Norwegian regulations regarding the electricity market are largely in line with the European regulations (mentioned hereabove). Norway is a part of the EEA*, where the Electricity market is a central part of the Energy Union. Hence, many of the directives and regulations in this field have been incorporated into the EEA Agreement.

Other relevant laws and regulations:

The Planning and Building Act* and the associated Regulations on Impact Assessments* stipulate that a comprehensive EIA* is mandatory for OWFs with an installed capacity of more than 10 MW.

The Planning and Building Act's provisions on municipal land use plans: a dispensation from the Municipal Land Use Plan* is required, if the project area hasn't already been reserved for wind energy purposes.

The Harbour and Fairways Act stipulates that a Detailed Plan* for OWFs shall be approved by the Coastal Administration* before construction can commence.

The Cultural Heritage Act* stipulates that construction of an OWF can only commence after the provisions regarding detailed surveys (§ 9) have been fulfilled. The five maritime museums in Norway (Oslo, Stavanger, Bergen, Trondheim and Tromsø) are in charge of this process.

8.1 The application process

The application process, for a "Construction license", follows as outlined by NVE[1] below.

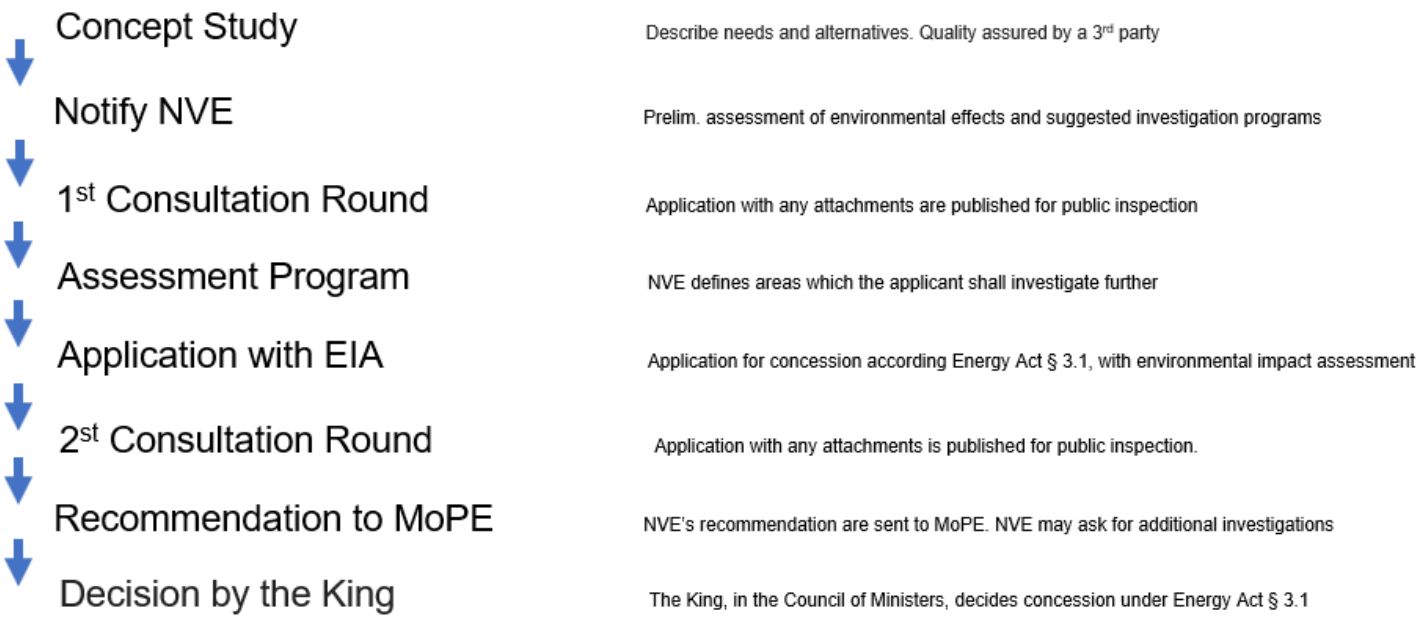


Figure II. Application process for a construction license

NVE has prepared a template with recommendations on how an application for "license for construction" should be developed. The application should include the following sections:

1. **Summary:**

   Brief, not technical, summary at the beginning of the application so that interested parties can easily familiarize themselves with the project.

2. **General information:**

   - Describe permits applied for, with legal reference (§ 3-1 of the Energy Act, the Ocean Energy Act, the Norwegian Expropriation Act, etc.)
   - Describe connection point and the facility (municipality and county location).
   - Reference to current licenses that will influence the presented project
   - Describe any simultaneous applications or permits already granted
   - Information on the ownership and operating conditions of the requested facility.
   - Development schedule, including scheduled time of commencement and commissioning of the plant.

3. **Completed work:**

   Prior to application submission the project applicant shall:

   - Notify involved parties,
   - Describe the known cultural heritage monuments that will be affected,
   - Describe alternative routes / connection point(s) that have been assessed but not requested (a brief justification shall be given, describing why the route / location is omitted),
   - Present completed reports on any impact assessments or other surveys which are conducted to clarify the potential negative effects of the plant.

4. **Description of the power plant the cable route:**

   The purpose of this chapter is to provide a description of the electrical installations and the cable route; in other words: the need for the facility is clarified, through an explanation that provides sound, coherent arguments to the question why the facility is to be built.

5. **Consequences for environment, natural resources, society and private interest**:

   The license application must account for the environmental effects of a possible project execution and consequences for community interests etc.

6. **Mitigating measures:**

   Measures that can reduce possible negative effects in the construction and operation phase, must assessed for all relevant topics.

8.2 The Ocean Energy Act

The *Ocean Energy Act* of 2010 stipulates that renewable energy generation at sea outside the Norwegian baseline as a main rule only can occur after the Ministry of Petroleum and Energy (OED) has opened up an area for license applications. Strategic impact assessments must be made before an area can be opened up. One important objective with this regulation was to lay predictable regulation for any development well ahead before it became applicable, and to have control over sea area allocation.

In 2010, a directorate group led by NVE identified sea areas that can be suitable for OWP development. NVE made a strategic impact assessment of the total sea territory and hence pointed at five prioritised areas.

In 2018, NVE further narrowed the five prioritised areas down to three areas. Two of these (large) areas are located in the southern part of Norway's sea territory, bordering on the territorial waters of the UK, the Netherlands, Germany and Danmark. These designated OWP areas are now subject to public hearing*.

The two southern areas are suitable for both ground-fixed and floating OWFs. The last one (Utsira) is only suitable for floating OWFs. There are no differences in the existing regulations as to whether the OWF will be based on floating foundations or on ground-fixed foundations.

8.3 The Energy Act

The *Energy Act* concerns the production, conversion, transmission, trade and distribution and use of energy. The law applies on Norwegian territory, except at sea. The law was introduced in 1990, as one of the first of its kind of a deregulated electricity market. The electricity sector was restructured from a regulated regime to a market of buyers and sellers of electricity, separation of production, transmission and distribution and a a market driven development of energy expansion. Later on in 1996, Norway and Sweden established Nord Pool as the first international Power Exchange, and in 2000, all of the Nordic countries had joined the Nord Pool market.

8.3.1 Foreign trade license of electric energy

An application for concession according to Energy Act § 4.2 shall contain the following:

- Description of the socioeconomic benefits with the project,
- Project specific Regulatory Model – possibly not relevant for future interconnectors as these probably will be operated by Statnett (to be discussed with NVE and MOPE),
- Effects on the Norwegian HV electric power transmission network,
- Project specific information,
- Description of the connecting part, i.e. Dutch EEZ or Danish EEZ.

As part of another project, further description of the connecting part will be analysed after a meeting with MoPE and NVE (the project team will conduct meetings with MoPE and NVE prior to final delivery for another project at the end of May 2019).

8.4 The Planning and Building Act

The Planning & Building Act* and the Associated Regulations on Impact Assessments*: a comprehensive Environmental Impact Assessment (EIA) is mandatory for OWFs with an installed capacity of more than 10 MW.

The Planning & Building Act's provisions on municipal land use plans: a dispensation from the Municipal Land Use Plan is required, if the project area hasn't already been reserved for wind energy purposes.

8.5 Climate Change Act

Norway has committed to reduce CO_2 emissions by 40% within 2030 rom the reference year 1990, as a follow-up to the Paris agreement, that has been ratified by the Government. The Ministry of Environment passed the *Act related to Norways Climate targets* (the Climate Change Act) on 01.01.2018 to secure the transition to a low-emission society within 2050. The law also defines a further reduction of 80-95% reduction within 2050.

Norway's total climate emissions were 52,7 Mt CO_2 -equivalents in 2017. Norway electricity generation is almost 100% renewable, so the main areas to cut emissions are transport, oil & gas (offshore gas turbines) and industry.
Because offshore oil & gas contribute to 25% of our CO_2 emissions, electrification of the oil and gas is an obvious candidate to Norway's 40% emission reduction target.

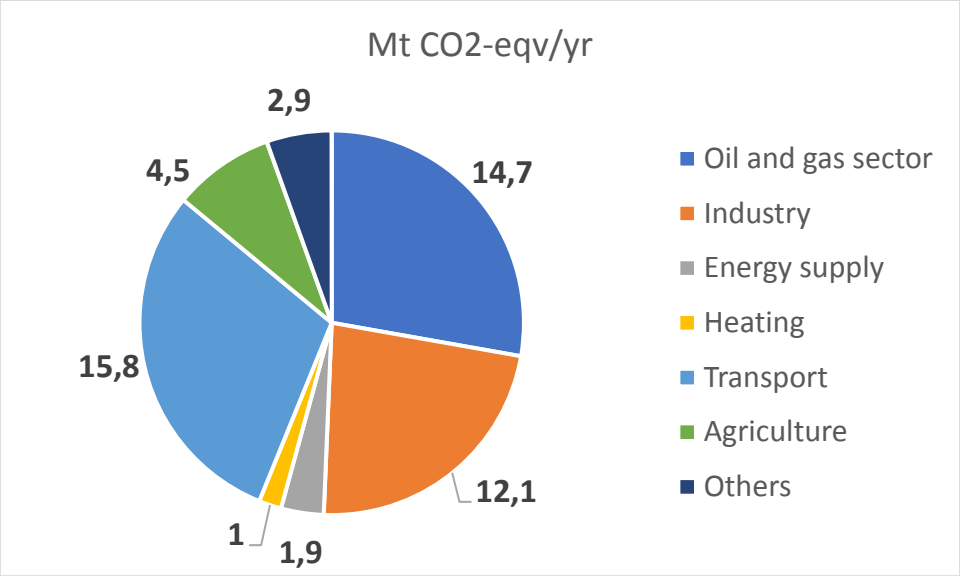


Figure III. The total Norwegian emissions in 2017 were 53 Mt CO_2-equivalents.
Source: SSB

8.6 The Regulation on Environmental impact Assessment

The Environmental impact assessment regulation, in Norwegian *"Forskrift on konsekvensutredninger"*, ensures a transparent process for assessing new planning initiatives.

8.7 The Harbour and Fairway Act

The Harbour and Fairways Act: the Detailed Plan* for OWFs must be approved by the Coastal Administration before construction can commence.

8.8 The Cultural Heritage Act

The Cultural Heritage Act: construction of an OWF can only commence after the provisions regarding detailed surveys (§ 9) have been fulfilled. The five maritime museums in Norway (Oslo, Stavanger, Bergen, Trondheim and Tromsø) are in charge of this process.

8.9 Agreement on the reduction of NO_x emissions 2018-2025

Environmental agreement about NO_x emissions:
https://www.regjeringen.no/no/tema/klima-og-miljo/forurensning/innsiktsartikler-forurensning/nox/id2587877/

Norway's 2018-2025 agreement on NO_x emissions:
https://www.regjeringen.no/contentassets/b464cb45ed1544fb9fa5df5f30612d93/nox-avtale-2018-2025.pdf

Norway's low emissions policy: https://www.regjeringen.no/en/aktuelt/norways-low-emissions-strategy/id2607245/

9 Appendix D – National support schemes relevant to NSWPH

9.1 Support schemes in Norway

Support schemes that are applicable for OWF /demonstration projects are listed underneath:

9.1.1 Possible support through Energi21 / EnergiX

Energi21 is a strategy body appointed by the MPE, for research, development, demonstration and commercialisation of new energy technology. The main objective of Energi21 is to give advice and advice to the Ministry of Petroleum and Energy and its affiliate agencies (Norway's Research Council, Enova and NVE), in addition to the energy industry in general. In its third strategy (2014), it recommends a strategic focus on offshore wind power as one of six prioritized priority areas.

EnergiX is a major energy research program in Norway's Research Council. The program has a total budget of about NOK 500 million per annum. Prior to the theme area "Renewable energy production", focus on wind power is central. This includes support for the development of offshore wind power technologies. Support from the program has been given to research projects, competence project for research institutions and business and innovation project for the business sector.

The research area for offshore wind power is a central part of the program. Examples are development of a new concept for floating wind power, installation concept for floating wind turbines, foundation for bottom-fixed turbines, models for installation of bottom-fixed foundations, study of the forces from waves and wind on foundation, operational and maintenance system, access system and model for wind lift.

9.1.2 Possible support from Enova

Enova is a primary institution in the energy sector's efforts to reduce emissions of greenhouse gases. Enova's goal is to contribute to reduced greenhouse gas emissions and strengthen security of supply for energy, in addition to technology development which in the longer term also contributes to reduced greenhouse gas emissions.

MoPE and Enova signed a new governance agreement for the years 2017 – 2020, where the schemes were re-adjusted towards other innovations compared to earlier ones. Transfers to the Climate and Energy Fund are also increasing compared to earlier schemes, to about NOK 2,7 billion in 2018.

Offshore wind power is encompassed by Enova's sub-goal of increasing innovation adapted to the transition to the low-emission society. Enova therefore supports innovative projects within offshore wind power, up to and including full-scale production, as long as the project is innovative. There are two Enova programs that are relevant for innovation projects within offshore wind power:

- Demonstration of new energy and climate technology
- Full-scale innovative energy and climate technology

In 2017, Enova launched a new program for demonstration of new energy and climate technology. In this program, the aim is that new technology – e.g. technology for offshore wind power - should be demonstrated in real-life operations. The technology must at least have been tested out on a pilot scale where the system solutions have been validated in relevant operating incidents. For these projects, Enova can provide loans on terms of up to 60 per cent of the costs. The object is to mitigate the technology risk, and if the technology does not work as intended, the company can apply for remittance of all or part of the loan.

Through the program "Full-scale innovative energy and climate technology", Enova can support the additional cost of using new and creative solutions for commercial facilities for e.g. offshore wind power. The technology must be new and substantially improved compared to the best technology that is in use in the market. For large businesses, Enova can support up to 45 per cent of the additional cost of the innovative solutions.

9.1.3 Possible support from Innovation Norway

Innovation Norway contributes with various types of tools that will facilitate access to capital, expertise and networks. They have supported several offshore wind power projects with their services.

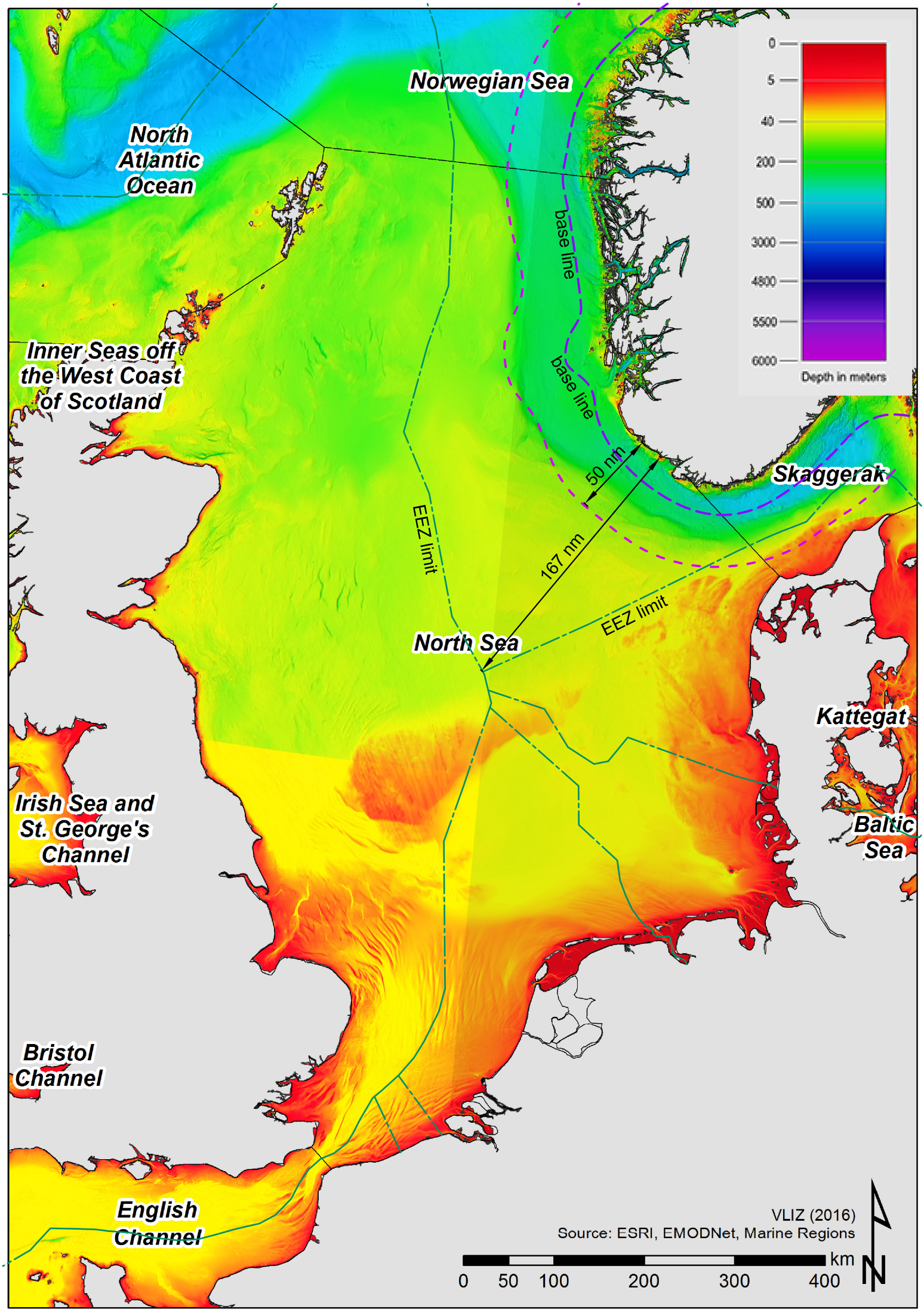
- with regards to the NO_x requirements for electrification of offshore installations,
- and/or regarding CCS and CO_2 emission reductions.

Legislation and regulations for OWFs will be analysed for the Norwegian territorial waters, depending on the distance to the Norwegian coast. Possible differences in legislation for wind power plants will be described:

- Between 12 nm and 200 nm from the base line: the tenderer considers that this is the most suitable area to realise wind farms in the Norwegian sector.
- Between the base line and 12 nm from the base line: the tenderer considers that it may be slightly more difficult to realise wind farms in this area, because most of this sea area consists of important fishing grounds.
- Inside the Norwegian base line: the tenderer considers that it may be more difficult to realise wind farms between the base line and the coastline, because the Norwegian authorities highly emphasize the natural values of the inner coastal area.

As shown on the following sea map, the distance perpendicularly measured from the Norwegian coast (at Egderholmen near Stornes) to the farthest southwestern corner of the Norwegian sector (where it meets the British and Danish sectors) is estimated to be approximately 167 nm.

Figure IV. Maritime zones of Norway


Norwegian Sea
North Atlantic Ocean
Inner Seas off the West Coast of Scotland
base line
base line
50 nm
167 nm
EEZ limit
EEZ limit
Skaggerak
North Sea
Kattegat
Baltic Sea
Irish Sea and St. George's Channel
Bristol Channel
English Channel
0
5
40
200
500
3000
4800
5500
6000
Depth in meters
VLIZ (2016)
Source: ESRI, EMODNet, Marine Regions
km
0 50 100 200 300 400
N

9.2 Emission taxes

9.2.1 CO_2 taxes

Law on taxes on CO_2 emission in the petroleum industry (LOV-2015-06-19-65) imposes a tax of 47.9 €/tCO_2. All oil and gas installations on the continental shelf are subject to this tax.

In addition to the CO_2-tax, the oil and gas industry is under the EU emission trading scheme where expected quota prices at time of writing is about 27 €/tCO_2

Norwegian petroleum industry amounts to about ¼ of total Norwegian CO_2 emissions.

9.2.2 NO_x taxes

A tax of 2 €/kg NO_x is imposed on Norwegian industry's NO_x emissions and VOC compounds as a follow-up of the Gøteborg Protocol towards 2025. Alternatively, the oil industry may pay a tax of 1.45 €/kgNO_x to the NHO NO_x fund, a voluntarily agreement between the *Confederation of Norwegian Enterprise* (NHO) and the Government, provided a commitment of reducing emissions by 15% within the agreement period 2018-2025.

9.2.3 Estimated Emission taxes from offshore electricity generation

In the table below, the total operating emission costs, as well as fuel costs for an assumed single cycle gas turbine, are estimated:

Gas turbine, offshore		**Unit**
Efficiency gas turbine	37	%
Emission intensity CO_2	880	kgCO_2/MWh
Emission intensity NO_x	1	kgNO_x/MWh
CO_2 tax	46	€/tCO_2
CO_2 quota price	25	€/tCO_2
NO_x tax	2,3	€/kgNO_x
Total emission fees	**65**	**€/MWh**
Expected gas prices (TTF)	20	€/MWh
Fuel costs	**54**	**€/MWh**
Total marginal costs	**119**	**€/MWh**

Table 1 Emission taxes for electricity generation offshore

9.2.4 Operational cost of gas turbines

Expected continental gas prices are about 20 €/MWh (TTF), which translates to a fuel price of 54 €/MWh assuming an =37% (LM2500 Gas turbine), the fuel costs of offshore gas turbine are in the order of 54 €/MWh.

9.2.5 The NO_x fund

As a follow-up of the Gøteborg protocol, NHO's NO_x fund aims to reduce NO_x emissions during 2018-2025. On the one hand, a tax of 21,97 NOK/kg NO_x is imposed – while on the other hand, companies, that are participating in the fund, can apply for funding to support the implementation of NO_x-reducing technologies. Electrification of offshore installations using OWFs can reduce emissions (currently 22,7 NOK/tCO_2), which can then be redistributed to NO_x-reducing initiatives. Electrification of the offshore wind energy installations are eligible for this fund from NHO*.

10 Appendix E – National guidelines for offshore wind energy

As background information are summarised here, amongst others, the government's whitepaper about offshore wind energy and the Energi21 strategic programme.

10.1 Norwegian policies for offshore wind energy

Havenergilova came into force in 2010. An important purpose of the marine energy program was to lay the framework conditions well in advance of any development, and to have control of the area disposal at sea. As a follow-up to this Act, a survey and a strategic impact assessment of 15 areas for offshore wind power have been carried out. Five areas were managed by the NVE, pointed out as those who should be opened for license applications first.

The Government has stated that, based on the strategic impact assessment, they will aim to clarify which marine areas it may be appropriate to open for applications for a license, but that has not yet happened. After ordering from the MPE in December 2017, the NVE has recommended opening two areas now (Utsira North and Southern North Sea I or II).

However, after the marine energy, exceptions can be made to the provisions on the opening of area for test projects as individual facilities with a limited life span or for smaller plants that are only to be linked to petroleum activities.

As a backdrop to Norway's guidelines for ocean-based investment, the recognition is that we have large sea wind resources and a maritime petroleum industry that is world-leading. At the same time, it is currently much more expensive to build wind power in the sea than on land in Norway. Offshore wind power, with fixed installations, currently costs around twice the amount of wind power on land. A key element of the Government's strategy for marine energy is therefore to strengthen its focus on research, development and demonstration in order to contribute to increased value creation and a safe, cost-effective and sustainable utilisation of the Norwegian energy resources. The Norwegian authorities have also stated that they will facilitate internationalisation and encourage participation in international cooperation and in the EU's research programs.

Demonstration projects in Norway can apply for support from Enova, while research and development of technology is supported through the Norwegian Research Council. Good research environments have been established within offshore wind power in Norway.

The Government has shown particular interest in technology for floating offshore wind power plants. Here, Norwegian expertise and experience from oil, gas and maritime activities will provide a good starting point for business development and employment.

Decision by the Parliament to promote offshore wind after the Parliament's Report "International experience and relevant models for support for offshore wind power in the early phase", Resolution No. 825, of the 4th of June 2018:

https://www.regjeringen.no/contentassets/2a7006dca4b0494ba4e09748afce6b77/no/pdfs/prp201820190001oeddddpdfs.pdf
("Internasjonale erfaringer og relevante modeller for støtte til havvindkraft i tidligfase")

https://www.regjeringen.no/no/dokumenter/prop.-1-s-20182019/id2613405/sec1

"The Parliament asks the Government to investigate international experiences with and relevant models for early-stage support mechanisms that are sufficient to stimulate the rapid development of offshore wind projects on a commercial scale."

The Ministry of Petroleum and Energy states in a letter dated 15 January 2019:

> "In the Petroleum and Energy Ministry's Proposition 1 S (2018–2019), the following is stated about the Ministry of Petroleum and Energy's follow-up:
>
> The background for the decision is representative proposals from Gisle Meininger Saudland (Progressive Party), Ketil Kjenseth (Labour), Lene Westgaard-Halle (Conservatives), Per Espen Stoknes (Norwegian Greens), ref. Document 8: 182 S (2017–2018), Position Statement 322 S (2017–2018).
>
> The Ministry of Petroleum and Energy will reply to the Parliament accordingly.
>
> The Energy and Environment Committee has in Position Statement 9 S (2018–2019) noted the Government's mention of the case."

10.1.1 Regulations for opening and awarding licenses for offshore wind

Resolution No. 824, June 4, 2018

> "The Parliament asks the Government to prepare detailed regulations for opening and awarding licenses for offshore wind on the Norwegian shelf."

The Ministry of Petroleum and Energy states in a letter dated 15 January 2019:

> « In the Petroleum and Energy Ministry's Proposition 1 S (2018–2019), the following is stated about the Ministry of Petroleum and Energy's follow-up:
>
> > "The background for the decision is representative proposals from Gisle Meininger Saudland, Ketil Kjenseth, Lene Westgaard-Halle and Per Espen Stoknes on the preparation of detailed regulations for opening and awarding licenses within offshore wind, cf. 322 S (2017–2018) and Document 8: 182 S (2017–2018).
> >
> > As can be seen from the discussion under resolution no. 245, dated 13 December 2017, the Ministry has initiated work on regulations for marine energy. The Ministry will inform the Parliament accordingly, when the regulations are laid down."
>
> The Energy and Environment Committee has in Position Statement 9 S (2018–2019) noted the Government's mention of the case and is looking forward to a briefing when the regulations are determined. »

10.1.2 Floating offshore wind power installations (Enova)

Decision no. 48, December 4, 2017:

> "The Parliament asks the Government to ensure that the mandate of Enova also includes floating offshore wind, so that Enova can contribute to realizing full-scale pilot / demonstration facilities."

The Ministry of Climate and Environment stated in a letter dated 28th of January 2019:

> « In the Proposition 1 S (2018–2019) from the Ministry of Climate and Environment, the following is stated about the Ministry of Climate and Environment's follow-up:
>
> > "The decision was made when processing Prop. 1 S (2017–2018), cf. 2 S (2017–2018).
> >
> > The decision has been followed up through the management agreement between the Ministry and Enova for the period 2017 to 2020. Development of offshore renewable technology, under this offshore wind, fell within Enova's mandate. In 2017, Enova launched two programs that are relevant for offshore wind power: "demonstration of new energy and climate technology" and "full-scale innovative energy and climate technology". The goal of the first program is to relieve technology risk and that new technology, such as offshore wind power, will be demonstrated under real operating conditions. Through the second program, Enova can support the additional cost through the use of new and innovative solutions. Enova has already been awarded support for a pilot project for floating

offshore wind, and is open to applications under the above-mentioned programs. The Government sees the petition decision as followed up."

The Energy and Environment Committee takes the information for information and the committee's members from the Conservatives, the Progressive Party, Labour and the Christian Democrats, which constitute the Parliament's majority, consider the request decision followed up, cf. 9 S (2018–2019). »

10.2 Energi 21

Energi21 is a strategy agency, appointed by the MPE, for research, development demonstration and commercialisation of new energy technology. Here, "Havvind for an international market" is highlighted as one of six priority areas.

The goal is primarily to develop an internationally competitive Norwegian business sector in offshore wind. Norwegian suppliers have ambitions to double their market share by 2030, where a conscious commitment to new technology is important to meet these ambitions. Norwegian research parties and industry have thorough expertise from petroleum and maritime sectors, which can be further developed within offshore wind power. In addition, Norway has been early with the development of floating offshore wind farms, which provides a competitive advantage for further project development.

The strategy also states that in a longer perspective, the focus on offshore wind can contribute to the utilisation of the large Norwegian wind power resources and the establishment of power generation on the Norwegian shelf. Some key research topics are foundation design, assembly and installation, reduced operating and maintenance costs, marine logistics, resource mapping and modeling, electrical infrastructure, maritime multi-use, etc.

Source: https://www.energi21.no/Strategien/energi21-strategien/

Energi21 will – in collaboration with the Research Council, Enova and Innovation Norway – carry out a project to gain increased knowledge about the way from research to market for different technologies.

Reference: https://www.forskningsradet.no/globalassets/publikasjoner/1253973868420.pdf

11 Appendix F – Maps of relevant constraints and regulatory areas

These GIS maps are provided by the open database of Statens kartverk.

11.1 Eligible areas for OWFs

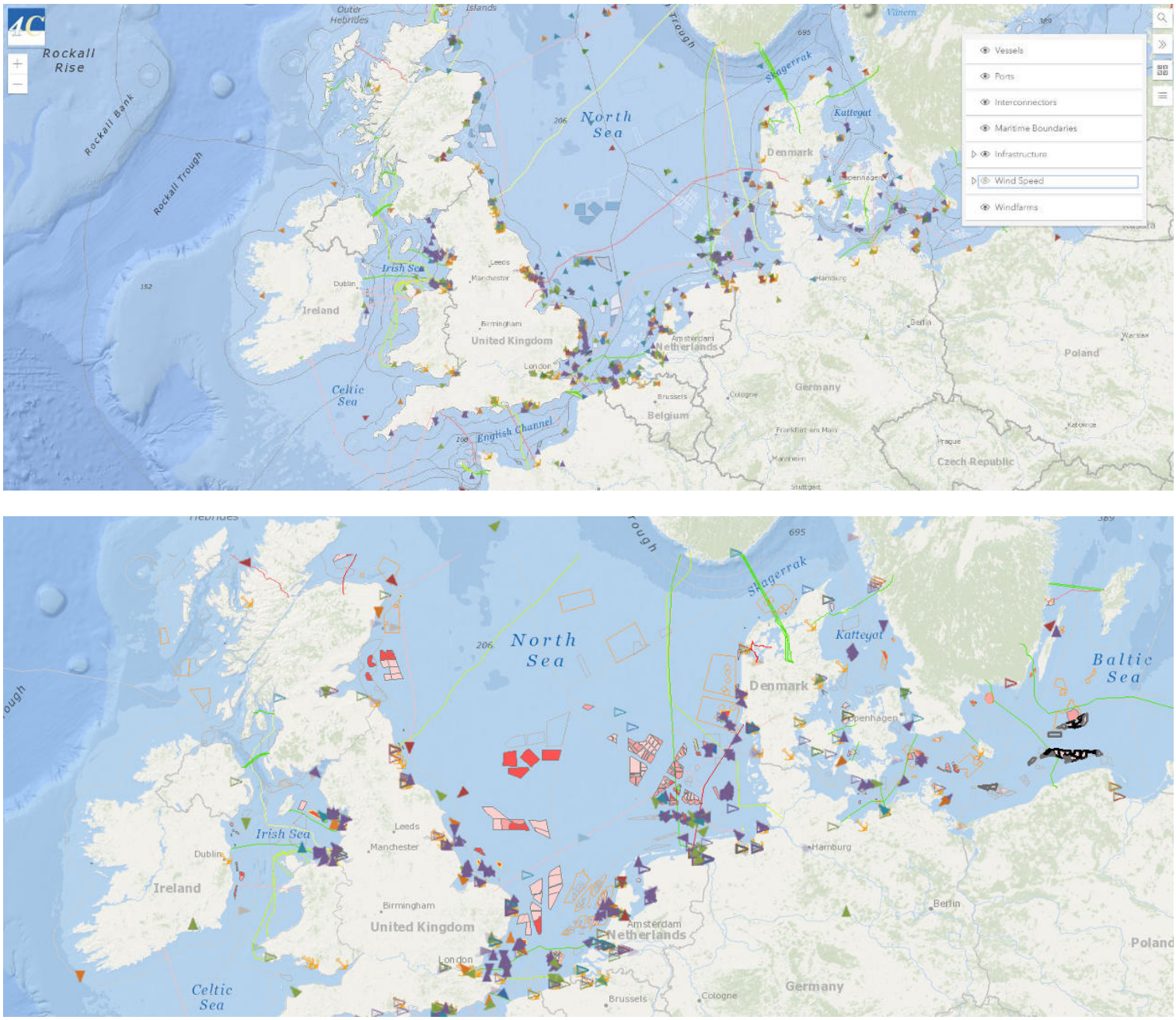


Figure V. Map showing windfarm areas in the North Sea.

Figure VI. Map showing windfarm areas in the North Sea.

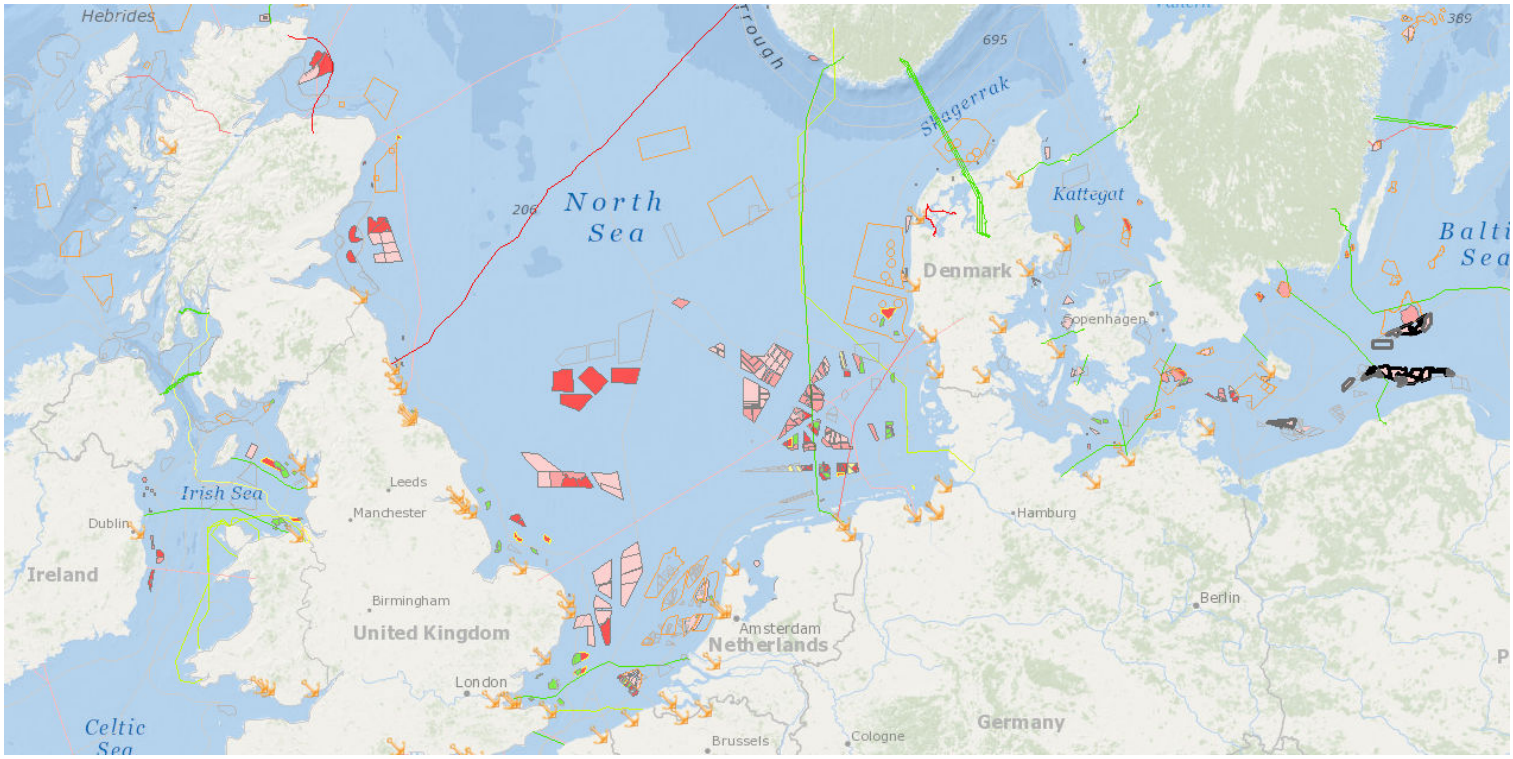


Figure VII. Map showing windfarm areas in the North Sea.

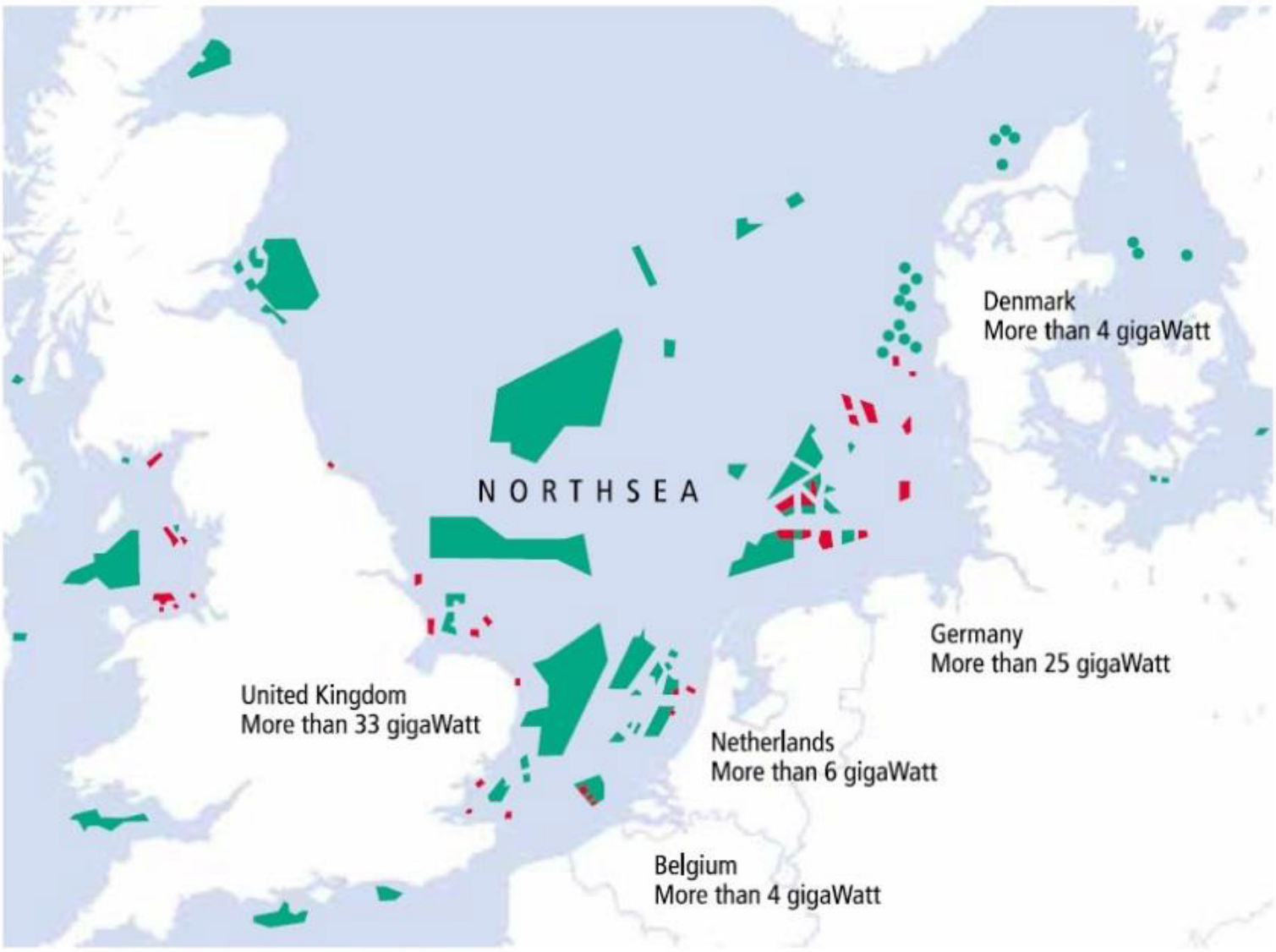


Figure VIII. Map showing windfarm areas in the North Sea.

The Ocean Energy Act lays down guidelines for which areas can be developed for offshore wind. It is the King who opens new areas. Only licenses can be searched for areas that have been opened, with the following exceptions:

- Production facilities for oil & gas installations (which are treated in accordance with the Petroleum Act),
- Pilot systems (stand-alone installations).

An excerpt from this press release (see reference R5): “The government wants to facilitate offshore wind power, especially with regard to demonstration projects for floating wind power ... The strategy for floating wind power presented by the government in autumn 2017 is not primarily aimed at power supply, but must contribute to Norwegian industry and Norwegian competence environments can seize the industrial opportunities associated with the development of offshore wind power. "

Areas (up to 500 MW each) that are recommended are the Utsira height and two areas in the southern North Sea - where the latter two are assumed to be mutually exclusive due to lack of grid capacity on land. These areas have been selected after a strategic impact assessment was carried out by NVE in 2012-2013.

- Utsira nord
- Sørlige Nordsjø I
- Sørlige Nordsjø II

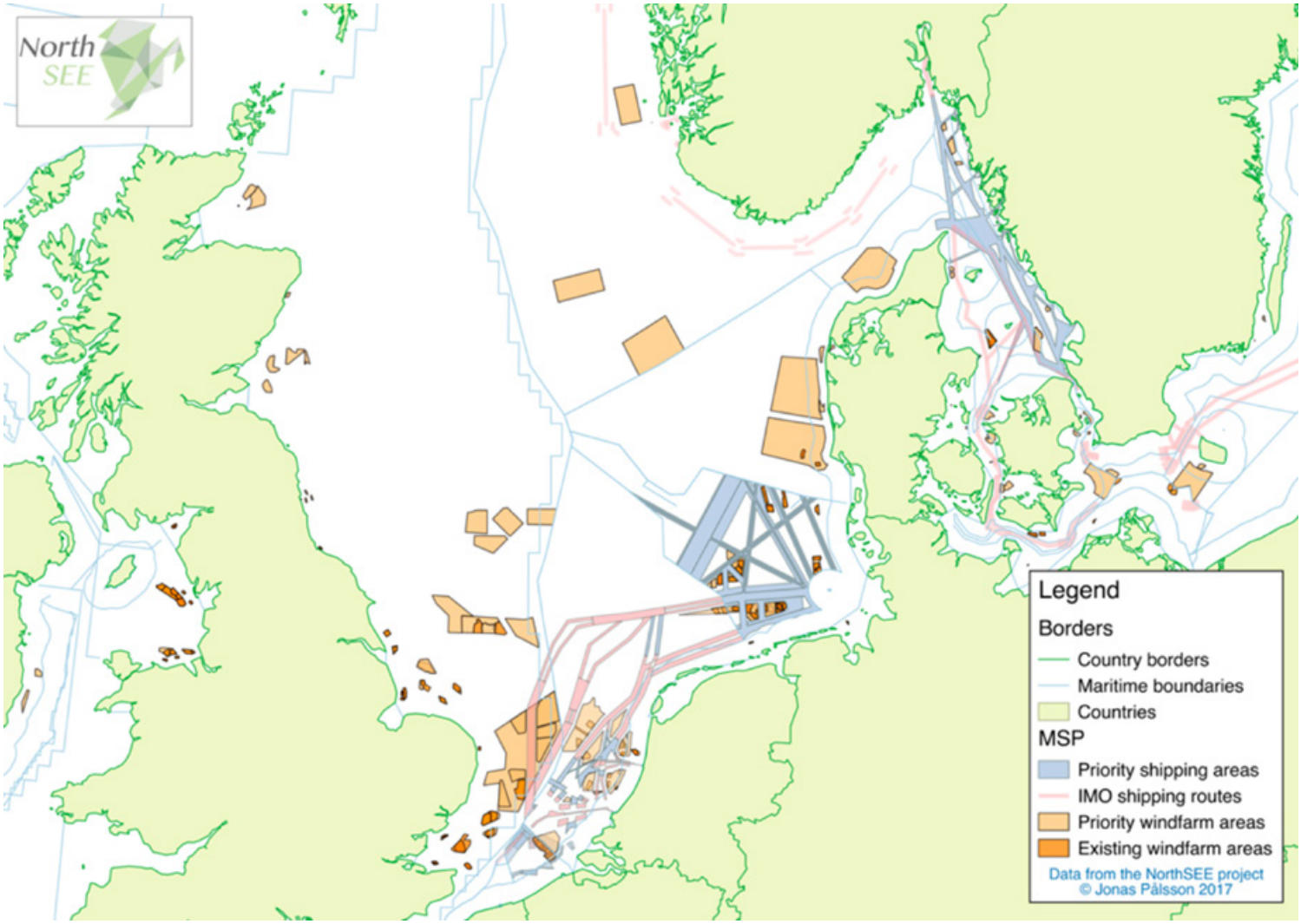


Figure IX. Map showing windfarm areas in the North Sea.

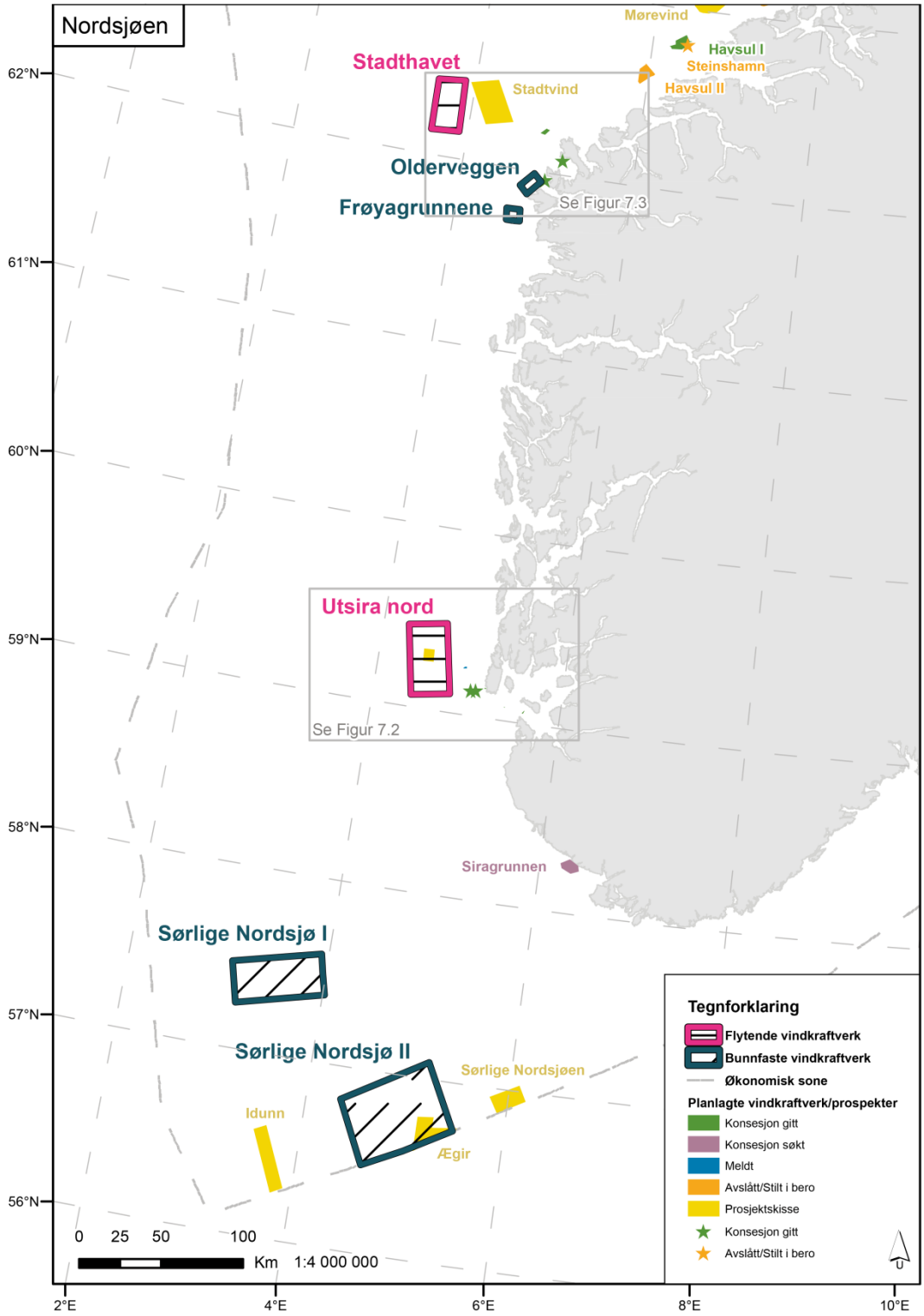
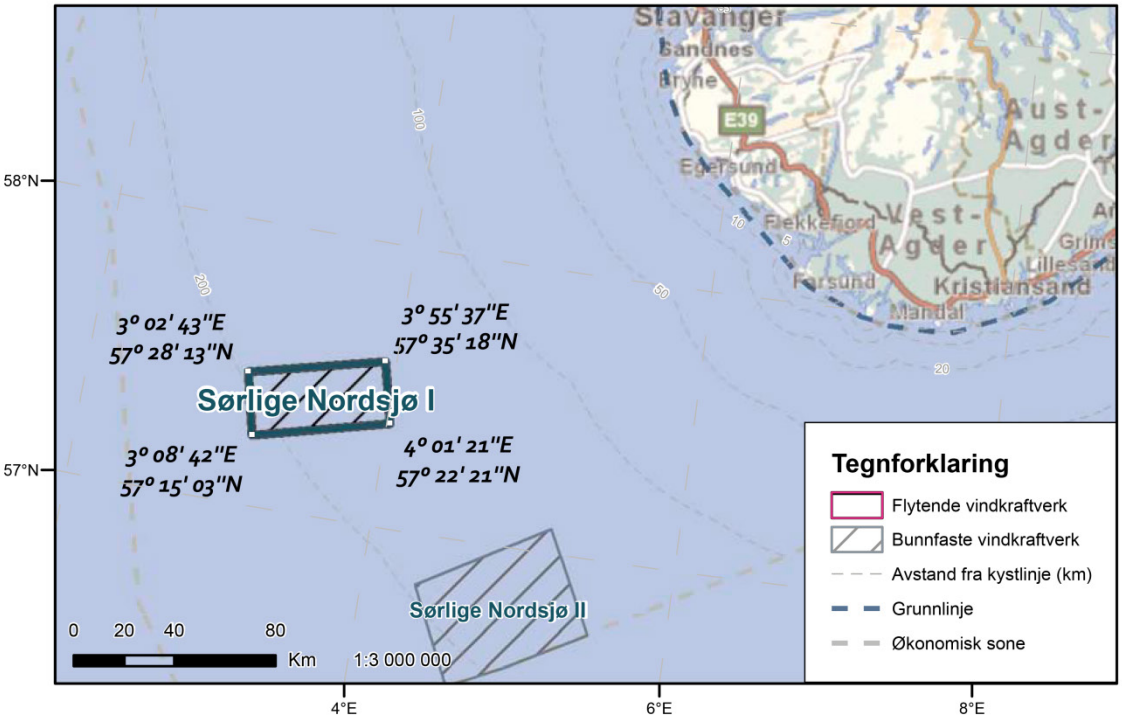


Figure X. Project sketches (in yellow) and planned areas (in dark blue / magenta) for offshore WP in the Norwegian sector



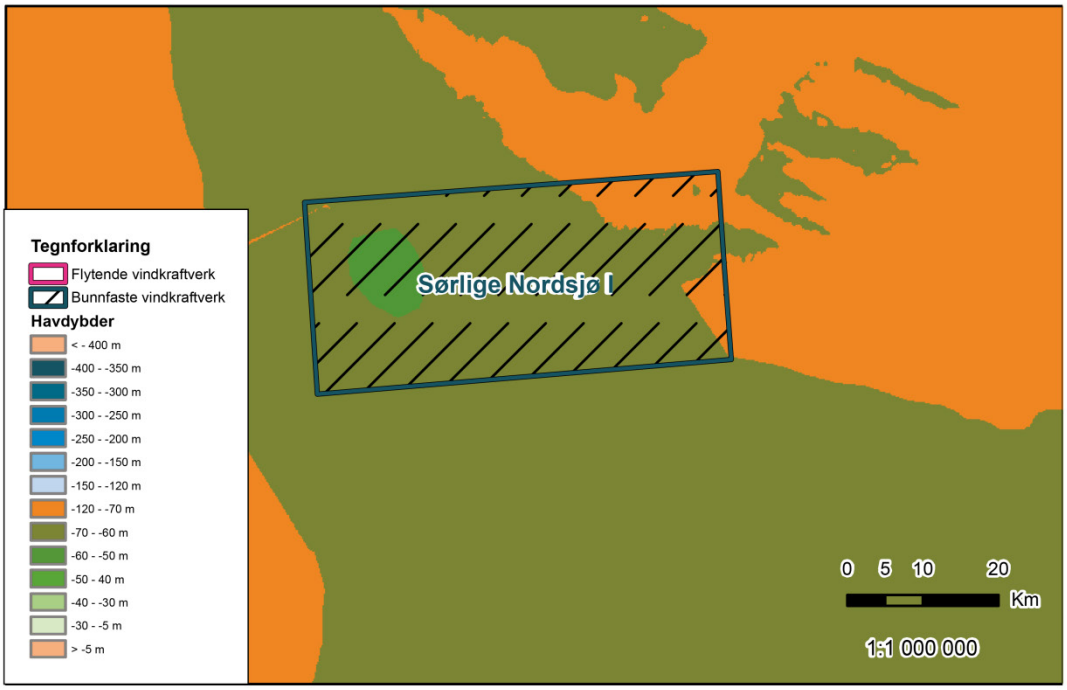


Figure XI. Geographical localisation of offshore WP area "Southern North Sea I"

Figure XII. Bathymetry around offshore WP area "Southern North Sea I"

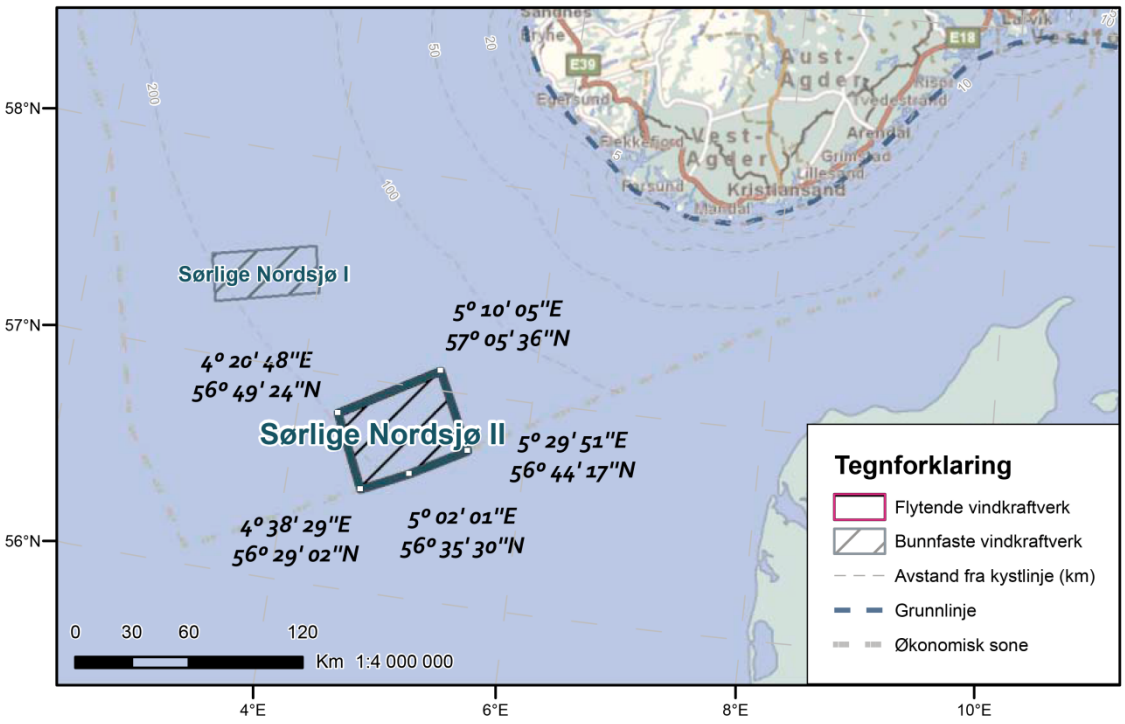


Figure XIII. Geographical localisation of offshore WP area "Southern North Sea II"

Figure XIV. Bathymetry around offshore WP area "Southern North Sea II"

11.2 Possible other areas

Last summer, the MPE conducted an input meeting around the proposed areas.

Work is underway on a regulation that will be heard. It is not known exactly when this happens, or who will promote it, but it has been working for a while (check / confirm with the NVE). It is not confirmed, but it is assumed that the regulation

will shed light on issues related to which areas will be opened for the development of offshore wind, licensing process (including investigation program and responsibility for this), award criteria, regulation / process in competition where several parties apply for the same area.

It is assumed that it will be possible to provide input to the consultation around possible other areas for the development of offshore wind. In this connection, it would be appropriate to record conditions regarding the lack of network capacity.

11.3 Protected natural areas

Protected areas according to *Forvaltningsloven* and the regional plan.

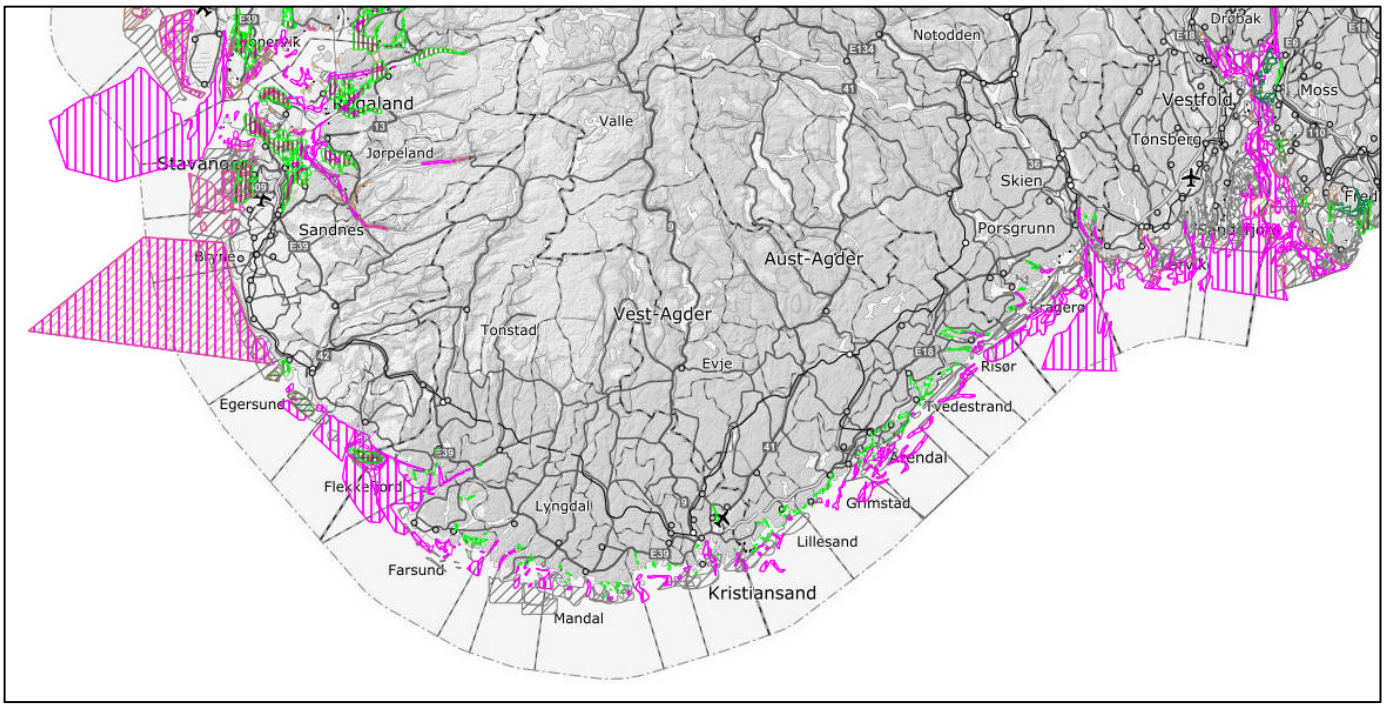


Figure XV. Fishing areas near the Norwegian coast (source: www.fiskeridirektoratet.no)

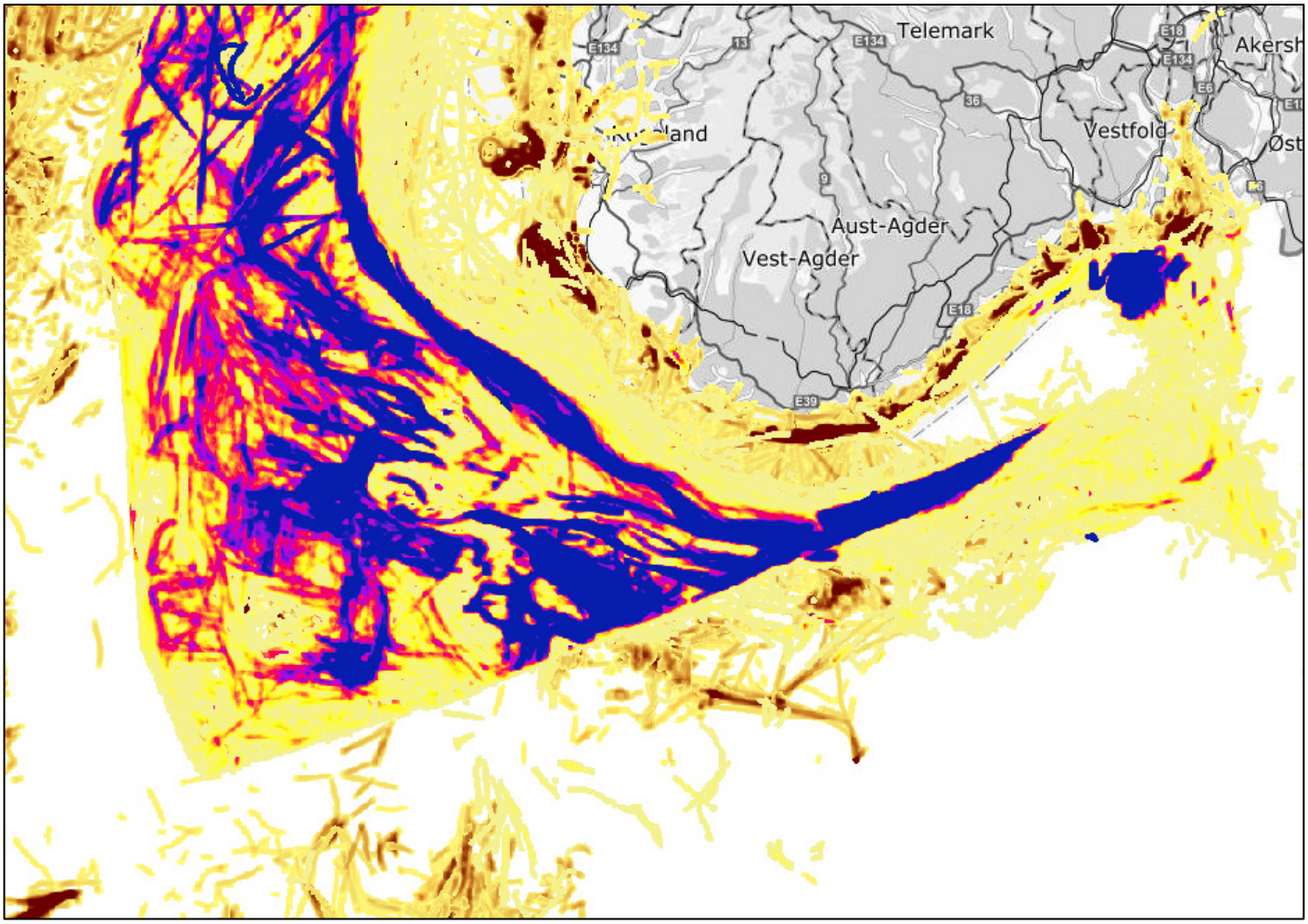


Figure XVI. Intensity of fishing activities, based on AIS-data from the fishing fleet.
(Source: www.fiskeridirektoratet.no)

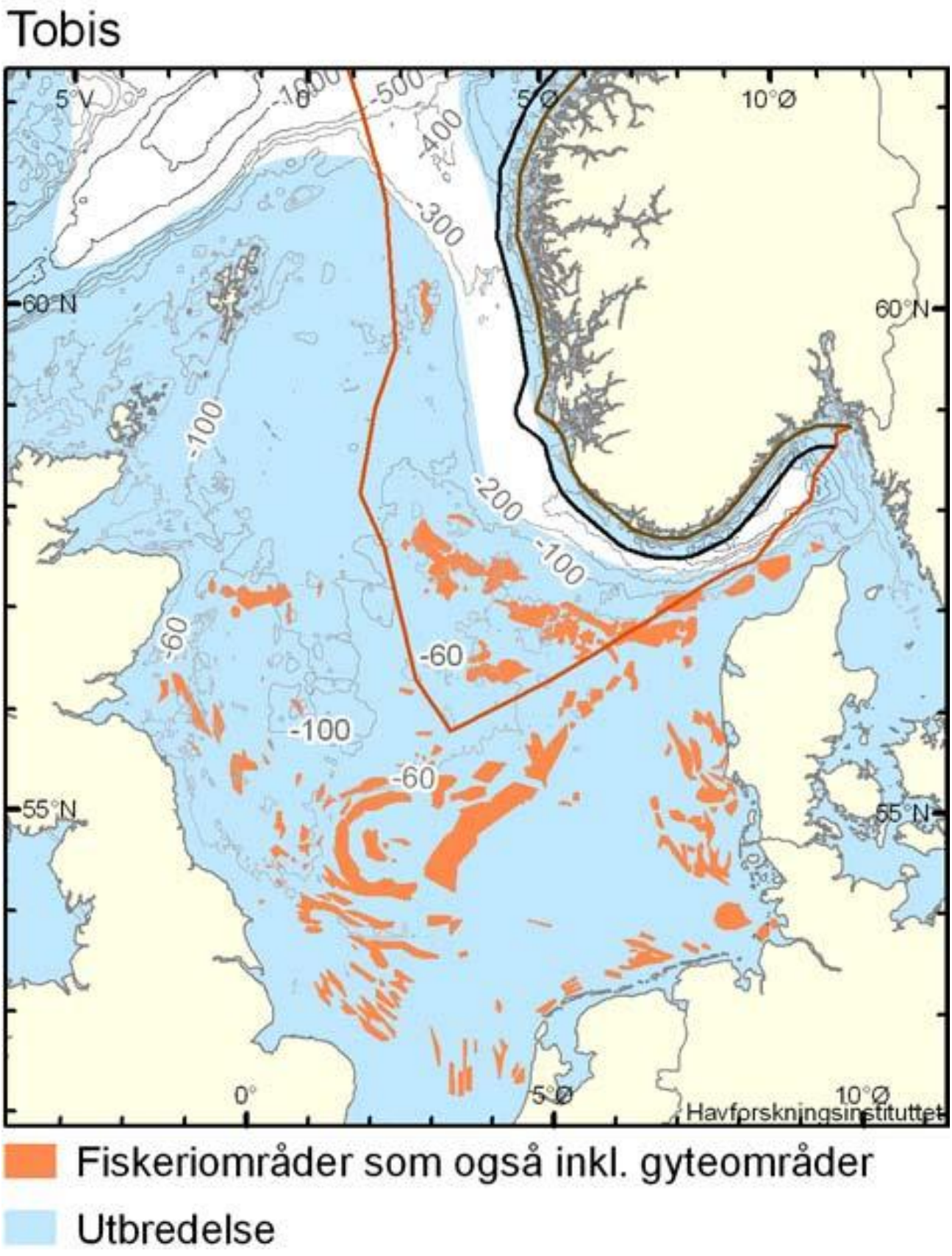
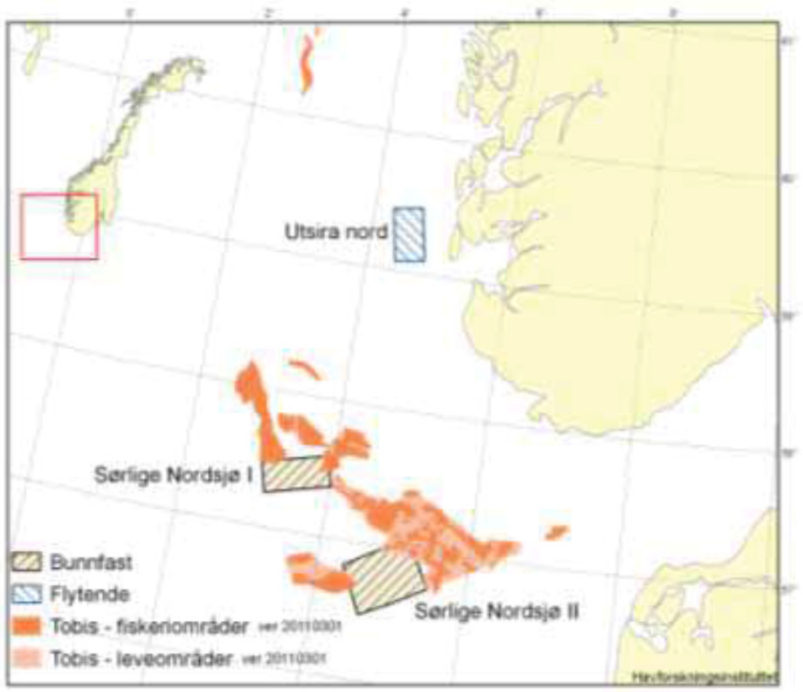
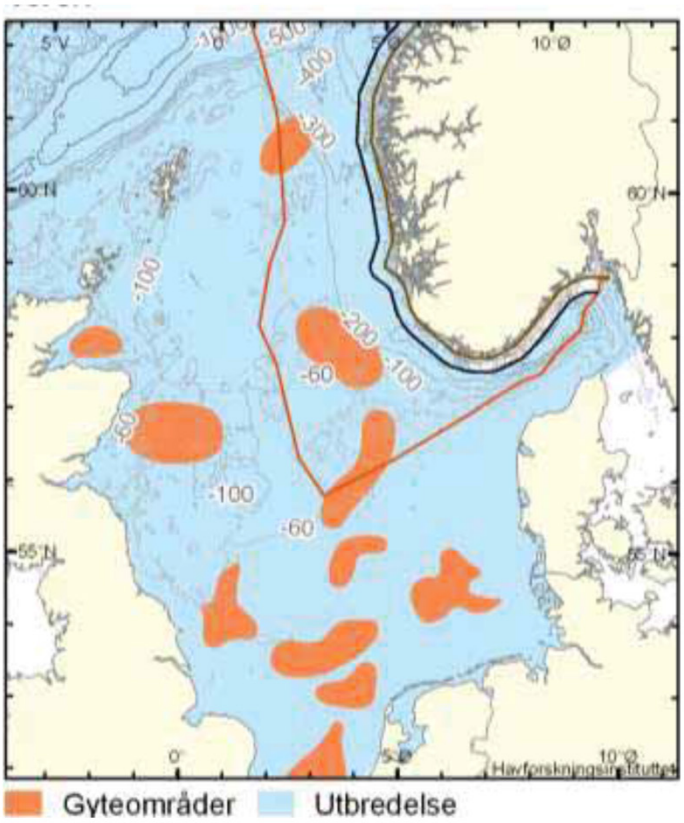


Figure XVII. Fishing and spawning areas for tobis.



Figur 4.4. Utbredelsesområder (leveområder) og fiskefelt for tobis i Nordsjøen. Utredningsområder for havvindanlegg med arealer øremerket bunnfaste installasjoner og arealer øremerket flytende installasjoner.

Figure XVIII. Distribution (living areas) and fishing fields for tobis.



Figur 4.8. Utbredelse og gytefelt for torsk i Nordsjøen og langs Norskerenna.

Figure XIX. Distribution and spawning areas for Atlantic cod.

FIGUR 4-11

Sporingsdata viser viktige områder for fiskeri i Nordsjøen. Dataene er hentet fra fartøy større enn 21 meter. Mindre fartøy opererer i tillegg langs hele kystlinjen i området.

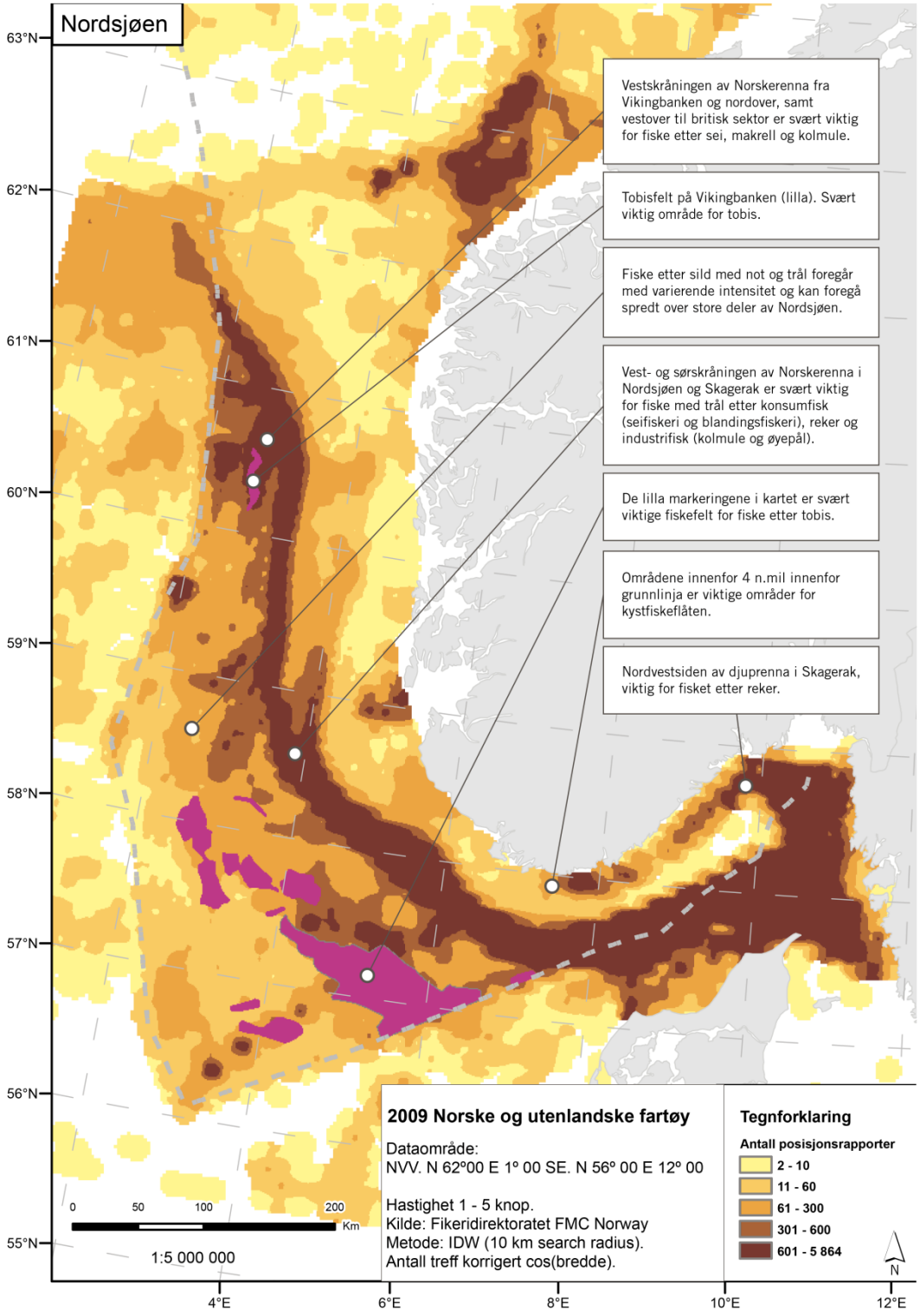


Figure XX. GIS data showing the intensity of fishing.

FIGUR 6-15
Vernede og særlig verdifulle områder i Nordsjøen.

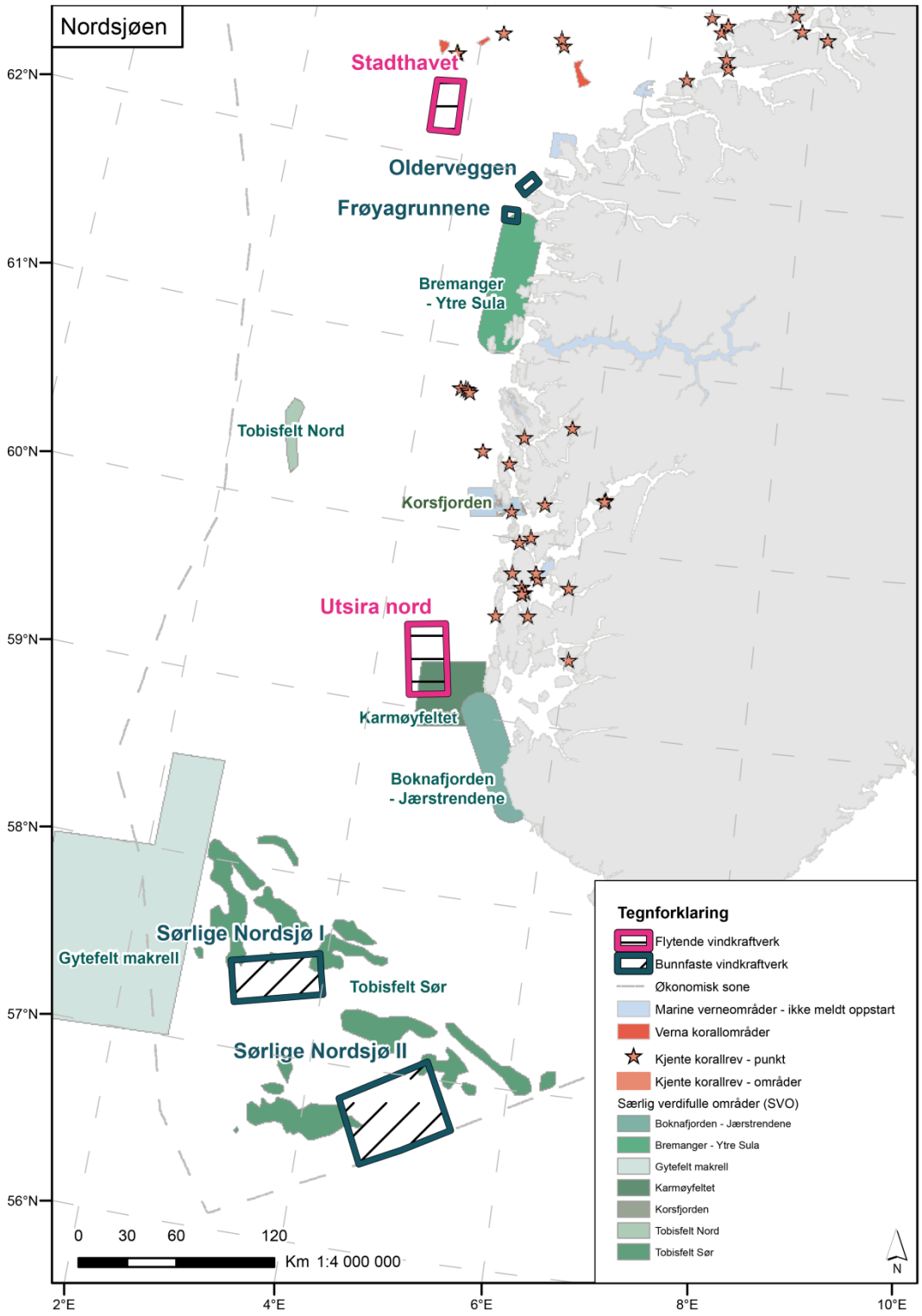
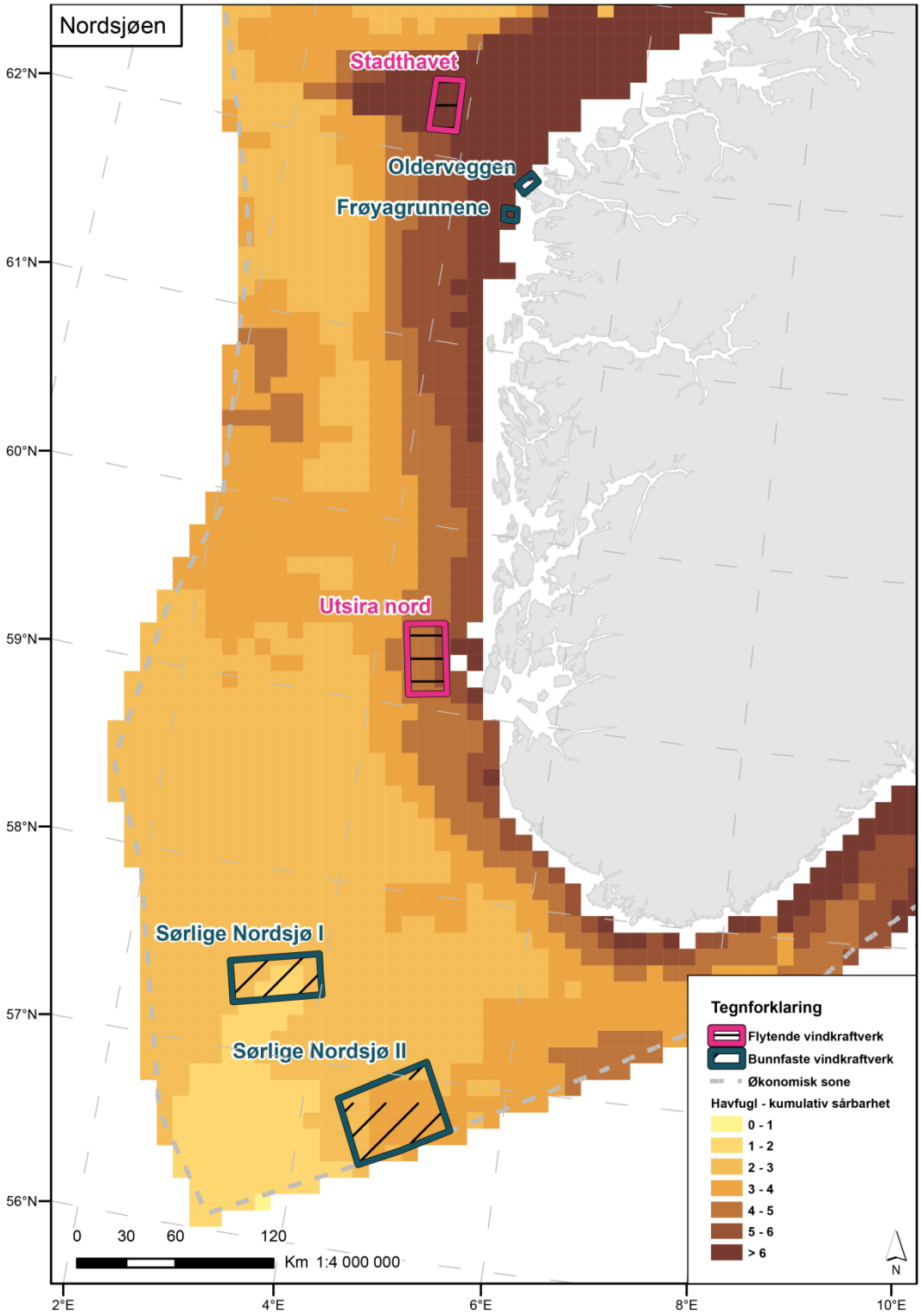


Figure XXI. Protected and especially valuable areas.

FIGUR 6-16

Kumulativ sårbarhet for alle havfugl arter i Nordsjøen basert på havdata.



106

Figure XXII. Cumulative vulnerability for all sea birds.

FIGUR 6-17

Kumulativ sårbarhet for alle kystfugl arter i Nordsjøen basert på kystdata.

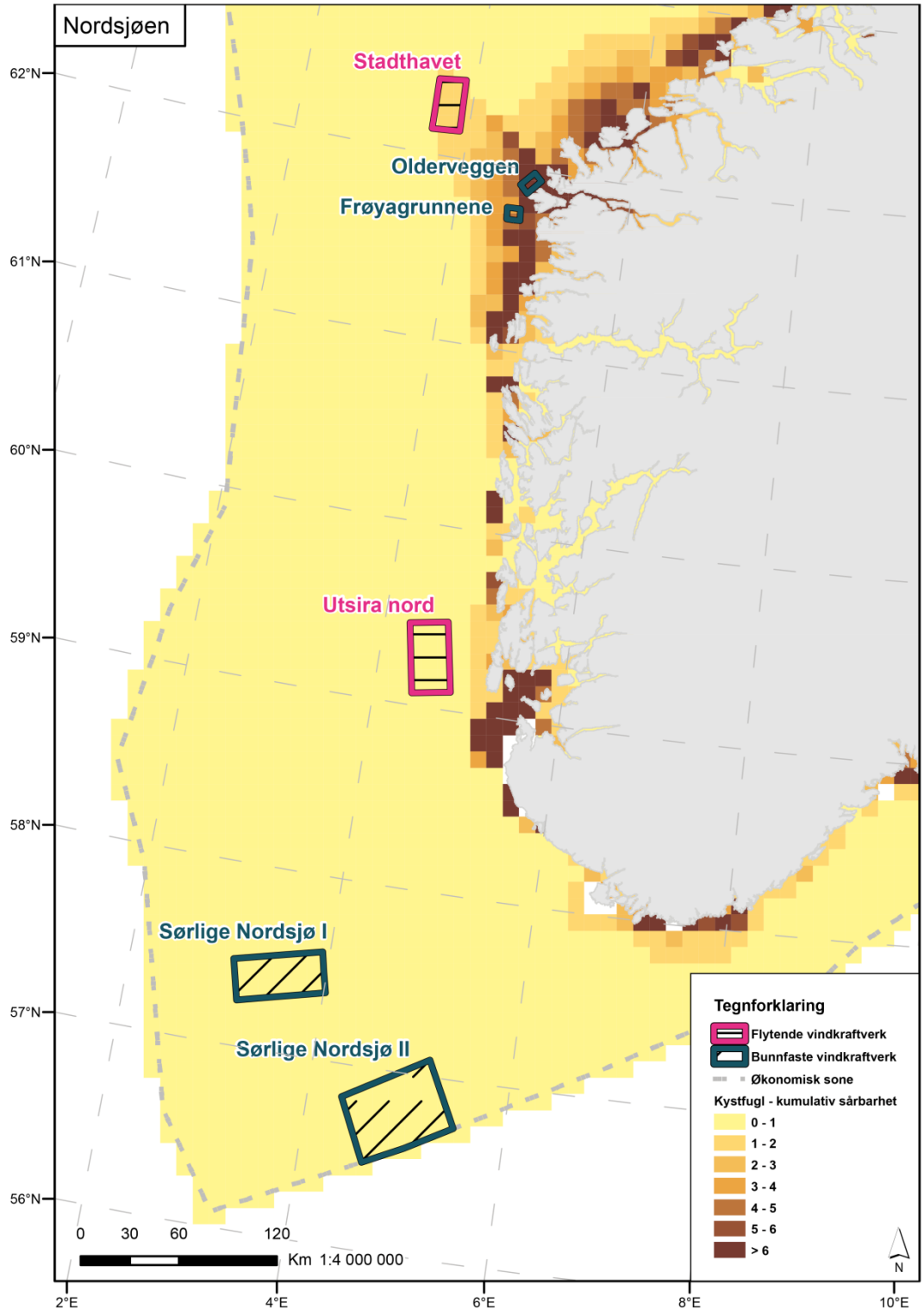


Figure XXIII. Cumulative vulnerability for all coastal birds.

FIGUR 6-18
Sporingstetthet for fiskefartøy over 21 meter i Nordsjøen.

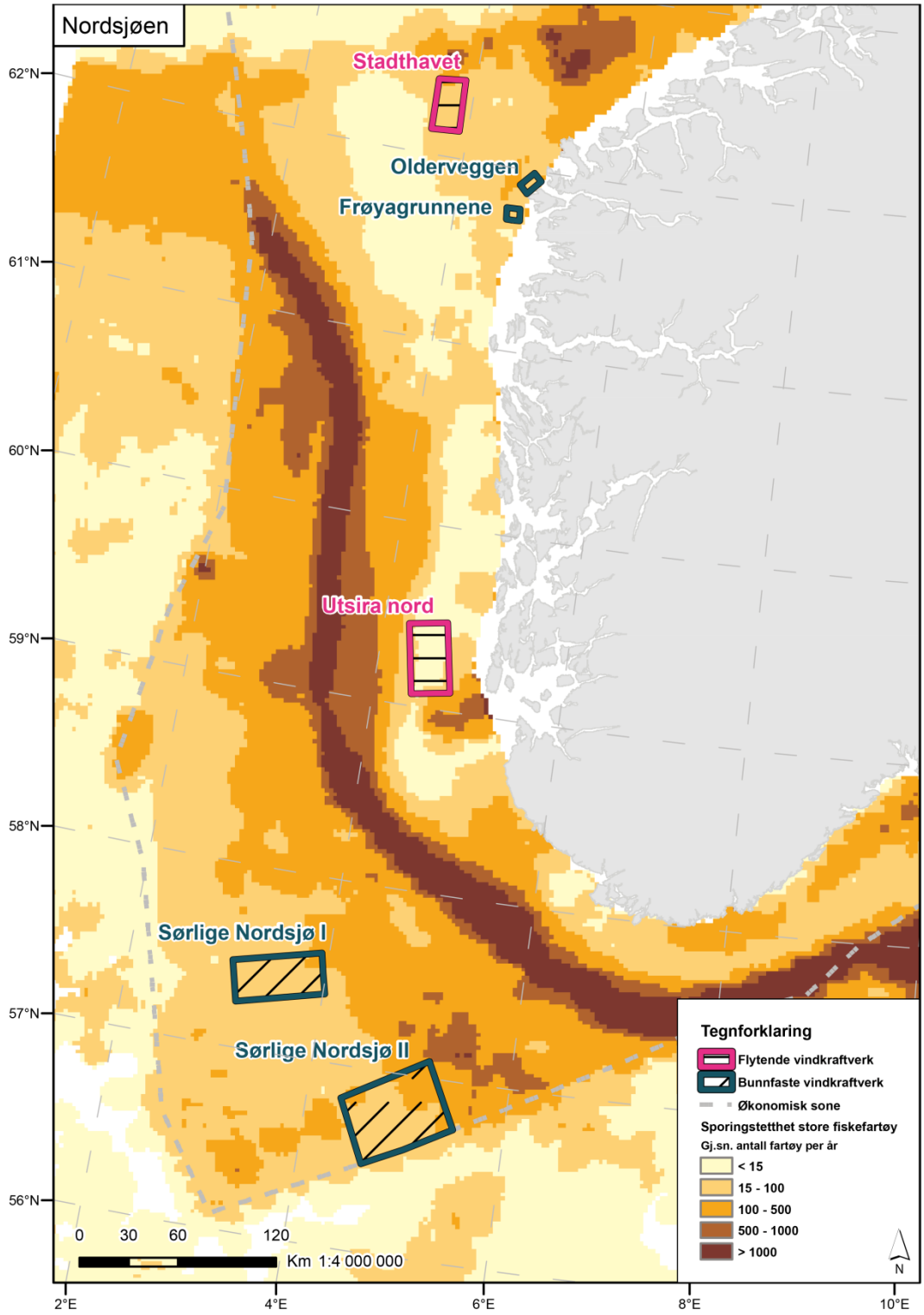
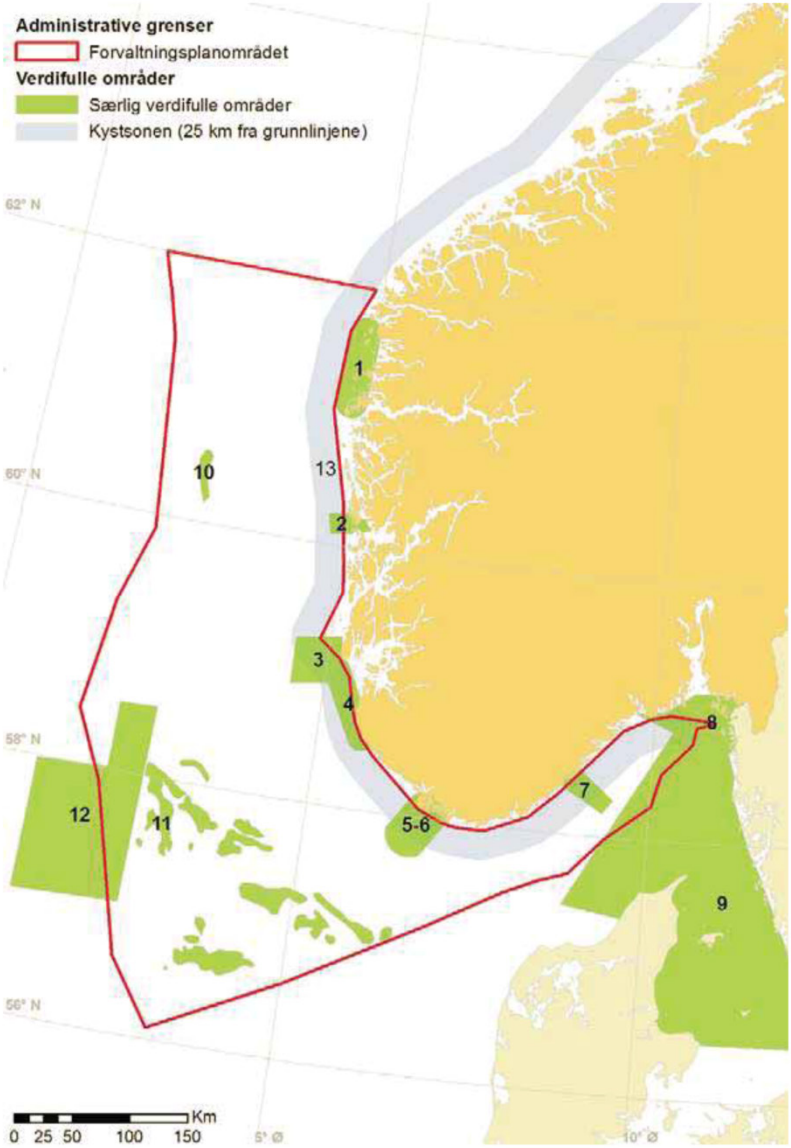


Figure XXIV. GIS data showing the density of traffic from fishing vessels.



Figur 2.1. Kart over særlig verdifulle områder i Nord-sjøen, Skagerrak og langs norskekysten til 62°N.
1: Bremanger til Ytre Sula,
2: Korsfjorden,
3: Karmøyfeltet,
4: Boknafjorden/ Jær-strendene,
5: Listastrendene,
6: Siragrunnen,
7: Snitt Skagerrak,
8: Ytre Oslofjord,
9: Skagerrak,
10: tobisfelt,
11: tobisfelt,
12: makrellfelt,
13: kystsonen (generelt viktig område).
(© E. Standal, Direktoratet for Natur-forvaltning).

Figure XXV. Map of especially valuable areas.

11.4 Fairways / ship routes (map)

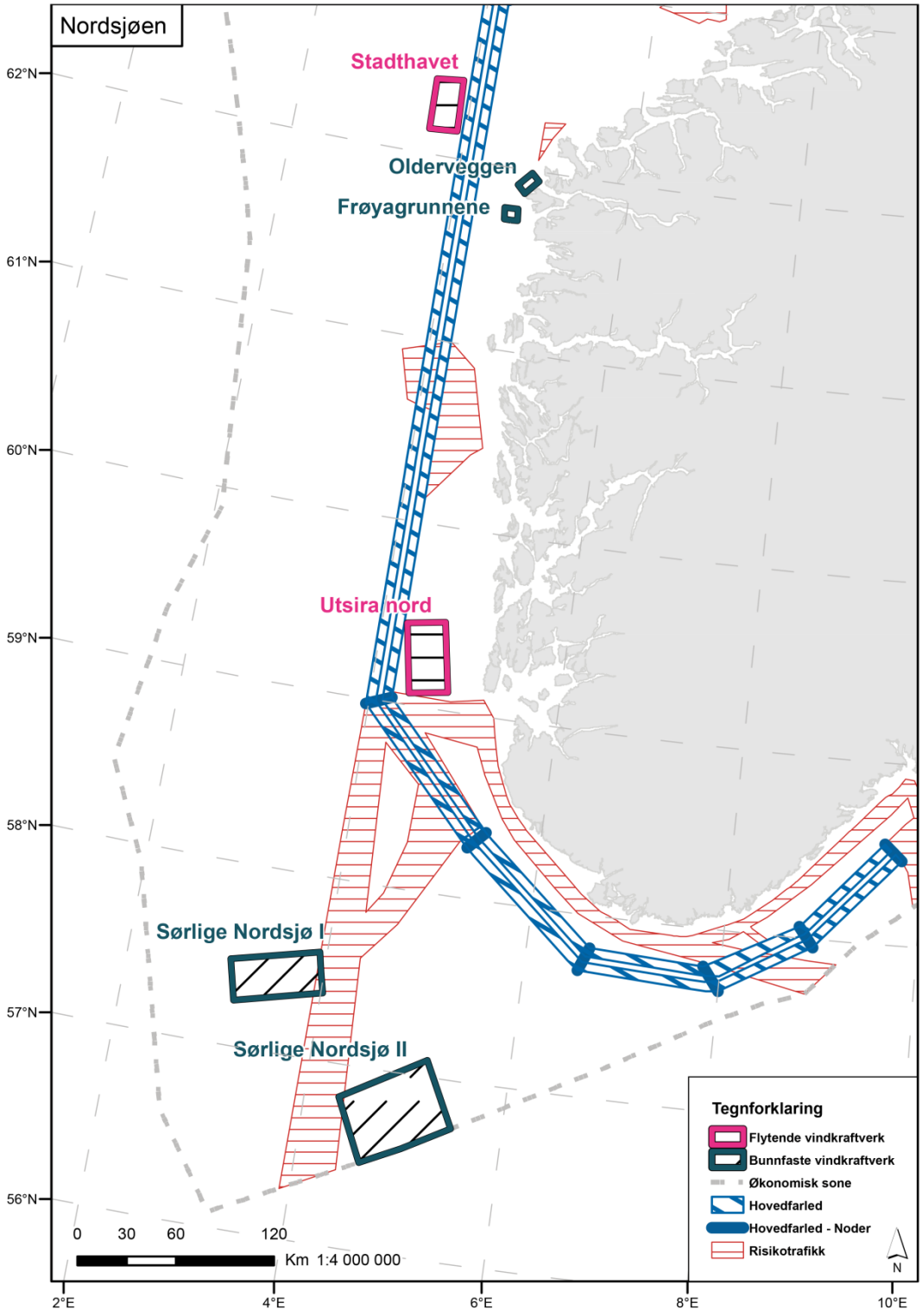


Figure XXVI. Main sea routes with the most intensive maritime traffic in the Norwegian sector.

11.5 The gas pipeline networks and telecommunication lines (map)

The oil and gas pipeline system:
The Norwegian continental shelf consist of a large network of oil and gas pipelines where the primary functions are transporting hydrocarbons from the offshore facilities, via onshore facilities for processing and further to the market (UK and continental Europe).

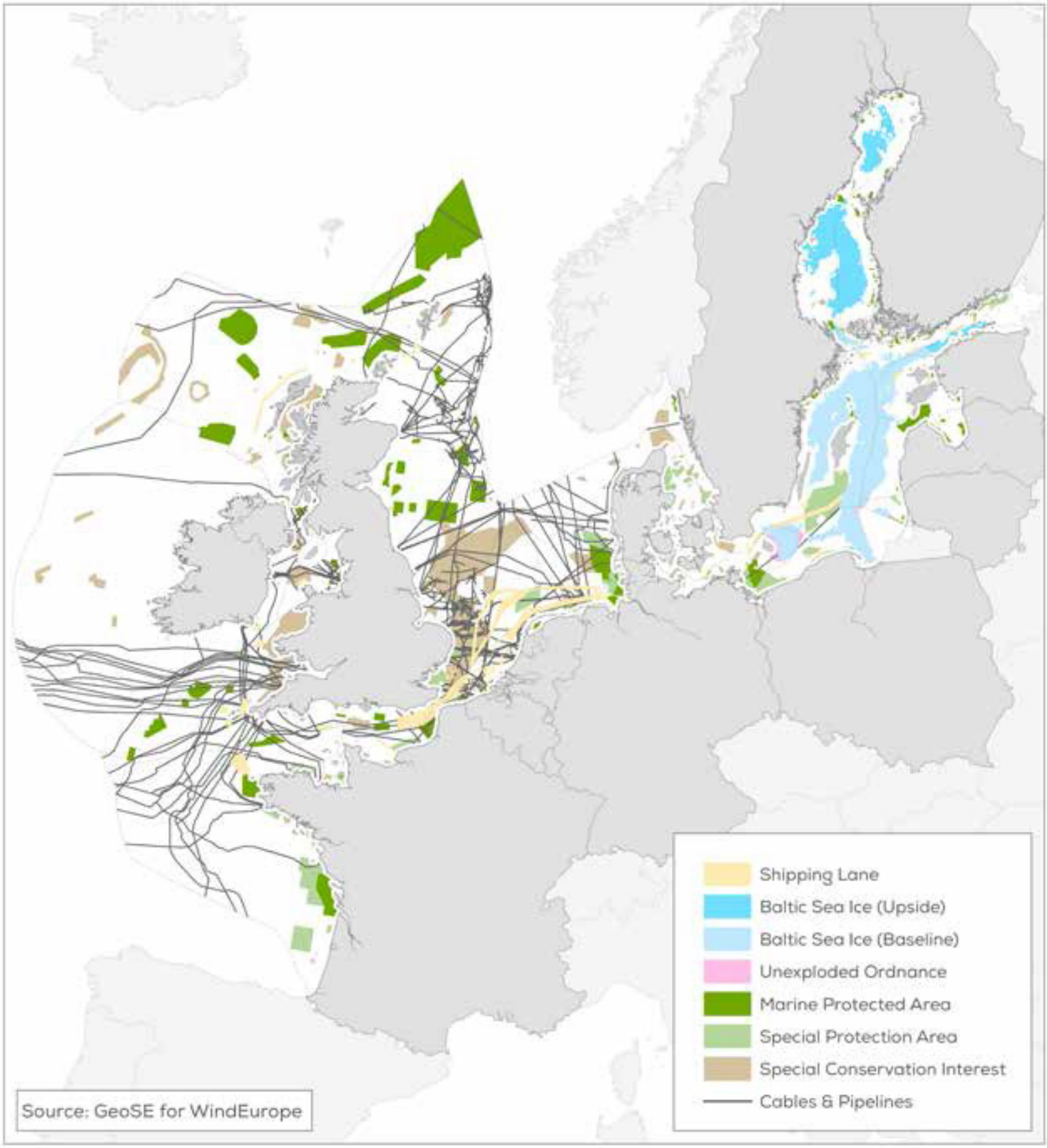


Figure XXVII. Map of pipelines.

The map below show the gas transportation system layout (oil pipelines are not shown for clarity):

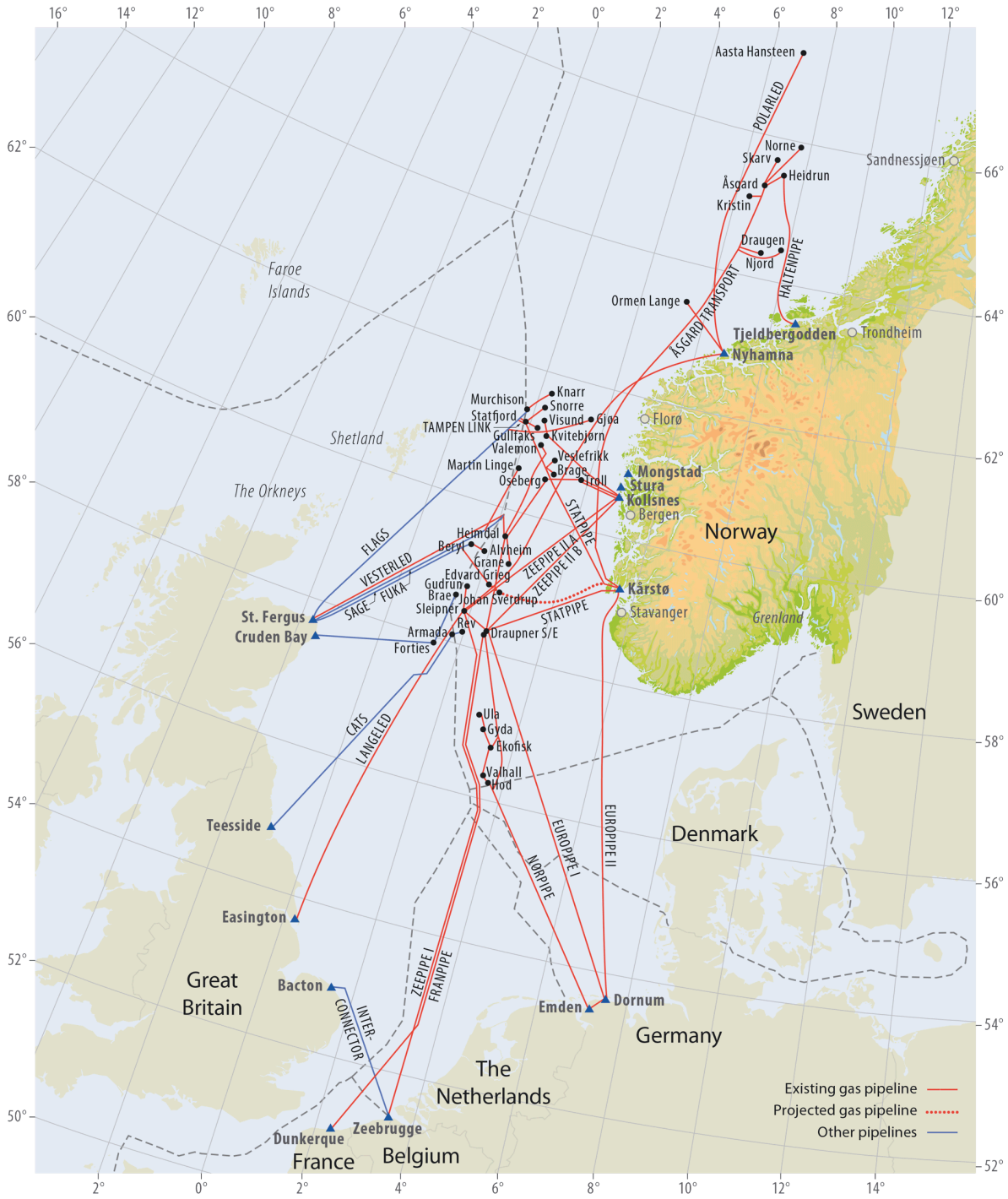


Figure XXVIII. Gas pipelines on the Norwegian continental shelf (oil pipelines are not shown for clarity). https://www.norskpetroleum.no/

The map below show the oil & gas transportation system layout (oil pipelines are also shown):

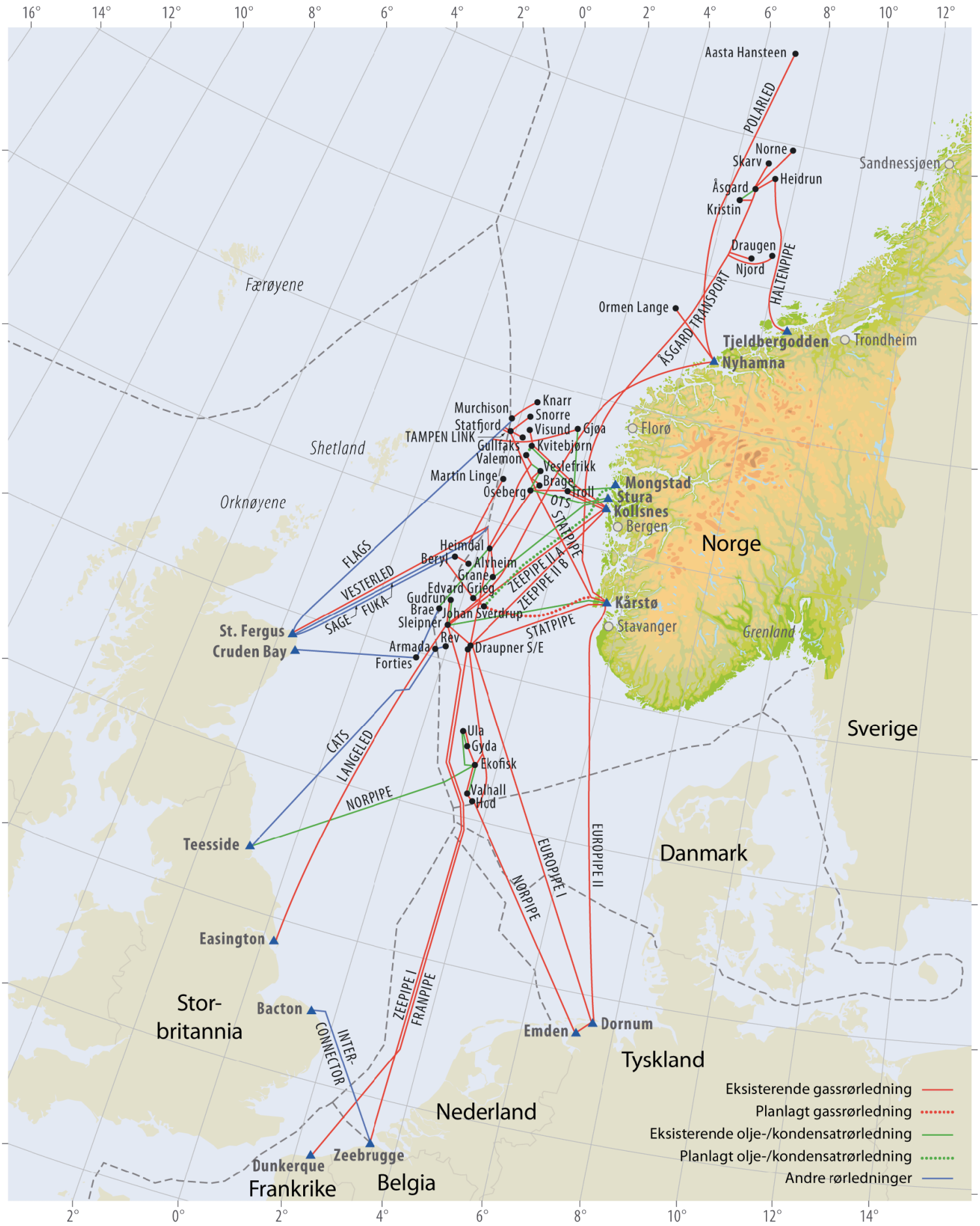


Figure XXIX. Oil & gas pipelines on the Norwegian continental shelf.

Figure XXX. Map of pipelines in the North Sea.

11.5.1 Use of pipelines

Currently all gas pipes on the Norwegian continental shelf are allocated for transport of Natural gas. The operation and use of the pipelines for this purpose is planned for its current use for several years ahead.
The gas network operator Gassco has studied the possibility of blending hydrogen into natural gas transport, as well as participating in related research programmes.

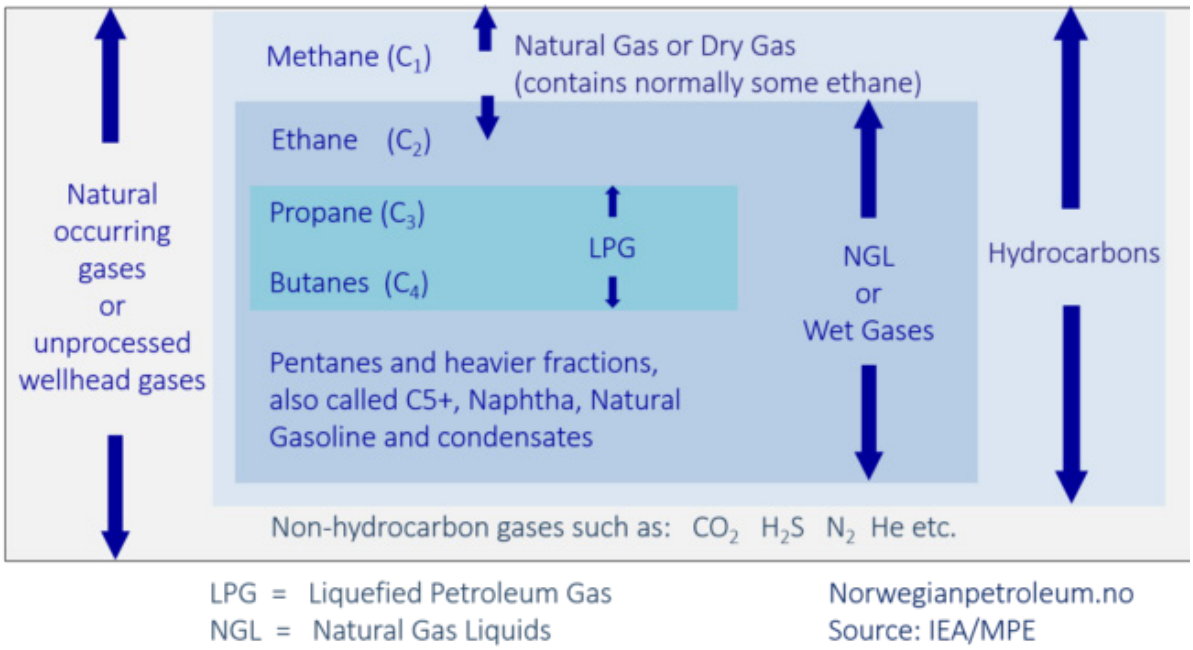


Figure XXXI. Types of gas in the infrastructure system.
https://www.norskpetroleum.no/

11.5.2 Stakeholders and owners

Most of the infrastructure on the Norwegian continental shelf is operated by the state owned company Gassco. The infrastructure is owned by the joint venture company Gassled. Gassled coordinate and arrange all use of the export system.

Gassled ownership:

Petoro AS*	46.697 %
Solveig Gas Norway AS	25.553 %
CapeOmega	16.322 %
Silex Gas Norway AS	6.428 %
Equinor AS	5.000 %

Source: https://www.gassco.no

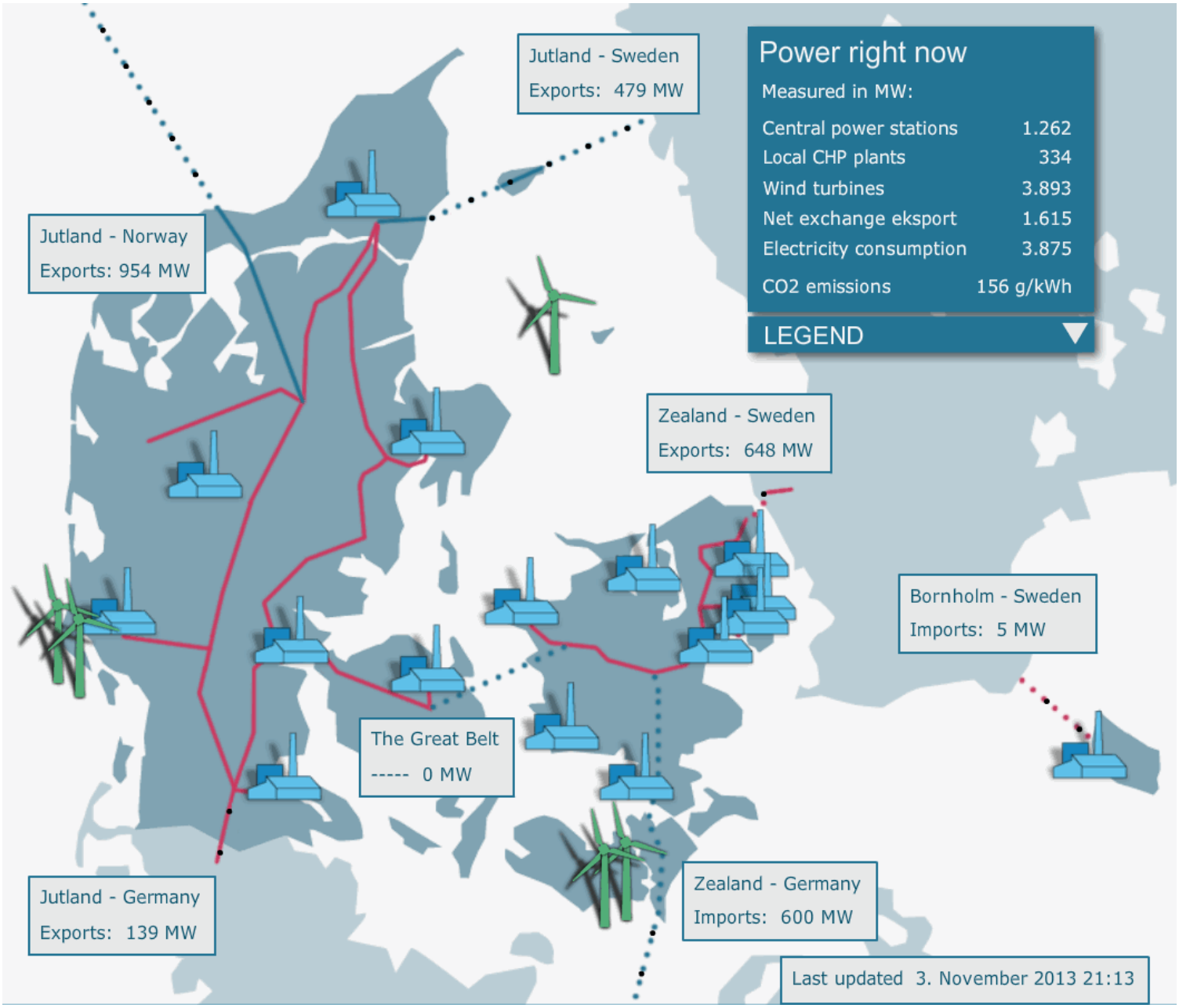


Figure XXXII. Map showing interconnector between Norway and Danmark.

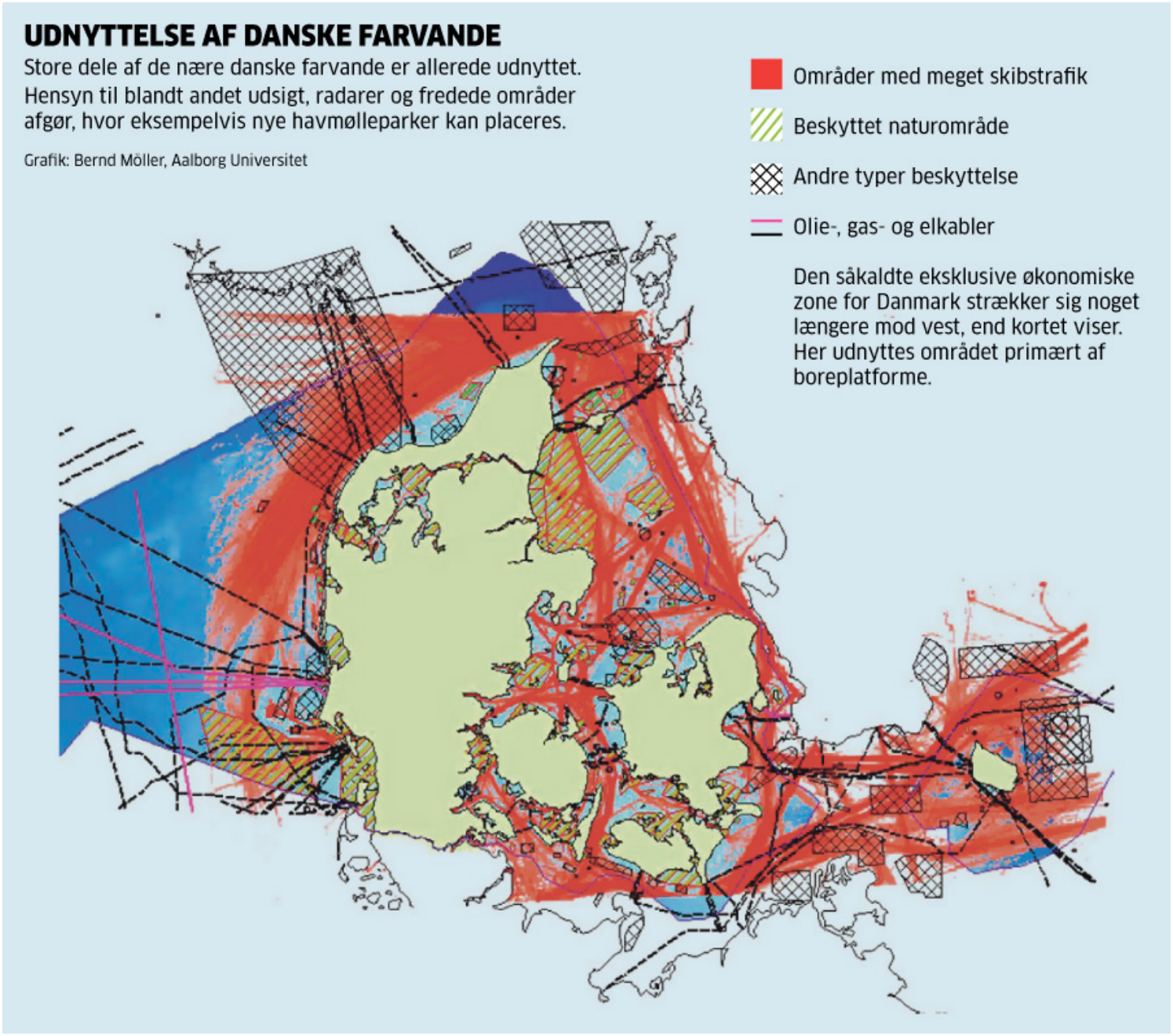


Figure XXXIII. Map showing the density of maritime traffic near the Danish coast.

12 Appendix G – About the consultants

12.1 Team

This report has been edited / supervised by the following team members:

12.1.1 Plan-AE

Jeroen Drees van der Sluijs (team coordinator - sustainability consultant)

12.1.2 WindFarmDesigns

Dr. Klaus-Ole Vogstad (consulting engineer)

12.1.3 Xrgia

Tommy Løvstad, Peter-Emil Soltvedt Johannessen (consulting engineers)
Leon Notkevich (external expert)
Kyrre Nordhagen (assisting consulting engineer)

12.1.4 Multiconsult

Helge Toft, Vegard Willumsen, Karen Nybakke, Nils Ånund Smeland (consulting engineers)
Kjetil Mork (environmental consultant)
Tom Edin Ødegaard (department manager)

Translations and used abbreviations - vocabulary (*)

English abbreviation:	English name / signification:	Norwegian abbreviation:	Norwegian name / signification:
	proposal for public hearing		*høringsforslag*
	Innovation Norway		*Innovasjon Norge* https://www.innovasjonnorge.no
	Norway's Research Council		*Forskningsrådet*
	the Norwegian Parliament		*Stortinget*
	Report to the Parliament, a declaration from the Parliament (a set of general recommendations, a white paper) Parliament Report, (superseded designation)	*Meld. St.* *St.meld.*	*Melding til Stortinget* *Stortingsmelding* (used until 2009)
	Proposal to the Parliament	*St.prp.*	*Proposisjon til Stortinget*
NCA	the Norwegian Coastal Administration		*Kystverket*
	the National Map Agency		*Statens kartverk*
	the Norwegian Institute of Marine Research	*HI*	*Havforskningsinstituttet*
	Norwegian Act relating to aquaculture (ref. Ministry of Fisheries)		*Lov om oppdrett av fisk, skalldyr m.v.*
	the Norwegian base line		*grunnlinjen*
	the Norwegian Environment Agency		*Miljødirektoratet*
	the Norwegian Aquaculture Act		*akvakulturloven* *(Lov om akvakultur)* https://www.regjeringen.no/no/dokumenter/the-norwegian-aquaculture-act/id430160/
	the Norwegian Harbour and Fairways Act (the Port & Waters Act)	*havnl.*	*Havne- og farvannsloven* *(LOV-2009-04-17-19 Lov om havner og farvann m.v.)* https://lovdata.no/dokument/NL/lov/2009-04-17-19
	the Norwegian Cultural Heritage Act		*Kulturminneloven* *(Lov om kulturminner)* https://lovdata.no/dokument/NL/lov/1978-06-09-50
	the Norwegian Energy Law (the Energy Act)		*Energiloven* https://lovdata.no/dokument/NL/lov/1990-06-29-50
	the Norwegian Marine Resources Act		*Havressursloven* *(Lov om forvaltning av viltlevende marine ressurser)* https://lovdata.no/dokument/NL/lov/2008-06-06-37

	the Norwegian Expropriation Act		*Oreigningslova* *(Lov om oreigning av fast eigedom)* https://lovdata.no/dokument/NL/lov/1959-10-23-3
	the Norwegian Nature Diversity Act		*Naturmangfoldloven* *(Lov om bevaring av natur, landskap og biologisk mangfold)* https://lovdata.no/dokument/NL/lov/2009-06-19-100
	the Norwegian Ocean Energy Law (the Ocean Energy Act)		*Havenergiloven* *(Lov om fornybar energiproduksjon til havs)* https://lovdata.no/dokument/NL/lov/2010-06-04-21
	the Norwegian Petroleum Law (the Petroleum Act)		*Petroleumsloven* *(Lov om petroleumsvirksomhet)* https://lovdata.no/dokument/NL/lov/1996-11-29-72
	the Norwegian Pollution Control Law (the Pollution Control Act)	*forurl.*	*Forurensningsloven* *(Lov om vern mot forurensninger og om avfall)* https://lovdata.no/dokument/NL/lov/1981-03-13-6
	the Norwegian Public Administration Law (the Public Administration Act)		*Forvaltningsloven* *(Lov om behandlingsmåten i forvaltningssaker)* https://lovdata.no/dokument/NL/lov/1967-02-10
	the Norwegian Public Procurement Law (the Public Procurement Act)		*Anskaffelsesloven* *(Lov om offentlige anskaffelser)* https://lovdata.no/dokument/NL/lov/2016-06-17-73
ACER	the Agency for the Coordination of Energy Regulators (in Europe)		
AIS	automatic identification system (used for sea vessel traffic services)		
CCS	carbon capture and storage / carbon capture and sequestration		*karbonlagring*
	maritime cable installations		*kabelanlegg i sjø*
	electrical grid infrastructure (grid structures)		*nettanlegg*
EEA	European Economic Area	*EØS*	*Det europeiske økonomiske samarbeidsområde*
EEZ	exclusive economic zone - the Norwegian EEZ		*Økonomisk sone (havsone)* *- Norges økonomiske sone*
	announcement (from / to a public authority)		*melding* *(fra / til en myndighet)*
	construction license for wind power plants		*byggetillatelse til vindkraftanlegg*

	license application		*konsesjonssøknad*
EIA	Environmental Impact Assessment		*miljøimpaktanalyse / konsekvensutredning*
EIA directive	Directive 2011/92 EF (cf. 2011/92/EU) "Environmental Impact Assessment"		*miljøkonsekvensutredning*
ENTSO-E	European Network of Transmission System Operators		
	Ministry of Climate & Environment	*KLD*	*Klima- og miljødepartementet*
MoPE	the Ministry of Petroleum & Energy	*OED*	*Olje- og energidepartementet*
	the Confederation of Norwegian Enterprise	*NHO*	*Næringslivets Hovedorganisasjon*
nm	nautical mile		
	NHO's NO_x fund		*NO_x-fondet*
NPD	the Norwegian Petroleum Directorate	*NPD*	*Oljedirektoratet*
NSWPH	North Sea Wind Power Hub		
NVE	Norway's Water Resources & Energy Directorate	*NVE*	*Norges vassdrags- og energidirektorat*
OBIS	Ocean Biogeographic Information System		
OWF	offshore wind farm		*havvindanlegg*
OWP	offshore wind power / offshore wind energy projects		
PBL	the Norwegian Planning & Building Law (the Planning & Building Act)	*PBL*	*Plan- og bygningsloven*
	Regulations on Impact Assessments (associated to PBL)		*Forskrift om konsekvensutredninger*
	the Municipal Land Use Plan		*Kommuneplanens arealdel*
	literally: "the Detailed Plan" (= a detailed Master Plan)		*detaljreguleringsplanen*
PPS	Planning & permitting study for April 2019		
SAC	Special Area of Conservation (Natura 2000)		
SEA directive	Directive 2001/42/EF (cf. 2001/42/EC) "Strategic Environmental Assessment"		
SPA	Special Protection Area (Natura 2000)		
TEN-E	Trans-European Networks for Energy (electricity priority corridors)		
ToR	Terms of Reference (for the Planning & permitting study)		
TSO	Transmission System Operator (operator of the transmission grid = Statnett)	*TSO*	*operatør av transmisjonsnettet*
TYNDP	10-year network development plan (of ENTSO-E)		
WF	wind farm		*vindenergianlegg*
WP	wind power		*vindenergi*

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R4. **ESAS (European Seabirds at Sea)**
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R13. **The NO_x-fund – *NO_x-fondet***
NHO
https://www.nho.no/samarbeid/nox-fondet/

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Suggestions for possible further analysis

The project team suggests that further work could be conducted to obtain a more complete picture of the possibilities of adding additional interconnectors to the Norwegian electricity network. The following studies are proposed:

- Planned grid development in Norway (Based on Statnett's grid development plan),
- Identification of suitable connection points for new interconnectors,
- Estimate a time frame for the development of an interconnector between Norway and a wind power hub on the North Sea, based on Norwegian and international legislations and regulations.

_____