

# *NORWEA POLICY REPORT*



WindSea

## OFFSHORE WIND - strategic recommendations

# ABOUT NORWEA

The Norwegian Wind Energy Association (NORWEA) is the voice of the Norwegian wind and ocean energy industry. NORWEA has, since it was established in 2006, promoted the utilization of renewable energy from wind in Norway.

We are ideally situated in the heart of Oslo ensuring close proximity to Norwegian decision makers. With approximately 130 members: developers, contractors, electricity providers, wind turbine manufacturers, component suppliers, research institutes, finance and insurance companies, lawyers, consultants and research institutions, NORWEA represents the entire value chain of the industry. We are the industry's key meeting place for wind and ocean energy academics, political discussions and industrial collaboration.

NORWEA's lobbying helps create a suitable legal and financial framework within which members can successfully develop their businesses.

NORWEA analyses, formulates and establishes policy positions together with the wind and ocean industry on key issues.

NORWEA produces a large variety of information tools and manages campaigns aimed at raising awareness about the benefits of wind and ocean renewable energy, dispelling the myths about wind and ocean energy and providing easy access to credible information.

NORWEA organizes numerous regular events: conferences, seminars and workshops, together with and for the industry.

This makes NORWEA the most powerful and successful network for wind and ocean energy in Norway.



NORWEA - WIND WAVE TIDAL

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## Executive summary

We often mislabel risk as uncertainty, as Al Gore described in a recent article in the WSJ where he encouraged investors to divest from fossil fuels<sup>1</sup>. Norway should not consider the future of oil prices as an uncertainty but should rather acknowledge the risk of a fall in oil prices and the need to diversify its economy. Policy tools for offshore wind can be divided into two categories related to different timeframes and objectives; the technology track and the long-term track. The technology track is a short to medium-term vision mainly focused on technology development and export. The long-term track is a vision post-2020, aiming at large scale power production and the use of Norwegian offshore wind resource. Coupling the existing technology development track for export with a long-term vision and ambition is needed for the Norwegian offshore wind sector to succeed and benefit from a consistent and continuous development framework.

- The offshore wind industry is taking off globally and will play a major role in Europe, where it is needed to meet renewable energy targets in 2020, but also in China, South Korea, the U.S. and Japan.
- The offshore wind industry can play the role of an insurance policy for Norway, as it will be more competitive in a 'low fossil-fuel prices' scenario, benefiting from low prices of offshore services and raw materials.
- The opportunity to leverage the Norwegian petro-maritime expertise is tremendous, from technology development and construction to offshore services and risk management. It includes stakeholders in offshore oil & gas industry, shipping, yards and port facilities, grid connections, etc.
- Market trends show an increase in distance to shore, water depth and project size. Norway has a strong competitive advantage in complex offshore activities and the potential to lead this niche sector growing dramatically.
- A dedicated offshore wind farm will reduce the GHG emissions from oil & gas platforms (25% of Norway's emissions) and create a great opportunity for the offshore wind industry.
- But Norway has demonstrated a very limited long-term ambition through limited support schemes and the absence of an updated national roadmap for the sector. About 200 Norwegian companies are involved in offshore wind and only 20 are dedicated to it. There is also no commercial scale project under operation as of today.

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<sup>1</sup> <http://online.wsj.com/news/articles/SB10001424052702304655104579163663464339836>

- The offshore wind industry needs support from the government through a clear and ambitious strategy, as well as a revised legislative framework to trigger a takeoff. This should be based on a technology track for exports coupled with a long-term vision on opportunities to exploit Norwegian offshore wind resource for power production.
- More targeted use of existing public organizations supporting the innovation chain could accelerate technology development in the Norwegian offshore wind sector.
- The opportunity to host offshore wind projects from EU's members through the renewables directive's joint project mechanism should be explored as an interesting option for exploiting the resource in a context of power oversupply.
- Business cases for offshore wind need to be developed further and promoted. One example is the use of offshore wind turbines for water injection to enhance the recovery of wells in the petroleum sector.
- The option to apply the petroleum tax regime to offshore turbines supplying power to oil & gas platforms should be explored as an interesting business case for pioneering projects.

The present note is based on interviews with 40 key stakeholders in the industry, public sector, regulatory agencies, interest groups and environmental organizations. It is also building on previous work by consultants, public institutions and academics throughout the last decade. This work has been focused on offshore wind but NORWEA recognizes the large opportunities in wave and tidal in Norway and recommends similar analysis for these technologies.

This note is intended to explore Norway's rationale to develop an offshore wind industry and market. In the first chapter, the global boom in the offshore wind sector is briefly described and major achievements; targets and market trends are reminded to give a picture of the global offshore wind market. The Norwegian background is then described, both in terms of industry, research and regulatory and policy environment. The second chapter is focused on the rationale to develop a Norwegian offshore wind sector. It is followed by an analysis of the challenges faced by the offshore wind industry. The last chapter offers policy proposals to enable the creation of a strong and sustainable offshore wind industry.

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# 1. Background

## 1.1. Global backdrop: bright future for offshore wind

- Globally, offshore wind will play a significant role in the future energy mix. In Europe, offshore wind technology will play an essential role in meeting the renewable energy targets in 2020, for example in the UK or Germany<sup>2</sup>. The European Wind Energy Association estimates that installed capacity of offshore wind could grow from 5 to 150 GW between 2012 and 2030<sup>3</sup>, meeting 14% of EU's total electricity consumption.
- The UK is leading the way with ambitious plans and strong policy support schemes. UK's Energy Technology Institute (ETI) is conducting a major program to reduce offshore costs through innovation. The UK connected the 630 MW London Array in 2013 as the world's largest offshore wind power plant<sup>4</sup>. However, concerns are rising among investors and industry players about regulatory uncertainties. The change of support schemes from 2017 created skepticism about the ability to meet the 18 GW target in 2020. Discussions around local content requirement are also a growing source of concern for foreign projects developers.
- As the sector is growing, offshore wind farms are built further from the coast and in deeper water to harness the better wind resource. Average project size has also increased significantly as typical size has grown from 60 to 300 MW<sup>5</sup>. Today, new offshore designs are needed to tap the huge resources of the North Sea, Atlantic and Mediterranean deep waters for water depths greater than 50m. Japan and the US are also promising markets for deep offshore wind. The first technical standards for floating offshore wind were published in June 2013 by a working group led by DNV GL<sup>6</sup>.

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<sup>2</sup> EU 2020 Offshore Wind target, BCG study 2013

<http://www.bcg.de/documents/file128841.pdf>

<sup>3</sup> Deep water, the next step for offshore wind energy, 07.2013, EWEA

[http://www.ewea.org/fileadmin/files/library/publications/reports/Deep\\_Water.pdf](http://www.ewea.org/fileadmin/files/library/publications/reports/Deep_Water.pdf)

<sup>4</sup> EA WIND, 2012 Annual Report, July 2013

[http://www.ieawind.org/annual\\_reports\\_PDF/2012/2012%20IEA%20Wind%20AR\\_smallPDF.pdf](http://www.ieawind.org/annual_reports_PDF/2012/2012%20IEA%20Wind%20AR_smallPDF.pdf)

<sup>5</sup> Offshore Wind Norway, Market and Supply chain, Multiconsult for Innovasjon Norge and Intpow, 2012

<http://intpow.com/ext/ver2/uploads/Offshore%20Wind%20Norway%20-%20Market%20and%20Supply%20Chain%202012.pdf>

<sup>6</sup> Design of Floating Wind Turbine Structure, June 2013

- Supply chains are being developed in leading offshore wind markets through large investments. These investments are currently focused on the bottom-fixed market rather than floating<sup>7</sup>.

## 1.2. Norwegian Background

- The Norwegian offshore wind resource is recognized to be among the best in Europe. The Norwegian Water Resources and Energy Directorate (NVE) have conducted a pre-selection of offshore wind areas based on environmental impact. It led to a potential estimated capacity of minimum 12 GW<sup>8</sup>.
- In 2013, NVE published the strategic environmental assessment<sup>9</sup> of the 15 zones identified in 2010<sup>10</sup>. The water depths of these zones are variable but several zones can be qualified as deep-water areas, with a depth larger than 50m. Apart from some zones in the Southern North Sea, there are thus limited shallow areas. In a study conducted for NVE Multiconsult has *“grouped 15 zones into three: [near shore - shallow water], [far offshore- shallow water] and [far offshore - deep water]. [Nearshore - shallow water] zones resemble current developments in Northern Europe. Two zones are [far offshore / shallow waters] in relatively similar conditions as deep zones of the “UK Round 3” such as Doggerbank. Four zones in [far offshore deep water] will require floating technologies and are thus largely subject to technology risks”<sup>11</sup>.*
- Despite the high quality of the Norwegian offshore wind resource and Norway’s leading role in the petro-maritime sectors, the Norwegian authorities have demonstrated a very limited ambition to develop a domestic market for offshore wind. No specific target for offshore wind has been announced and support schemes or grants for demonstration

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<sup>7</sup> Technological and Cost Development Trends of Renewable Offshore Energy Production, published 07/ 08/12, Multiconsult for NVE/OED [http://webby.nve.no/publikasjoner/rapport/2012/rapport2012\\_50.pdf](http://webby.nve.no/publikasjoner/rapport/2012/rapport2012_50.pdf)

<sup>8</sup> Offshore Wind Norway, Market and Supply chain, Multiconsult for Innovasjon Norge and Intpow, 2012 <http://intpow.com/ext/ver2/uploads/Offshore%20Wind%20Norway%20-%20Market%20and%20Supply%20Chain%202012.pdf>

<sup>9</sup> Havvind Strategisk Konsekvensutredning NVE 2013 <http://www.nve.no/no/Havvind/Havvind--Strategisk-konsekvensutredning/>

<sup>10</sup> Havvind - forslag til utredningsområder, NVE 2010 <http://www.nve.no/no/Havvind/Havvind-forslag-til-utredningsomraader/>

<sup>11</sup> Technological and Cost Development Trends of Renewable Offshore Energy Production, published 07/ 08/12, Multiconsult for NVE/OED [http://webby.nve.no/publikasjoner/rapport/2012/rapport2012\\_50.pdf](http://webby.nve.no/publikasjoner/rapport/2012/rapport2012_50.pdf)

projects are limited. The national strategy for offshore wind was not revised in 2012, as planned in the national strategy published by OED in 2008<sup>12</sup>.

- In 2012, responsible Norwegian developers put its first fully licensed offshore wind farm on hold. The Havsul project, a 350 MW offshore wind farm, was planned to be built off the coast of Møre. Wenche Teigland, chairman of the board of Vestavind Offshore AS, deplored a lack of political support. The project was the only offshore wind park that has been granted a concession by NVE. NOK 200 million was invested in developing the project.
- Major research programs on offshore wind have been launched with the creation of two research centers, Norcowe and Nowitech, in 2009. This followed the recommendations of Forskningsrådet's Energi21 program identifying offshore wind as one of the 6 areas of priorities.
- The two main regional industry clusters focusing on offshore wind are Arena Norwegian Offshore Wind (NOW), located in Bergen, and Windcluster Mid-Norway, in Trondheim. Both clusters achieved Arena's status in 2009-2010, receiving 50% of funding from Innovation Norway. Their members represent the entire offshore wind value chain<sup>13</sup> and they cooperate closely with research centers (NOWITECH and NORCOWE).
- NCE-maritime, an industry cluster part of the Norwegian center of expertise, located in Ålesund, joined the European project ECOWindS to gather knowledge about the installation, operation and maintenance of offshore wind turbines<sup>14</sup>.
- The introduction of the EI Certificates system in 2012 between Sweden and Norway illustrated a clear choice of a technology neutral support scheme for Renewables in Norway.
- The offshore wind sector is currently very small in Norway and there is no commercial scale project under operation as of today<sup>15</sup>. A study conducted in 2011 identified 105 Norwegian firms involved in offshore wind. Among them, only 18 declared offshore wind as their main activity. The study also found that for the majority of the other companies involved in offshore wind, this activity represented less than 25 % of their tasks<sup>16</sup>.

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<sup>12</sup> Om lov om fornybar energiproduksjon til havs, 2008 OED

<http://www.regjeringen.no/pages/2210574/PDFS/OTP200820090107000DDDPDFS.pdf>

<sup>13</sup> <http://www.arenanow.no/?page=2&show=48&title=The+Arena+Program>

<sup>14</sup> <http://www.ncemaritime.no/default.aspx?menu=405>

<sup>15</sup> Offshore Wind Norway, Market and Supply chain, Multiconsult for Innovasjon Norge and Intpow, 2012

<http://intpow.com/ext/ver2/uploads/Offshore%20Wind%20Norway%20-%20Market%20and%20Supply%20Chain%202012.pdf>

<sup>16</sup> Teknologi- og industriutvikling fra et norsk bedriftsperspektiv, CenSES-report, 2011, by G.H. Hansen & M. Steen

Another report in 2012 identified 150 Norwegian companies involved in the offshore wind sector<sup>17</sup>. Most of these companies are technology exporters with a strong focus on R&D and innovation. But project developers and finance providers are also involved.

- In autumn 2008, oil prices fell from 140 USD to 40 USD per barrel. Some Norwegian offshore stakeholders, like offshore service providers, decided to diversify their activities and shift some of their focus to the offshore wind sector. But with the booming oil prices most of them focused back exclusively on the oil & gas sector after 2011. The major oil discoveries in summer 2011 in the Norwegian continental shelf also contributed to this shift. Greater activity in the oil sector provided the offshore supplier industry enough business opportunities.

## 2. Motivations

- **Leveraging petro-maritime expertise**

Norway has developed an exceptional expertise in offshore and subsea activities through its maritime and petroleum sectors. The potential to leverage Norwegian know-how and expertise in offshore services from installation to O&M and apply them to the offshore wind sector is tremendous<sup>18</sup>. This expertise ranges from technology development and construction to offshore services and risk management. It includes stakeholders involved in different sectors like the offshore oil & gas industry, shipping industry, yards and port facilities, and grid connections.

- **Industrial Insurance policy**

In case of a fall in oil prices, the demand for offshore services, which are currently expensive, will decrease. This would create a virtuous circle for the offshore wind sector, which would pay a lower price for offshore services. Moreover raw materials such as steel and cement are correlated to oil prices and would also get cheaper. Hence, the

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[http://www.ntnu.no/documents/7414984/0/Hansen+og+Steen+\(2011\)%20Vindkraft+til+havs.pdf](http://www.ntnu.no/documents/7414984/0/Hansen+og+Steen+(2011)%20Vindkraft+til+havs.pdf)

<sup>17</sup> Offshore Wind Norway, Market and Supply chain, Multiconsult for Innovasjon Norge and Intpow, 2012

<http://intpow.com/ext/ver2/uploads/Offshore%20Wind%20Norway%20-%20Market%20and%20Supply%20Chain%202012.pdf>

<sup>18</sup> 'Industriaktører, akademia og store deler av offentlig virkemiddelapparat har en klar oppfatning om at Norge har gode industrielle muligheter innen offshore vindkraft, med bakgrunn i vår teknologi- og kompetansebase fra olje-, gass- og maritim virksomhet' Energiutredningen; verdiskaping, forsyningssikkerhet og miljø, 09/12, p.196, til OED

<sup>18</sup> <http://www.regjeringen.no/pages/37306204/PDFS/NOU201220120009000DDDPDFS.pdf>

offshore wind industry would stand as more competitive worldwide in a scenario that would be otherwise disastrous for the Norwegian economy. Today's investment in offshore wind technology could thus be seen as an insurance policy for the country.

- **Leading the deep-water wind industry**

Most offshore wind farms will be installed in deep waters in the future as the installation of wind farms in 10-35 m water depth is expected only until 2015<sup>19</sup>. Norwegian seabed conditions create a real opportunity to develop deep offshore technologies (such as floating turbines), which could be exported to huge markets with similar seabeds (Japan, US, Korea or China). Norway needs to take part in the early development of floating technologies to guarantee its ability to exploit its huge local wind potential in the long term.

- **Large wind resource**

The offshore wind resource in Norwegian continental shelf is generally more favorable than in other European zones. In the 15 zones selected by NVE, the average wind speed ranges from 8.9 to 11 m/s<sup>20</sup>. It gives the industry a competitive advantage in the long run as it reduces the levelized cost of electricity for offshore wind projects compared to other markets.

- **Opportunity for oil platform electrification**

Electrification of oil platforms is also key for Norway as 25% of its GHG emissions come from the oil sector. Today most of the offshore oil and gas platforms are powered by gas fired turbines located on the platforms and having very low efficiency (30%-40%). Emissions from the Norwegian continental shelf are also likely to increase because fields are further away, located at great depths and require pressure support to stay stable during recovery. Offshore wind farms to provide power to oil & gas platforms would greatly reduce emissions from the sector, while reducing operational risks. Excess power from offshore wind turbines can be sent to shore via cables, which can also be used as back-up to cope with the wind resource intermittency. Siragrunnen, a project

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<sup>19</sup> Technological and Cost Development Trends of Renewable Offshore Energy Production, published 07/08/12, Multiconsult for NVE/OED

[http://webby.nve.no/publikasjoner/rapport/2012/rapport2012\\_50.pdf](http://webby.nve.no/publikasjoner/rapport/2012/rapport2012_50.pdf)

<sup>20</sup> Offshore wind power in Norway, Strategic environmental assessment – English summary  
[http://www.nve.no/Global/Havvind/english%20summ\\_WEB\\_080513.pdf](http://www.nve.no/Global/Havvind/english%20summ_WEB_080513.pdf)

currently developed by Havgul Clean Energy, is exploring this option<sup>21</sup>. Norway could be a pioneer in oil platform electrification by offshore wind farms, offering oil companies the opportunity to contribute to climate change mitigation efforts.

- **Contributing to reduced GHG emissions**

Renewables currently provide appr. 60%<sup>22</sup> of Norway's total energy needs, including oil extraction. In order to meet its ambitious emission reduction targets, Norway will need to electrify its transportation and oil extraction sectors. This will increase electricity demand in Norway post-2020, a demand that will likely require significant increase in renewable energy generation. With limited potential for increased hydro, onshore and offshore wind will have to take a large part of the burden.

- **Increasing the competitiveness of energy-intensive industries**

An increase in power supply will lead to more balanced base load electricity prices, which will support the competitiveness of energy intensive industries in Norway (pulp & paper, aluminum, steel).

- **Limited environmental impact**

Offshore wind farms have generally a limited visual or noise impact. In addition, large offshore areas are available with low conflict of interests with other activities.

- **Nordic competition**

Sweden has a comparable environment, in spite of some advantages when it comes to sea-depth, but manages so far to develop offshore projects, fixed and floating in spite of a lower quality wind resource. This is due to an easier access to investment, a faster administrative process and more advantageous depreciation rules. Sweden is also exploring the possibility of using a joint-programs framework to develop offshore wind projects.

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<sup>21</sup> <http://www.tu.no/kraft/2012/09/18/advarer-mot-dobbelstotte-han-selv-kan-tjene-pa>

<sup>22</sup> National Renewable Energy, action Plan under Directive 2009/28/EC, OED  
[http://ec.europa.eu/energy/renewables/transparency\\_platform/doc/dir\\_2009\\_0028\\_action\\_plan\\_norway\\_nreap.pdf](http://ec.europa.eu/energy/renewables/transparency_platform/doc/dir_2009_0028_action_plan_norway_nreap.pdf)

- **Potential for large local content**

Multiconsult's preliminary assessment indicates that the local content share for a first pilot could range from 40 to 75% (depending whether Norwegian turbine manufacturers like SWAY or Blaaster can provide the turbine)<sup>23</sup>.

- **Joint mechanism potential**

Some EU members are struggling to meet their renewable energy targets due to limited local resources, while offshore wind potential in the Nordic countries is likely to be in excess of the national renewables targets. Therefore there is an opportunity to use the Nordic offshore wind in a European context. On the one hand, using joint project framework to aid offshore wind could compensate the lack of sufficient support schemes in Nordic countries. On the other hand, user countries could prefer to enter into joint project agreements rather than using more expensive domestic potential or other cooperation mechanism to meet their national RES targets. If the EU framework for cost efficient cooperation mechanisms is continued post 2020 there is hence a potential for Norway to host offshore wind projects using the joint mechanism framework<sup>24</sup> to develop zones assessed under the ocean energy act by NVE. The most likely scenario would be using the mechanisms for direct export to markets with sufficient willingness to pay. Sweden expressed interest to use this mechanism and recently released a report assessing options to host offshore wind project through joint mechanism agreements<sup>25</sup>.

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<sup>23</sup> 'Rational & Benefit developing Norway's first offshore wind farm' by Multiconsult for Havgul Clean Energy  
[http://www.siragrunnen.no/contribute/RationaleandbenefitsofdevelopingNorwaysfirstoffshorewindfarm\\_09.02.2012\\_01.pdf](http://www.siragrunnen.no/contribute/RationaleandbenefitsofdevelopingNorwaysfirstoffshorewindfarm_09.02.2012_01.pdf)

<sup>24</sup> Offshore wind farms as joint projects, by Thema consulting (on behalf of the Nordic Working Group for Renewable Energy under Nordic Council of Ministers), June 2013 [http://www.nordicenergy.org/wp-content/uploads/2013/09/THEMA-report-2013-12-Offshore-wind-farms-as-joint-projects\\_final-report.pdf](http://www.nordicenergy.org/wp-content/uploads/2013/09/THEMA-report-2013-12-Offshore-wind-farms-as-joint-projects_final-report.pdf)

<sup>25</sup> Finansiering av ge- mensamma projekt enligt förnybart- direktivet  
En delrapport i uppdraget om samarbetsmekanismer i Energimyndighetens regleringsbrev 2013  
<http://www.energimyndigheten.se/Global/F%C3%B6retag/Elcertifikat/Nyhetsbrev/Finansiering%20av%20gemensamma%20projekt%20enligt%20f%C3%B6rnybartdirektivet%20ER%202013%2028.pdf>

### 3. Challenges

- Cost reduction is the biggest challenge as Norway's energy and climate policy is not primarily technology-driven but more focused on cost-effectiveness and market instruments<sup>26</sup>.
- In the Nordic Power Market, a large power oversupply is estimated in the 2020-2030 horizon due to low demand growth rate and an increase in hydro, wind and CHP. Norway still has the potential to upgrade many hydro plants and benefits from large onshore wind potential. This leads to a lack of rationale for offshore wind development in terms of energy supply in the short to medium term in Norway. The power oversupply leads to a need to create good framework conditions for energy-intensive industry, to insure a timely construction of interconnectors and to proceed to an actual shift from fossil to renewables for the transport sector, heating or oil & gas platform. The debate around shutting down Swedish nuclear plants, nuclear power plants in Finland and Russian export volume could reduce the oversupply.
- Norway suffers from a lack of incentives to create new industries due to low unemployment rate and a good economic environment.
- The Norwegian energy sector structure and ownership leads to reluctance to increase electricity supply, in order to avoid lower electricity prices.
- Securing grid connections for offshore wind in a timely manner may be challenging, as Norway's stakeholders are also involved in huge upgrades of the electric grid, as well as grid extensions and major interconnector projects. The lengths of export cables are also impacting capital expenditure and potential power losses.
- Some industry stakeholders believe that current research programs have limited understanding of and interest in the industry's challenges<sup>27</sup>.
- UK and the Dogger Bank is seen as the market for Norwegian stakeholders because of the large installed capacity (9 GW).

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<sup>26</sup> Elin Lerum Boasson, Cicero, Why has the EU chosen another approach than Norway?  
[http://www.uioenergi.uio.no/english/research/doctoral-degree/schools/milen-research-school/events/conferences/2013/eu-norwegian-res-130925\\_elin-lerum-boasson.pdf](http://www.uioenergi.uio.no/english/research/doctoral-degree/schools/milen-research-school/events/conferences/2013/eu-norwegian-res-130925_elin-lerum-boasson.pdf)

<sup>27</sup> Teknologi- og industriutvikling fra et norsk bedriftsperspektiv, CenSES-report, 2011, by G.H. Hansen & M. Steen  
[http://www.ntnu.no/documents/7414984/0/Hansen+og+Steen+\(2011\)%20Vindkraft+til+havs.pdf](http://www.ntnu.no/documents/7414984/0/Hansen+og+Steen+(2011)%20Vindkraft+til+havs.pdf)

- Industry players deplore challenging access to capital, as investors are not used to finance offshore wind in Norway.
- Technical challenges specific to the assessed zones identified in NVE's report include the water depth (several zones will require floating technologies) and water depth variation. Export cable length varies from 10 to 200km for different zones<sup>28</sup>.

## 4. Policy proposals

Policy tools for offshore wind can be divided into two categories related to different timeframes and objectives; the technology track and the long-term track. The technology track is a short to medium-term vision mainly focused on technology development and export. The long-term track is a vision post-2020, aiming at power production and the use of Norwegian offshore wind resource at a larger scale. The existing technology development track should be coupled with a long-term vision and ambition to produce power. This link is key to enable Norwegian offshore wind sector to develop further. Below different options are suggested for policy support schemes, as well as a list of actions to trigger the take-off of the offshore wind sector.

- **Generate an industry roadmap through Ministry Cooperation**

Norway needs to develop a long-term strategy for offshore wind, which should be part of Norwegian energy, climate, financial and industrial policies. An offshore wind strategy should be built as an **industry** roadmap and thus involve stakeholders in the Ministry of Petroleum and Energy (Olje- og energidepartementet), Ministry of Environment (Miljøverndepartementet), Ministry of Finance (Finansdepartementet) and Ministry of Trade and Industry (Nærings- og handelsdepartementet).

- **Long-term ambition**

The short-term ambition to develop and export technology and services to other markets should be coupled with a long-term ambition to use this technology to utilize the Norwegian offshore resource at a larger scale. While this would require an off-taker for

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<sup>28</sup> Technological and Cost Development Trends of Renewable Offshore Energy Production, published 07/08/12, Multiconsult for NVE/OED  
[http://webby.nve.no/publikasjoner/rapport/2012/rapport2012\\_50.pdf](http://webby.nve.no/publikasjoner/rapport/2012/rapport2012_50.pdf)

the power produced, an ambition to open developing zones post 2020 could be the first step towards coupling the technology track with the power track.

- **Strengthen the focus on offshore wind in public institutions' mandate**

The industry deplores a disparity between funding for R&D projects and pre-commercial demonstrations.<sup>29</sup> Support schemes along the innovation chain should be coordinated to insure that there is no gap in the innovation process and that enough projects are at a sufficient maturity level to produce power. Many Norwegian stakeholders have also identified the market for offshore wind as being the North Sea. Further international support schemes could be considered to support Norwegian stakeholders in markets outside the Norwegian continental shelf.

- **Developing offshore wind as joint mechanisms**

On the one hand, using joint project framework as support for offshore wind could provide the necessary support schemes in Nordic countries, where the offshore wind potential is likely to be in excess to renewables targets. On the other hand, EU countries with insufficient resource, struggling to meet their targets, could prefer to enter into joint project agreements rather than exploiting more expensive domestic resources or other cooperation mechanisms. Sweden is discussing the green certificate market's expansion to other countries (France, Germany, Luxembourg, etc.) and recently released a report on different tools to be used to support offshore wind projects, in addition to the existing certificate market<sup>30</sup>. Norway should explore the option of hosting offshore wind projects as joint mechanisms in the framework of the European Renewable Energy Directive if the architecture of cooperation mechanisms is continued beyond 2020.

- **Develop specific business cases**

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<sup>29</sup> Teknologi- og industriutvikling fra et norsk bedriftsperspektiv, CenSES-report, 2011, by G.H. Hansen & M. Steen  
[http://www.ntnu.no/documents/7414984/0/Hansen+og+Steen+\(2011\)%20Vindkraft+til+havs.pdf](http://www.ntnu.no/documents/7414984/0/Hansen+og+Steen+(2011)%20Vindkraft+til+havs.pdf)

<sup>30</sup> Finansiering av ge- mensamma projekt enligt förnybart- direktivet  
En delrapport i uppdraget om samarbetsmekanismer i Energimyndighetens regleringsbrev 2013  
<http://www.energimyndigheten.se/Global/F%C3%B6retag/Elcertifikat/Nyhetsbrev/Finansiering%20av%20gemensamma%20projekt%20enligt%20f%C3%B6rnybartdirektivet%20ER%202013%2028.pdf>

Business cases developed on the opportunity for offshore wind projects to qualify to petroleum taxation regime should also be explored and supported further. This option should be considered as an interesting business case for pioneering projects.

- **Develop specific technology applications**

One interesting example is the use of offshore wind turbine to provide power for water injection in well recovery enhancement process in the oil & gas sector. This technological option has been founded to be cost-competitive in some conditions.

## 5. Other recommendations

- **Consolidate Norway's rationale for a Norwegian offshore wind sector**

The motivations and potential benefits to develop the Norwegian offshore wind sector are explored in this report. There is a need to bring these arguments in the public debate.

- **Put numbers on hypotheses**

Insufficient levels of quantitative analysis and data-driven studies compromise the stakeholder's ability to move forward in building an offshore wind strategy. Industrial opportunities to develop offshore wind in Norway should be evaluated in terms of the value creation potential from both exports and the domestic market. This should also include a detailed mapping of opportunities to transfer Norwegian capabilities from offshore oil & gas and maritime to offshore wind sectors. Opportunities and challenges of synergies from offshore oil & gas and maritime industry should also be studied further<sup>31</sup>.

- **Increase industry and research partnerships**

Research budget allocations discussed today will impact the ability of Norwegian research institutions to contribute to the industry's expertise. The industry should keep investing and shaping research projects to their needs in research programs.

- **Defining licensing authority**

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<sup>31</sup> Multiconsult published a tender for a multi-clients study in 2012, which was put on hold because of an insufficient participations.

To avoid licensing bottleneck, the permitting body should be designed in accordance with the ocean energy act and its capacity should be enhanced in order to insure a simple and quick licensing and permitting process for offshore wind farms.

## 6. Key milestones for Norwegian offshore wind analysis and regulation

The table below lists some key documents of the regulatory and legal framework, as well as economic and technical studies conducted in the last decade. The list is not intended to be exhaustive but includes key milestones the offshore wind sector in Norway.

Year	Regulatory and legal	Key studies
2006	'Norsk Klimapolitikk'	
2007	'Vindkraft offshore – industrielle muligheter for Norge' (Energirådet for OED)	
2008	National strategy paper on – 'Lov om fornybar energiproduksjon' (OED) (not revised in 2012)	
2009	Creation of Nowitech and Norcowe - R&D centers and industry clusters	
2010	<ul style="list-style-type: none"> <li>Offshore Energy Act – 'Havenergilova' voted 06/10 -&gt; led to NVE zone assessment work</li> <li>NVE publishes a study on proposed areas for strategic environmental assessment: 'Havvind, Forslag til utredningsområde'</li> </ul>	
2011	Electricity certificate act voted, establishing swedish-norwegian green certificate market from 01/12	Report on 'Offshore wind market and supply chain' (Multiconsult for Intpow and Innovasjon Norge)
2012	Green paper on energy - 'Energiutredningen; verdiskaping, forsyningssikkerhet og miljø'	<ol style="list-style-type: none"> <li>Report on 'Rational &amp; Benefit developing Norway's first offshore wind farm' (Multiconsult for Havgul Clean Energy)</li> <li>Report 'VINDKRAFT TIL HAVS - Teknologi- og industriutvikling fra et norsk bedriftsperspektiv' (CenSES)</li> </ol>
2013	NVE publishes study on strategic Environmental Assessment for offshore wind: 'Havvind Strategisk Konsekvensutredning'	<ul style="list-style-type: none"> <li>Report on Deep Water - The next step for offshore wind energy (EWEA)</li> <li>Floating wind farms technical standards by DNV</li> </ul>
2015	White paper Energy – 'Energimeldingen'	

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