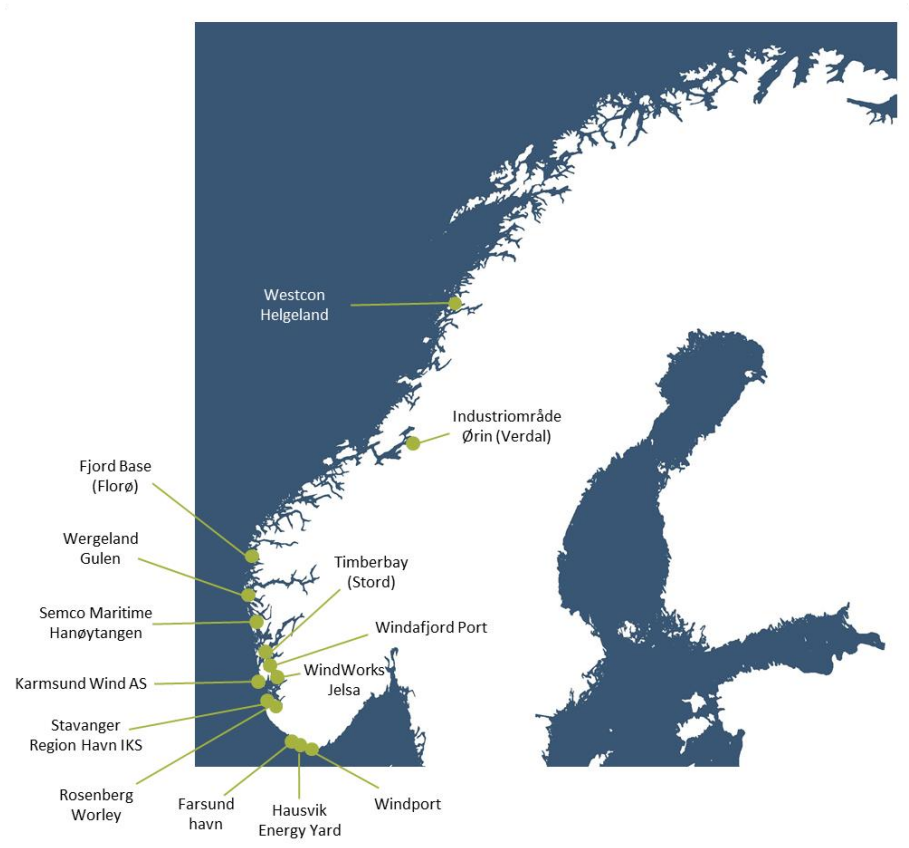
Feasibility study of assembly and installation ports within the offshore wind market – a Norwegian perspective

This study has been conducted by Menon Economics on behalf of Norwegian Offshore Wind, Export Finance Norway, Invest in Bergen, Invest in Agder and Invest in Rogaland. The purpose of the study is to identify and assess opportunities for Norwegian assembly and installation ports in offshore wind towards 2030. Development projects related to offshore wind will lead to significant industrial opportunities for Norwegian ports, as assembly and installation ports are a vital component in the offshore wind value chain. Considering the existing offshore wind project pipeline, there will be strong demand for the services ports offer in the foreseeable future.

Preliminary mapping of planned Norwegian assembly and installation ports

In this study we have identified 14 ports in Norway that could be relevant for providing assembly and installation services to offshore wind farms towards 2030. These are ports that are either operational today or are under development. *The common denominator for all of them is that they have plans to develop their areas to take on assembly and installation tasks for offshore wind farms by 2030*. However, there is variation in the plans regarding the technologies they are targeting (bottom-fixed, floating, or both), the size of the areas they will have available for assembly and storage, as well as whether they also have plans to facilitate manufacturing on-site and offer operational- and maintenance services. The identified assembly and installation ports are located along large parts of the Norwegian coastline, concentrated on the southwest and west coast of the country.

Figure A: Location of identified assembly and installation ports. Source: Menon Economics



Offshore wind in a European perspective

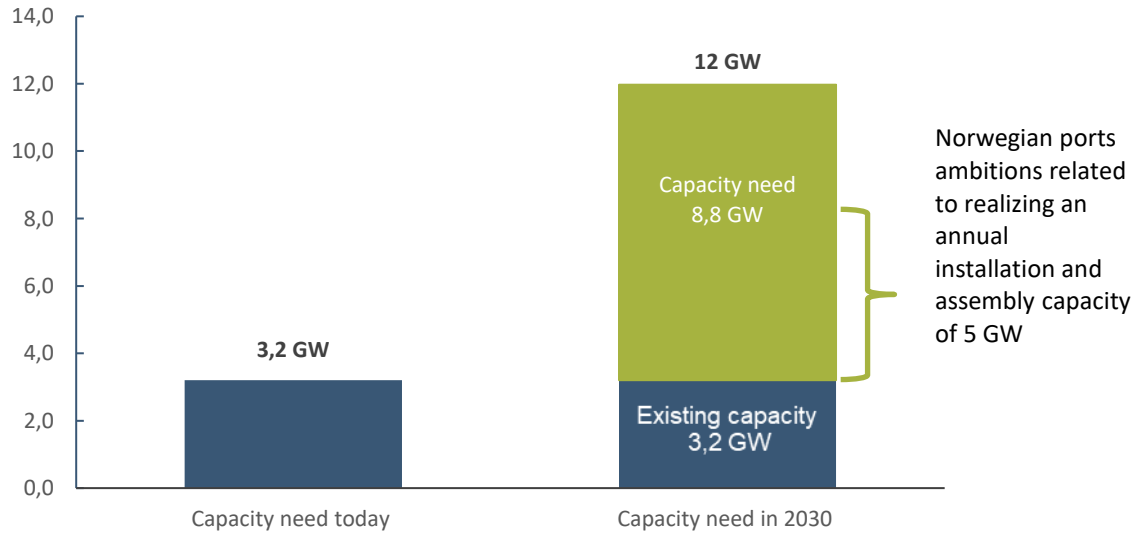
European authorities play a leading role in facilitating investments in renewable energy, including offshore wind. The EU has set ambitious goals for offshore wind development and has articulated strategies to achieve these. In addition to the EU, several individual countries in Europe have clearly stated ambitions for offshore wind development. Offshore wind has become a multinational industry, with bottom-fixed installations being the dominant technology today, while the market for floating offshore wind is still relatively immature. As of 2022, approximately half of the global offshore wind capacity was installed in Europe. This capacity is primarily located in Northern Europe, particularly in the North Sea.

Estimated demand for assembly and installation capacity towards 2030.

Location is an important factor in assessing relevant offshore wind projects that Norwegian assembly and installation ports can serve. For Norwegian ports, projects in Northern Europe, in particular in the North Sea, are expected to be especially relevant in terms of economic potential. Our analyses indicate that offshore wind development will be particularly significant in the North Sea, with a potential capacity of 72 GW by 2030. Including the Atlantic (including the Irish Sea) and the Baltic Sea, offshore wind capacity could reach 97 GW.

Based on the expected offshore wind development, we estimate the demand for installation and assembly capacity by 2030. Our calculations indicate a significant opportunity for Norwegian installation and assembly ports, which collectively aim to achieve an installation and assembly capacity of 5 GW annually by 2030. For offshore wind parks being developed in the North Sea, there will likely be a demand for an installation and assembly capacity of up to 12 GW by 2030, nearly four times the existing capacity of 3.2 GW (see Figure B below). Similarly, the demanded installation and assembly capacity in all of Northern Europe would be 16 GW by 2030, compared to an existing capacity of 4.7 GW. The identified plans in Norway can therefore cover a significant portion of the demanded capacity but will face competition from other countries, especially in areas geographically distant from the Norwegian value chain.

Figure B: Capacity of installation and assembly ports delivering to offshore wind projects in the North Sea today and expected capacity demand in 2030. The capacity demand in 2030 are divided into existing capacity, the total capacity planned by Norwegian players, and additional capacity that needs to be developed. Source: Menon Economics, based on data from DNV, BVG, and 4COffshore.

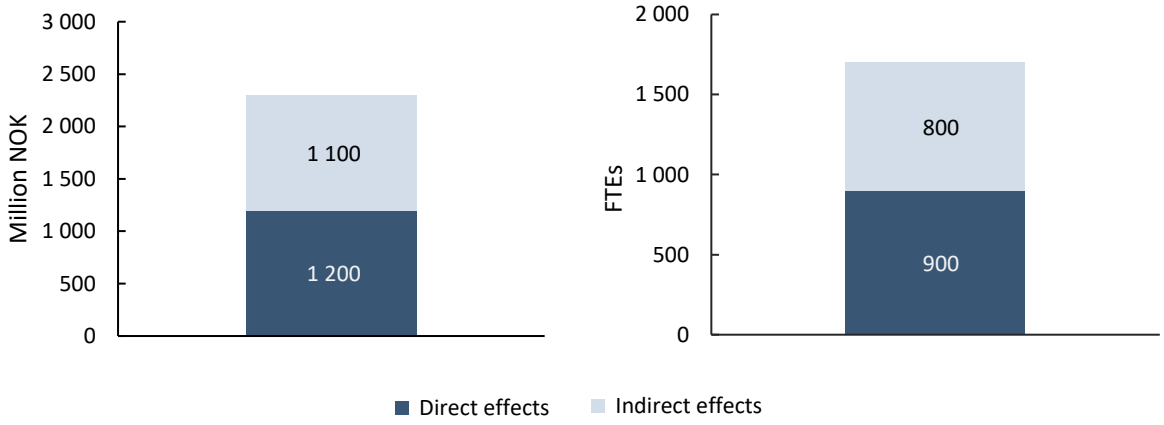


We consider the greatest potential to be within the floating offshore wind segment, as the market for bottom-fixed installations is more mature, and the associated port infrastructure is more developed. For floating offshore wind, installation and assembly activities also represent more activity at port facilities. However, at present, it is challenging to quantitatively differentiate between the two technologies because the plans we have identified (in Norwegian ports) are still at an early stage, and many players are exploring opportunities across the offshore wind industry. While we believe that the likelihood of realizing services towards floating offshore wind is higher for Norwegian ports, we cannot discard what the ports themselves have reported. Several ports have provided figures on expected total capacity and that they are planning to serve both markets. Therefore, updating the analysis as projects mature and the knowledge base increases is recommended. This will also allow for more updated and refined estimates (including per technology) of the future economic potential that exists.

Potential economic impact effects of assembly and installation ports

We have analyzed the potential economic ripple effects of port activity associated with installation and assembly. As an example case, we have estimated that an assembly and installation port with an annual capacity of 500 MW will generate value creation (contribution to GDP) effects ranging from 600 million NOK to 2.3 billion NOK, depending on whether the capacity is bottom-fixed or floating technologies. We also find that an installation and assembly port of the same size will support between 600 and 1,700 full-time equivalent jobs, depending on the foundation technology. The figure below shows the value creation and employment effects for an installation and assembly port with an annual capacity of 500 MW associated with the development of floating offshore wind. Direct effects refer to employment and GDP contribution effects that will be seen within the offshore wind industry. Indirect effects are generated as a result of the demand impulse from the offshore wind industry and will have spillover effects in the wider Norwegian economy through purchases from various subcontractors in the supply chain.

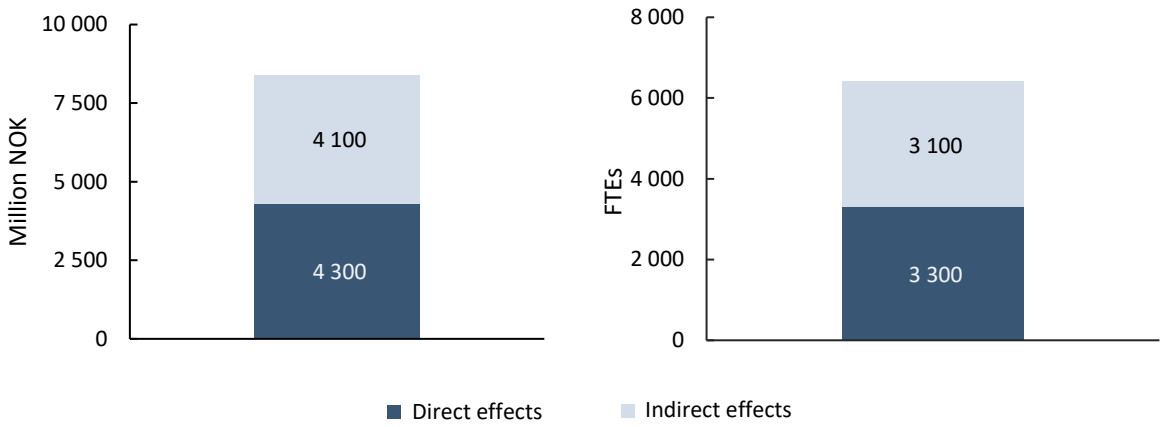
Figure C: Left side: Value creation (GDP contribution) effects for an installation and assembly port with an annual capacity of 500 MW related to the development of floating offshore wind. Right side: Employment effects for an installation and assembly port with an annual capacity of 500 MW related to the development of floating offshore wind. Source: Menon Economics.



To illustrate the size and economic impact of a successful establishment of a Norwegian-based port industry within offshore wind, we have estimated the ripple effects associated with a case where we assume that 50 percent of the capacity to the mapped assembly and installation ports is realized. This entails an annual installation and assembly capacity of 2.5 GW. In terms of technology, we have assumed that 65 percent of the

capacity serves the floating wind market and 35 percent serves the bottom-fixed market. Our analysis shows that such a scenario would generate approximately 8.4 billion NOK in value creation and around 6,400 full-time equivalent jobs per year. It is important to note that the successful establishment of such a large capacity in Norway is highly uncertain and will depend on significant competitiveness in the export market.

Figure D: Left side: Value creation effects associated with a total Norwegian installation and assembly capacity of 2.5 GW annually - both floating (65%) and bottom-fixed (35%) technologies. Right side: Employment effects associated with a total Norwegian installation and assembly capacity of 2.5 GW annually - both floating (65%) and bottom-fixed technologies (35%). Source: Menon Economics.



Barriers and criteria for success in establishing a Norwegian port industry for offshore wind

We have identified several barriers and success criteria necessary in order to succeed with developing a competitive assembly and installation industry within offshore wind. Input from various port operators in Norway also indicates that there are several barriers that can hinder the necessary development of port infrastructure, thus potentially impeding or delaying Norwegian ports' ability to serve offshore wind development at an industrial level. This is supported by existing literature from Norway and Europe. The barriers primarily revolve around challenges related to access to sufficient space in the ports and adequate financing to invest in upgrading and expanding ports. In terms of space, social acceptance plays a crucial role in obtaining zoning approvals from the municipality to the port, as well as whether the port is publicly or privately owned and whether the port is already located in a regulated area or associated with industrial and commercial activities. Financing challenges encompass both the risks associated with the timing and pace of offshore wind development in the coming years, as well as coordination and collaboration at the national level, between ports, and between ports and developers. Moreover, the distance between the port and the location where offshore wind farms will be installed can influence which sites are suitable as assembly ports for offshore wind. The suitability will, among other factors, depend on whether the port will assemble bottom-fixed or floating offshore wind. Access to sufficient expertise and workforce can also be a barrier to the development of ports, although this is not necessarily solely a concern for the offshore wind industry and ports in Norway.