



Potential for offshore wind in Norway

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Enova SF

- Enova SF is a public enterprise owned by the Royal Norwegian Ministry of Petroleum and Energy
- Manages the Energy Fund:
 - Managed approx. 140 million euros in 2007
 - Budget 2008: approx. 235 million euros
- Enovas mission is to promote long-term, environmentally friendly changes in energy consumption and energy generation
- Performance targets:
 - 12 TWh of energy conserved and added renewable energy generation by the end of 2010 (including 3 TWh of wind power and 4 TWh of renewable heating)
 - 30 TWh by 2016
- In 2007 Enova had contractual commitments for an energy result of approximately 2.4 TWh. A total of 10.12 TWh has been contracted for during the period 2001-2007 (incl. 1.5 TWh onshore wind)



Offshore wind resources in Norway

In 2007 Sweco/Econ conducted a study on behalf of Enova on the ocean energy potential for Norway.

The study's objective was to describe the resource potential, the cost level and the challenges related to harvesting the energy potential from renewable offshore energy sources.

The study focuses on wind, wave and tidal power.



The resource basis

- The resource basis are estimated on two levels:
 - For a specific plant/technology
 - Total domestic potential for each of the resource groups (wind, wave and tidal)

Analyses in the study are performed by:

Fugro OCEANOR- Wave

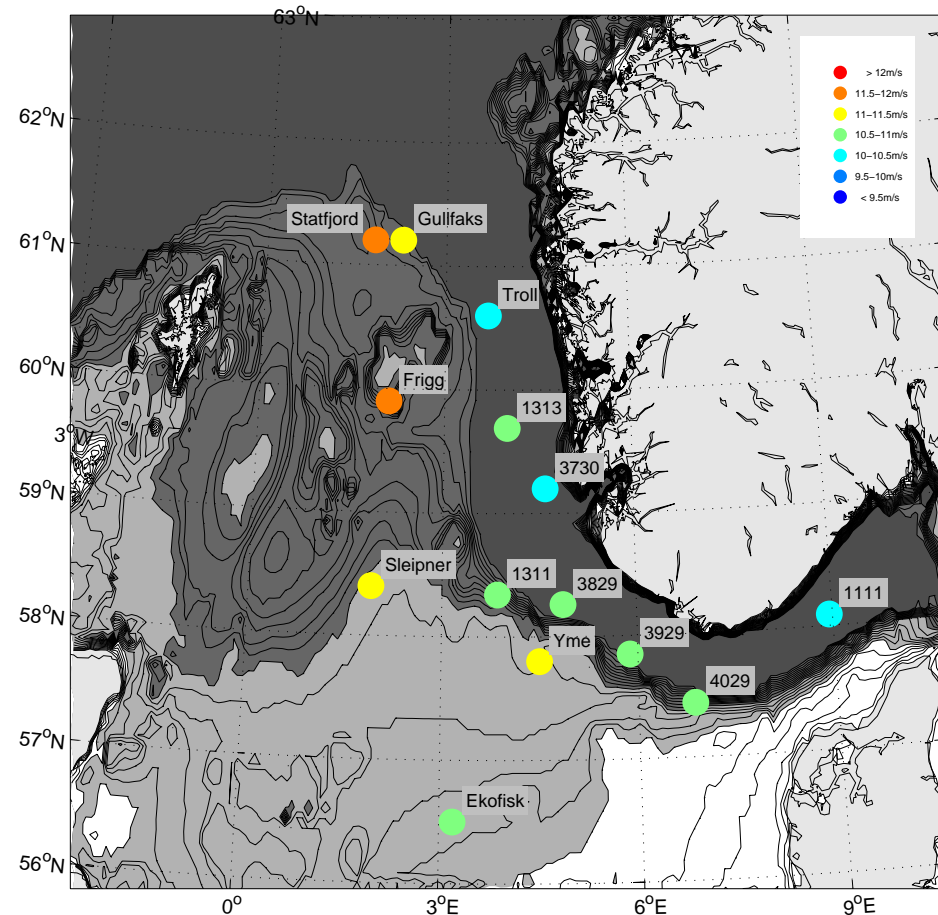
SWECO Grøner - Tidal

Kjeller Vindteknikk - Wind



Resource basis wind power – analysis for one installation

- The annual average wind speed offshore is expected to be in the range 10 – 12 m/s in the North Sea
- In average – there will be approximately 40-50 days a year with wind outside the typical production window for standard turbines
- The geographical variations from south to the north are not significant. In the northern part of Norway the wind is comparable but with stronger extremes
- The coastline is starting to affect the wind at least 50 km from shore





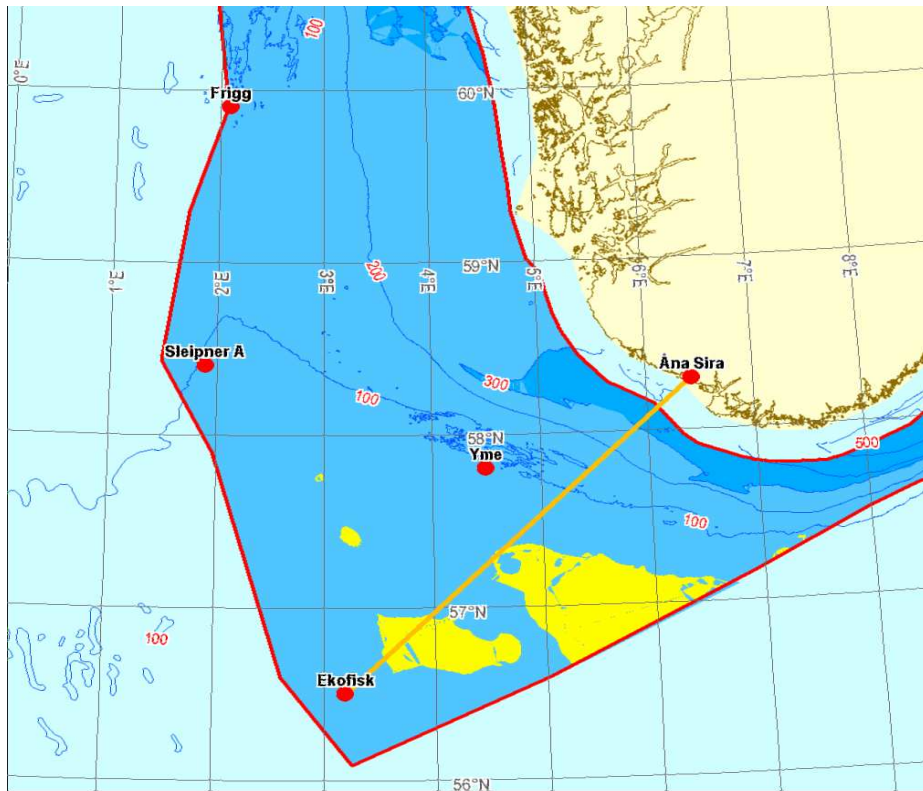
Resource basis offshore wind

Potential offshore wind (TWh)			
Water depth	Enova estimate outside 20 km	NVE estimate close to the coast	Total
0-30 m	11	114	125
30-60 m	786	85	871
60-300 m	12970	n.d.	12970
Total	13767	199	13966

The potential for the areas outside 20 km from the coastline is estimated by multiplying the area (km²) by 10 MW/km² and an operational time of 4000 hours

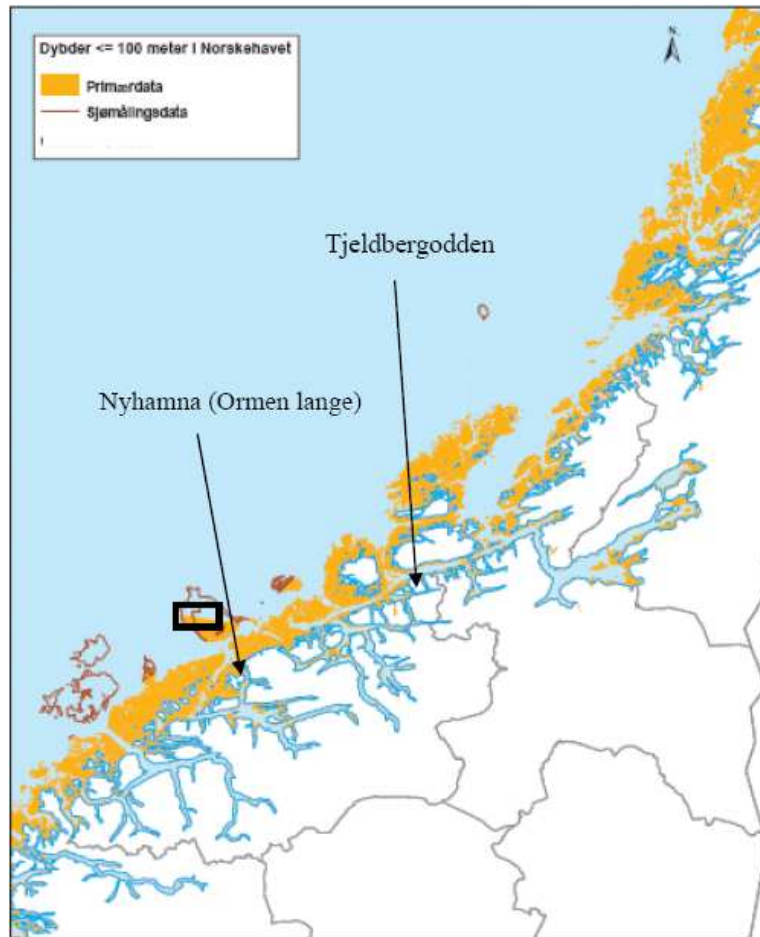


Example, potential offshore wind project





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Source: NVE





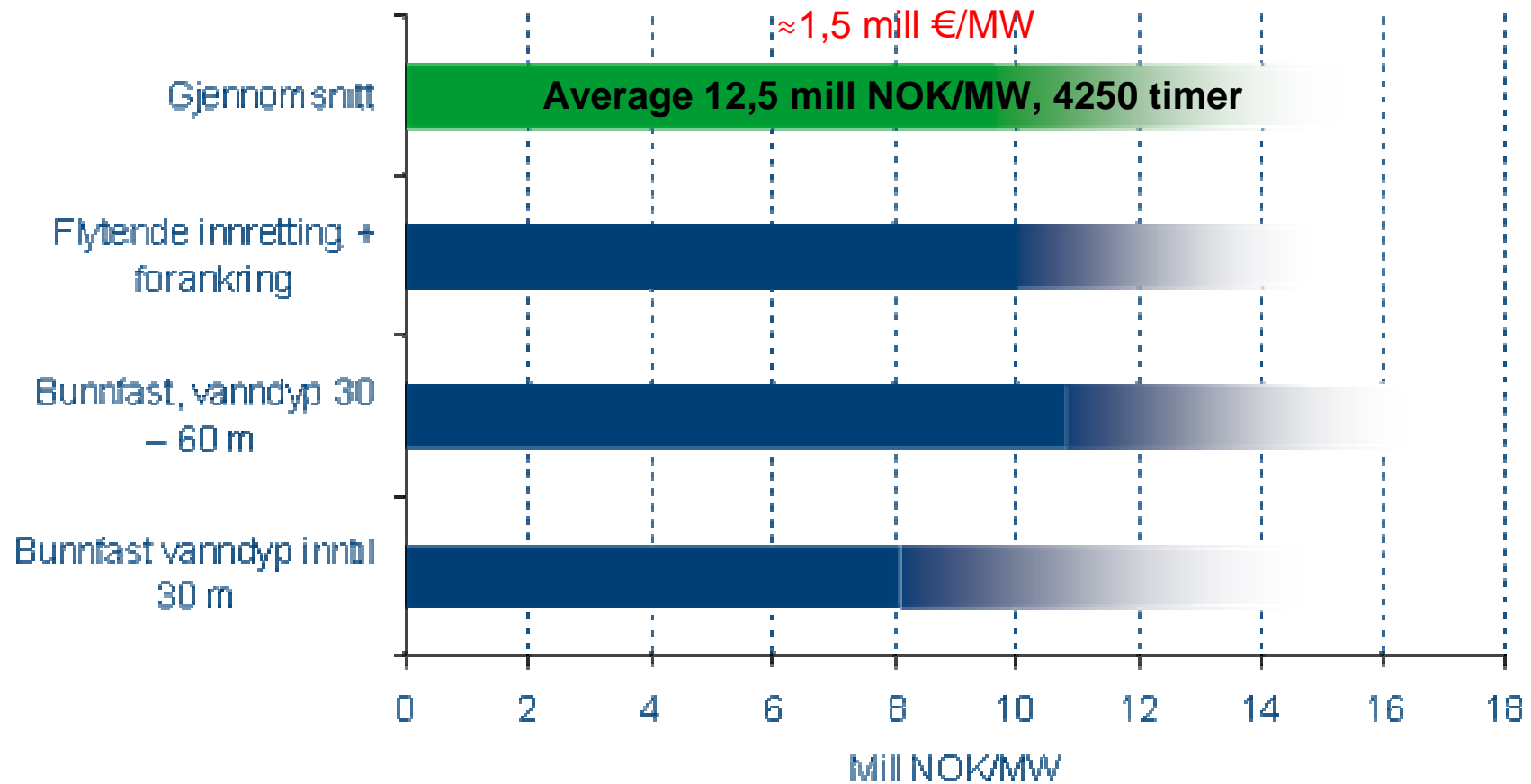
Economy

- Assumptions
 - Electricity price: 45 øre/kWh (56 Euro/MWh)
 - Lifetime: 20 years
 - Internal rate of return: 8% (before tax)
- Future income is combined with estimated time of operation and conversion to an annual rate
- Net Present Value calculation is performed for each of the technologies
- Maximum investment costs reflects a Net Present Value of zero



Offshore wind power technologies

Maximum investment costs for wind power technologies





Barriers for offshore wind

In general:

With SoA technology for offshore wind, there is a significant gap between cost level and potential commercial income.

In addition in Norway:

Cost of alternatives: In short to medium term alternatives for new RE production (onshore wind, hydro) exists, with large resources available, and being more competitive.

Example: 15 TWh onshore wind technical feasible in Norway by 2025.

Cost: approx. 9 bill. Euros, may need public funding of a approx. 2.3 bill. Euros

Market: National (and Nordic) scenarios indicate future excess marked for electricity (future net exporter or increased use of electricity)

Framework: Regulatory framework mission and needs to be developed



Thank you for your attention

www.enova.no

