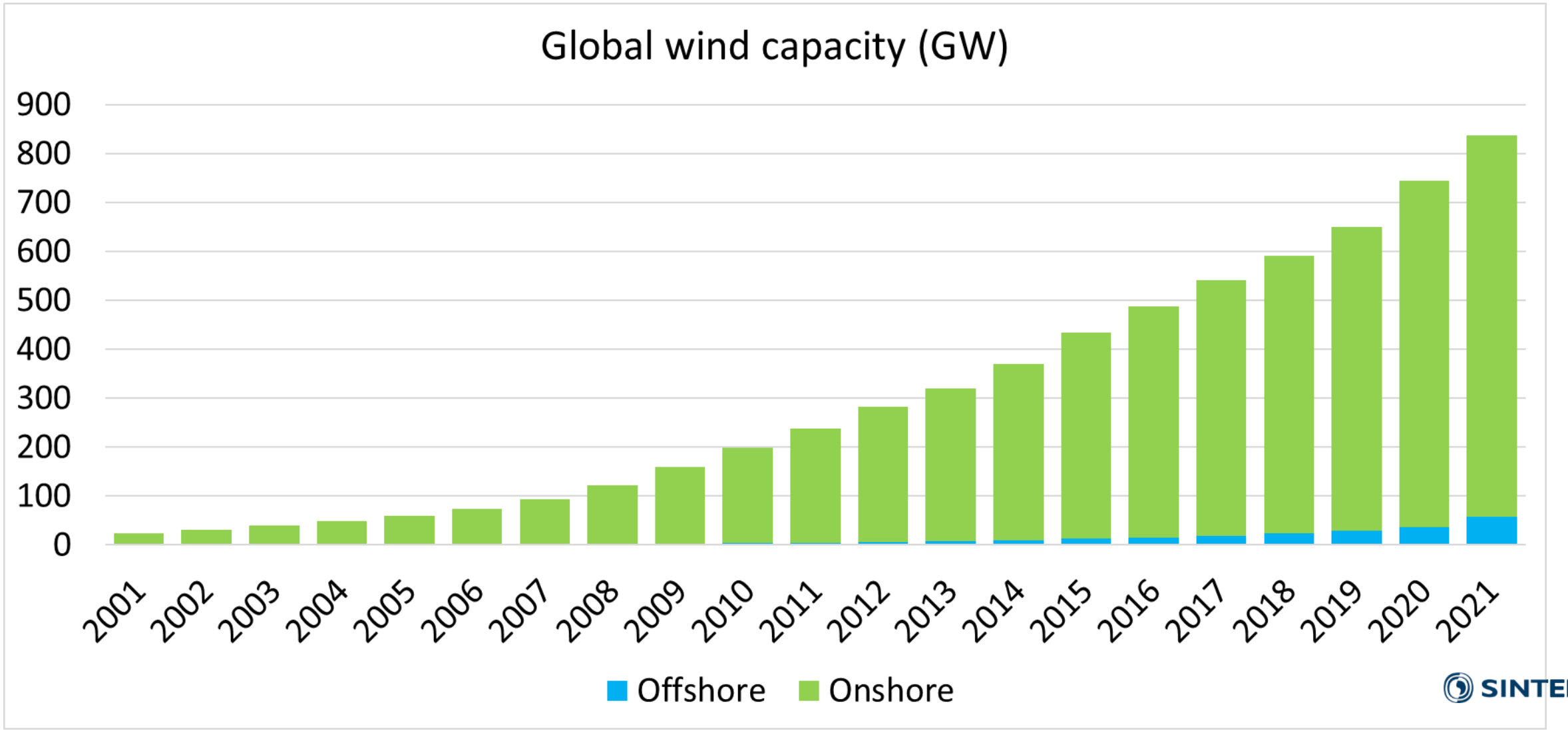
November 2022

Offshore wind and the future renewable energy system

John Olav Tande, Chief Scientist SINTEF & Director of NorthWind

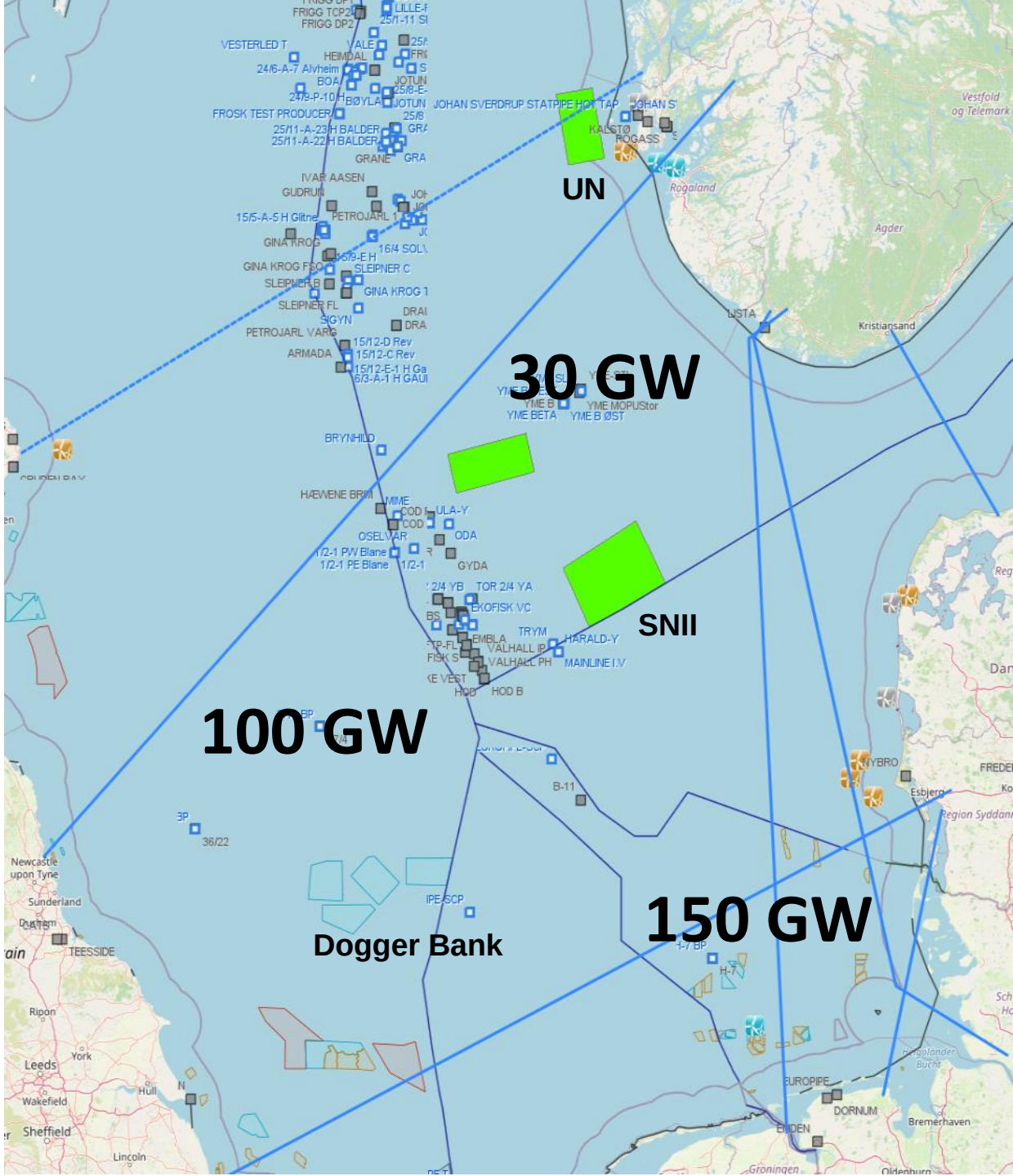
Wind energy is in strong growth



SINTEF

Energy revolution

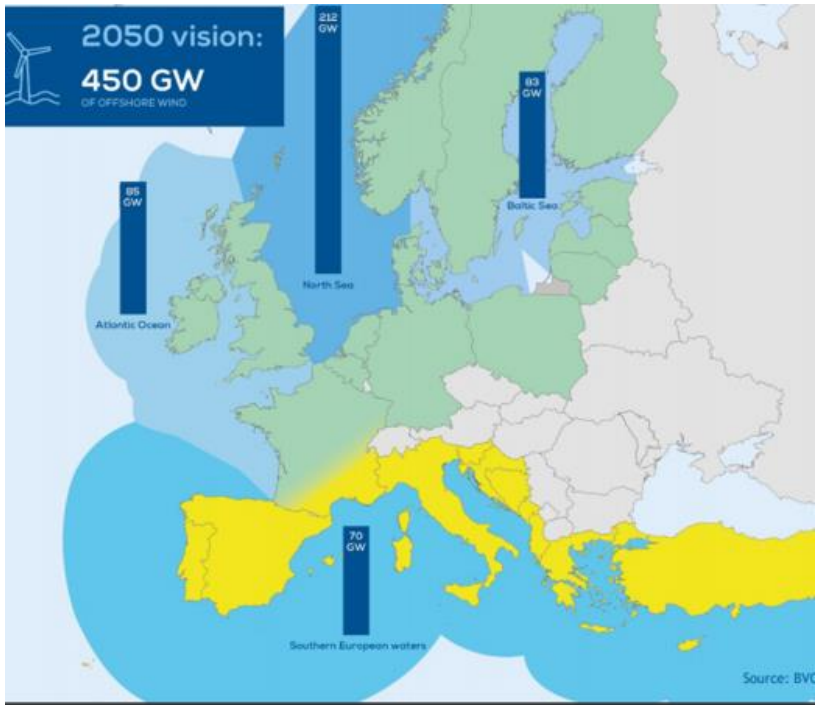
Offshore wind will supply 1/3 of the electricity in EU by 2050

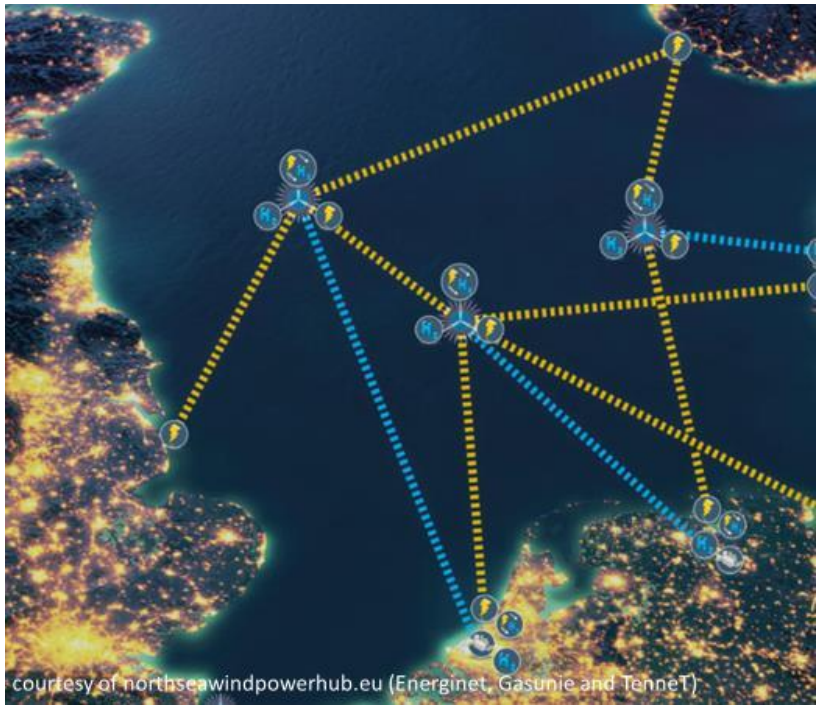


An ocean of opportunities

- 30 GW offshore wind = a doubling of the Norwegian power system of today
- A new offshore power system
- A totally new power system operation
- A BIG opportunity for the industry
- A strong need for new knowledge, innovation and competence

A trillion EUR business

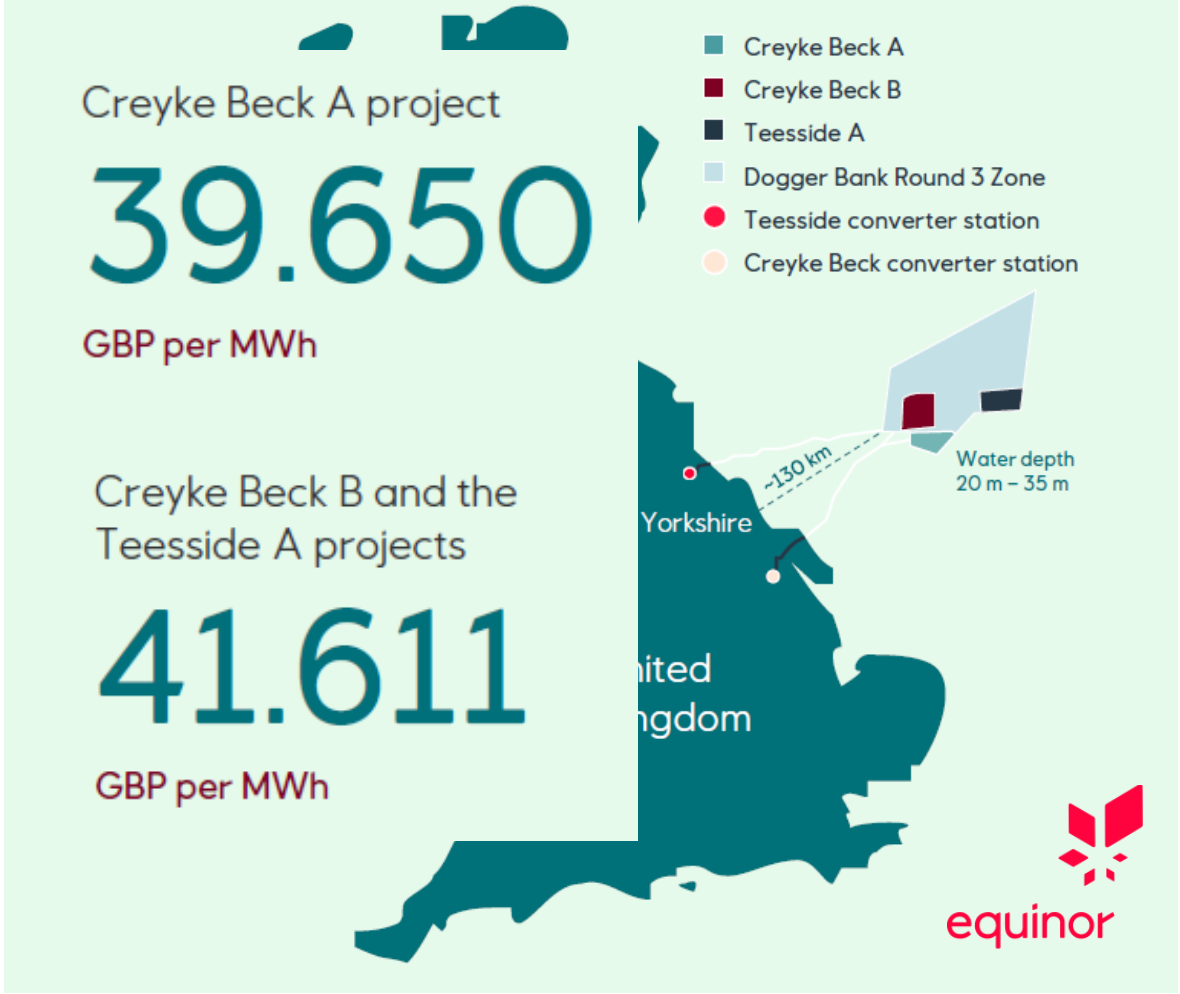




SINTEF

Offshore bottom-fixed wind deliver affordable generation

Dogger bank 3.6 GW



SINTEF

Floating wind is at an early stage of development. LCOE can be cut through Research, Innovation and Deployment.

Image courtesy WindFloat Atlantic / Principle Power with Aker Offshore Wind overlay

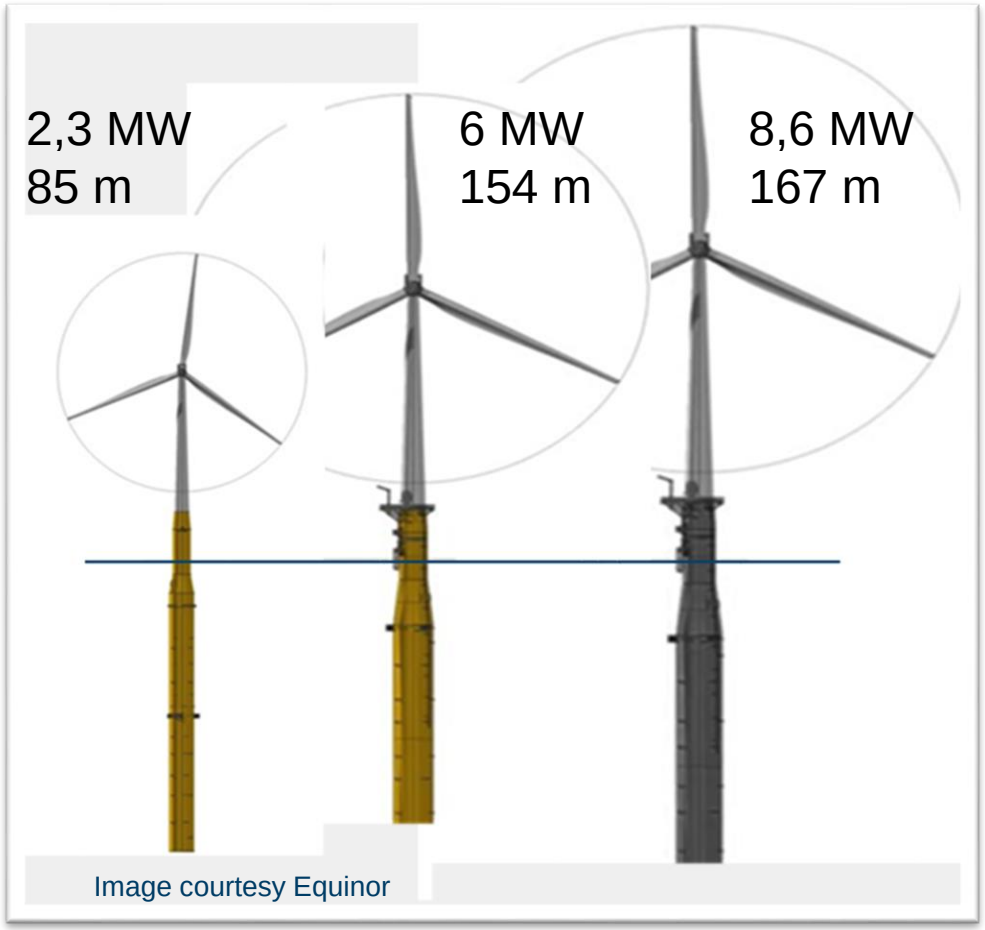


Image courtesy Equinor


Courtesy of World Wide Wind

Knowledge

+

Industry

= $$$

SINTEF

FME NorthWind

A strategic research and innovation action to reduce the cost of wind energy, facilitate its sustainable development, create jobs and grow exports

Partners: SINTEF (host), NTNU, NINA, NGI, UiO and 50 industry partners

Total budget 2021-2029: 345 MNOK financed by Research Council of Norway, industry and research partners

NORTH WIND

Norwegian Research Centre on Wind Energy

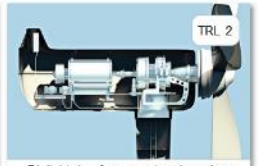
30 innovations in development

SKARV – Bird collision avoidance system

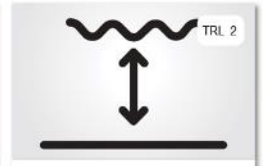
Hybrid laser-arc welding (HLAW)

Holo Lens digital twin application

Increased sensitivity and accuracy in health monitoring of bearings by using Acoustic Emission



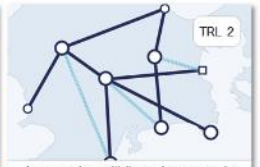
Digital twin of gear system based on more accurate material and damage data



Implement a model accounting for finite water depth

Diffusion and innovation models for offshore wind technology

Structuring the methodology of a logistics predictive maintenance approach



Increased sensitivity and accuracy in health monitoring of bearings by using Acoustic Emission

Comprehensive framework for optimising offshore grid design and operation

ConSite Wind – Consensus-based siting of onshore wind energy development

COSMO – Computer tool for Optimization and Simulation of Marine Operations

AviSite – Online application for assessing life cycle impacts on avian diversity for siting of onshore wind farms

Acoustic emission for laser welding process monitoring

Optimised power cable installation for coupled tension-torque behaviour

Logistics decision support tool for bidding phase

New method for thermal-electrical cable analysis including power variation and utilising accurate loss calculation

New models for degradation and lifetime assessment of HVAC insulation systems

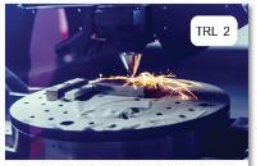
HAM as a new paradigm in modelling

Fast multiscale modelling from global > meso > micro > wake scales

Advanced ancillary services from wind farms

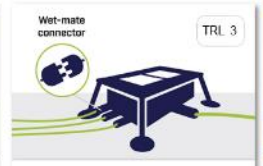
Improved estimation of fine contents in silty sands from CPT measurements

Reliability-based structural design



Additive manufacturing technology for repair and maintenance of offshore wind structures

Map potential innovations when it comes to installation of GBS



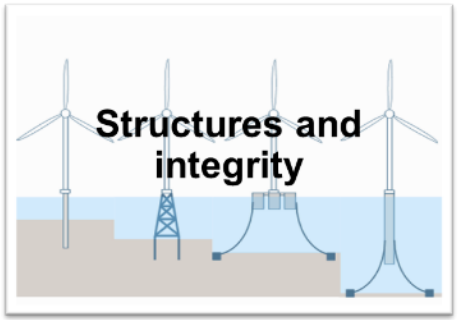
Wet-mate connectors for >66 kV

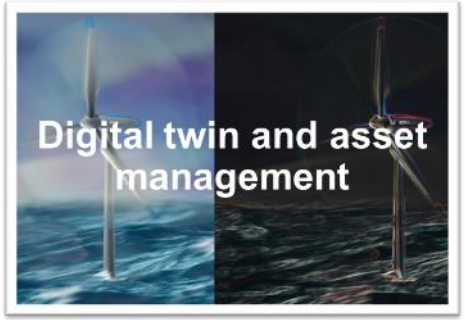
New material model for power cables, including effects of hysteretic damping and coupling to torque, axial force and pressure

Combined testing and multiscale characterisation procedure for high and very high cycle fatigue

Online park design/optimisation tool

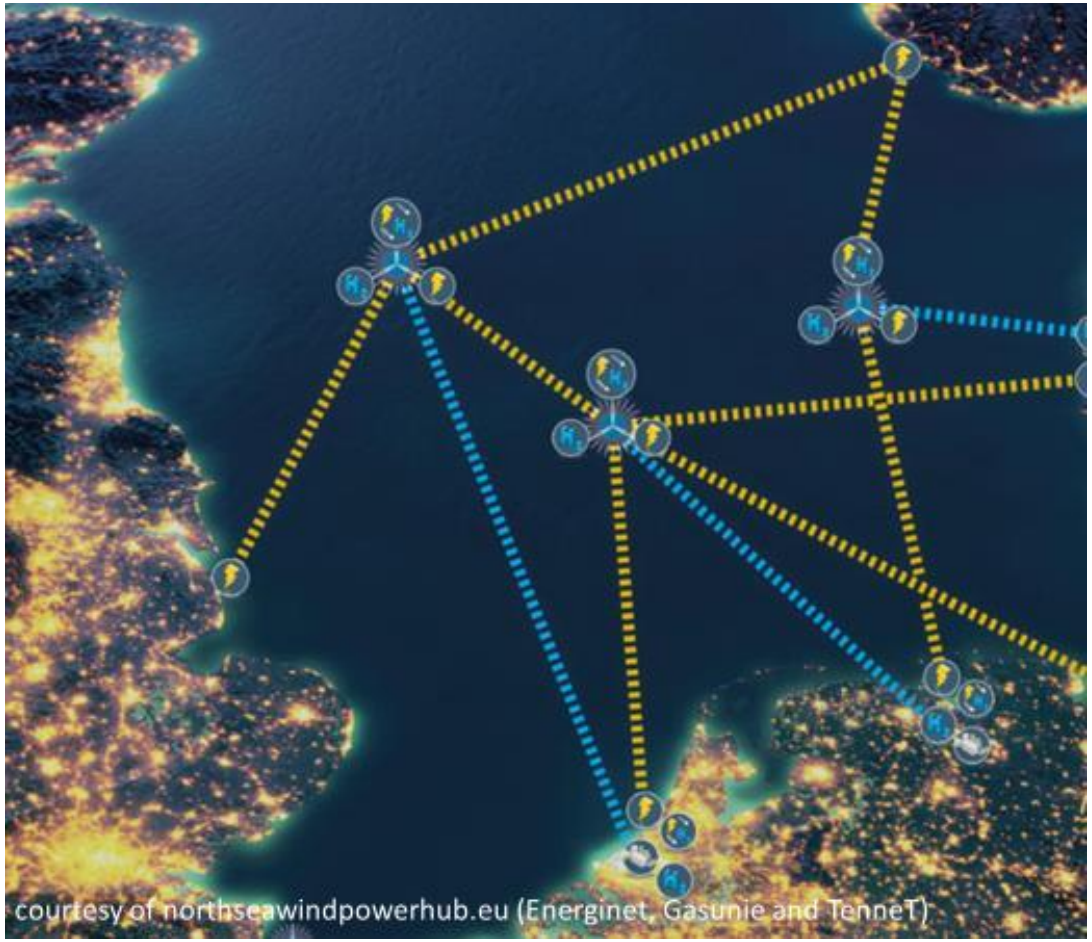
Reduced order model for wakes





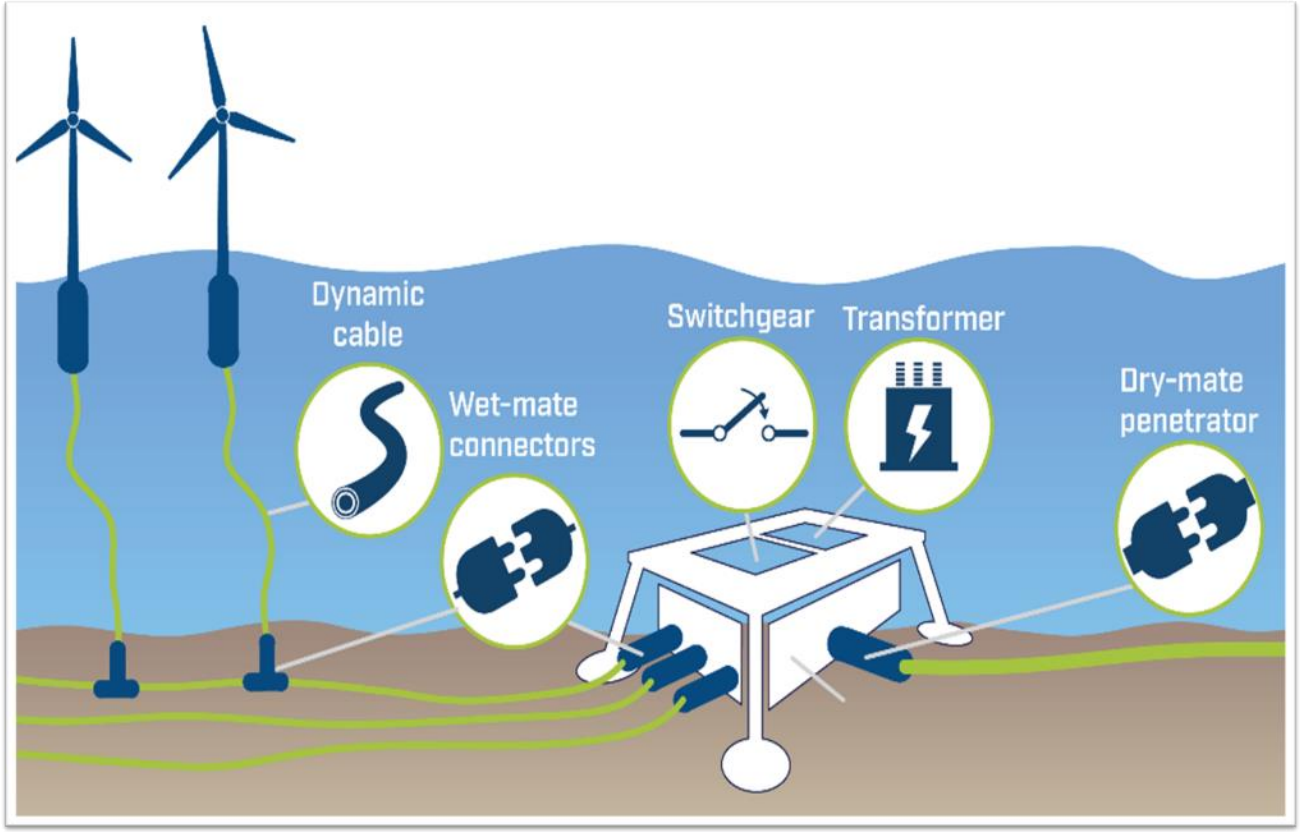
NORTH WIND

The future requires new energy solutions



NORTH WIND

Sub-sea connectors for floating wind



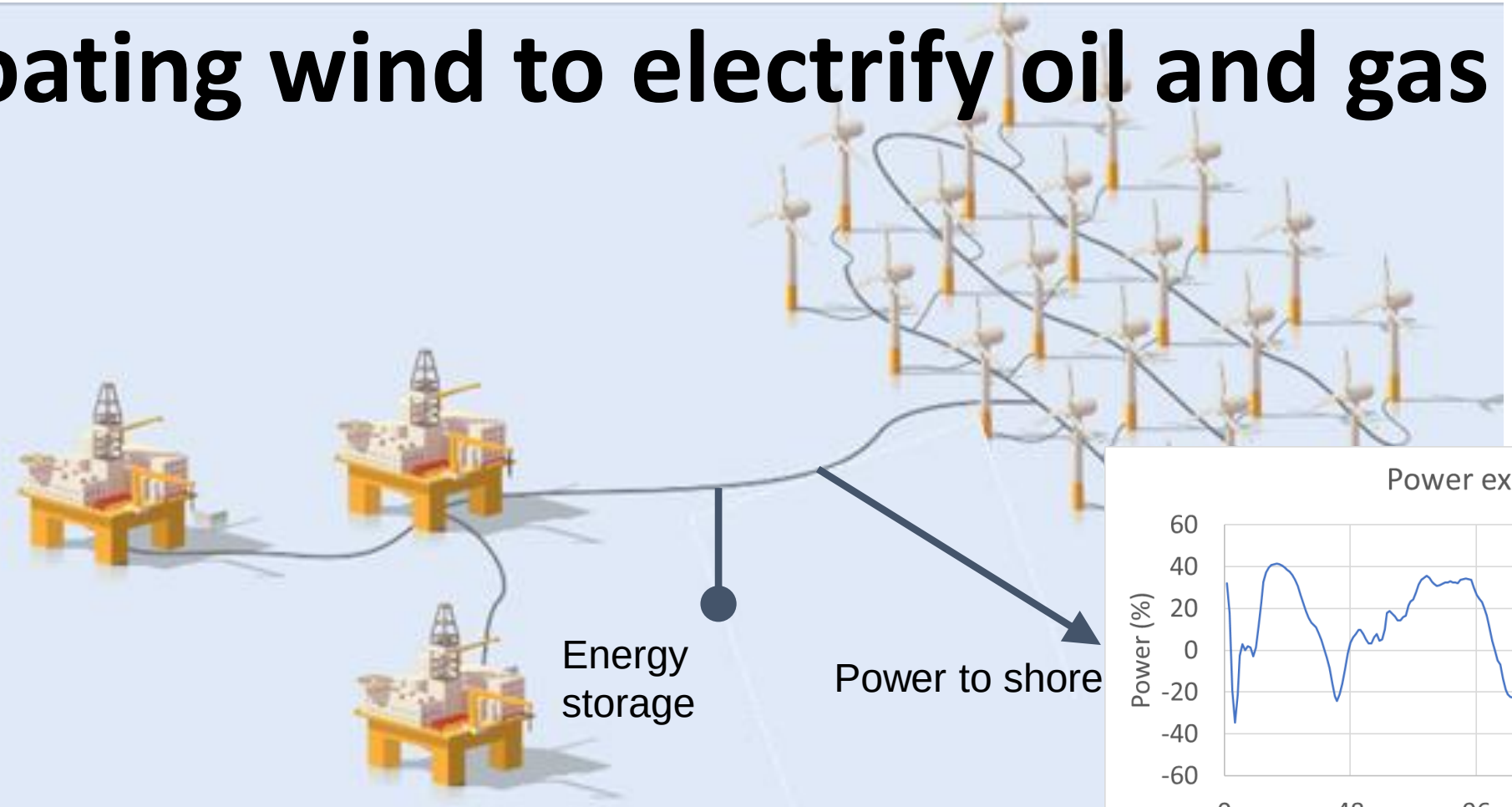
Innovative concepts for subsea wet-mate and dry-mate subsea connectors that can handle higher operating voltage and power than existing technology.

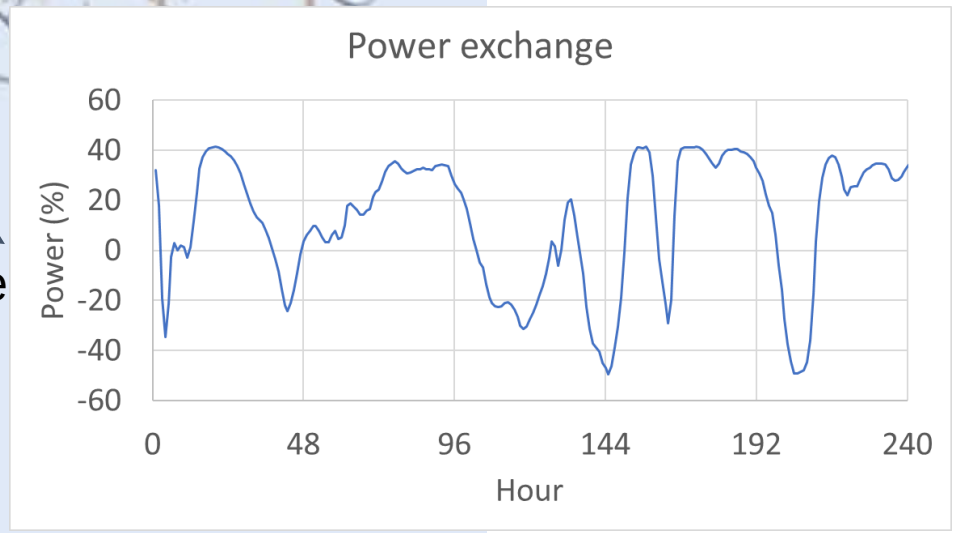
- Impact: Enabling technology for subsea substations, which have a related CAPEX decrease of 20 %
- TRL: 3 (09-2022)
- Plan for further development: Work to be continued in spin-off project (SeaConnect)

NORTH WIND

Accelerating deployment:

Floating wind to electrify oil and gas

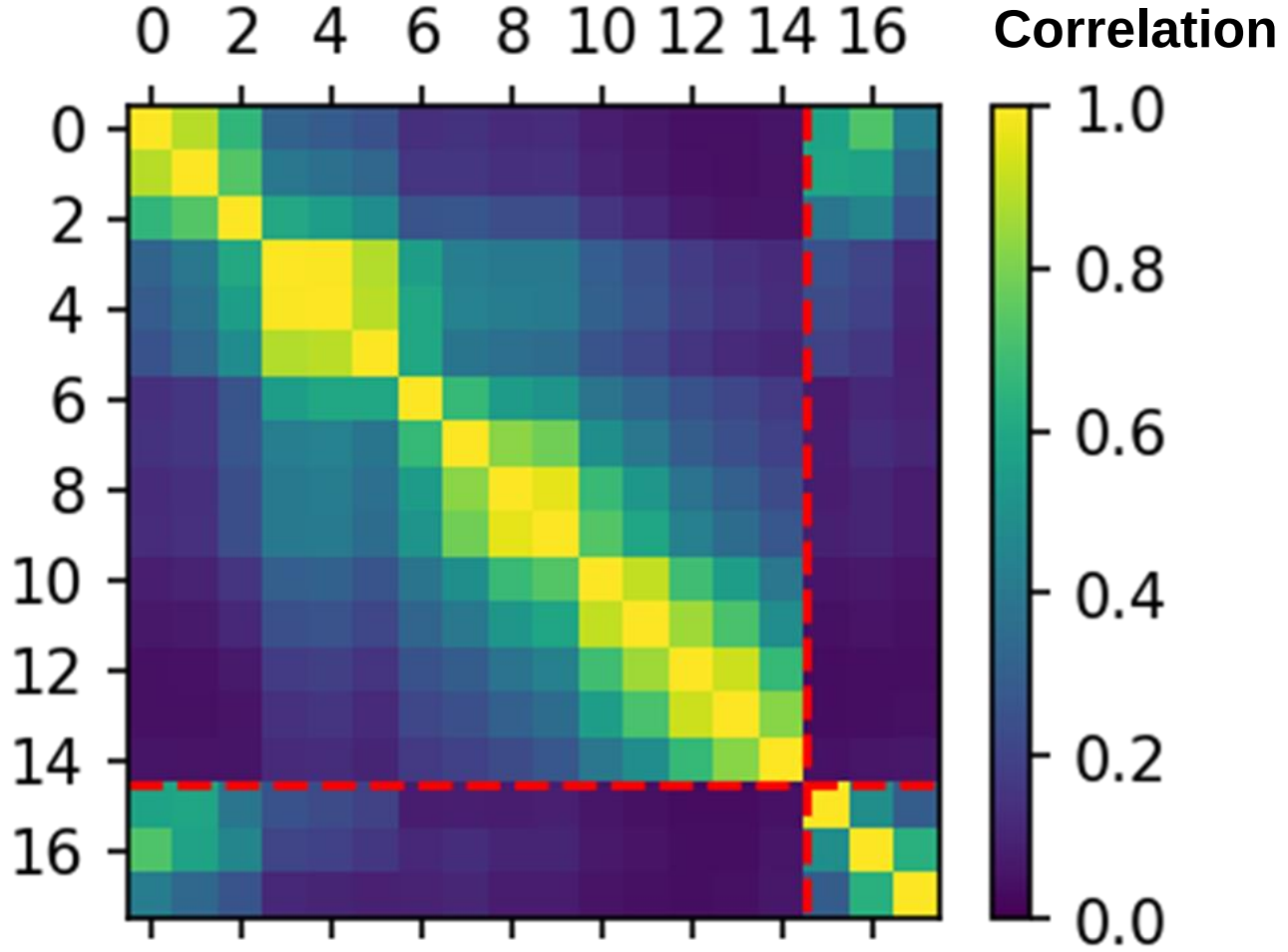




LOWEMISSION

NORTH WIND

Wind in the south is not correlated with wind in the north

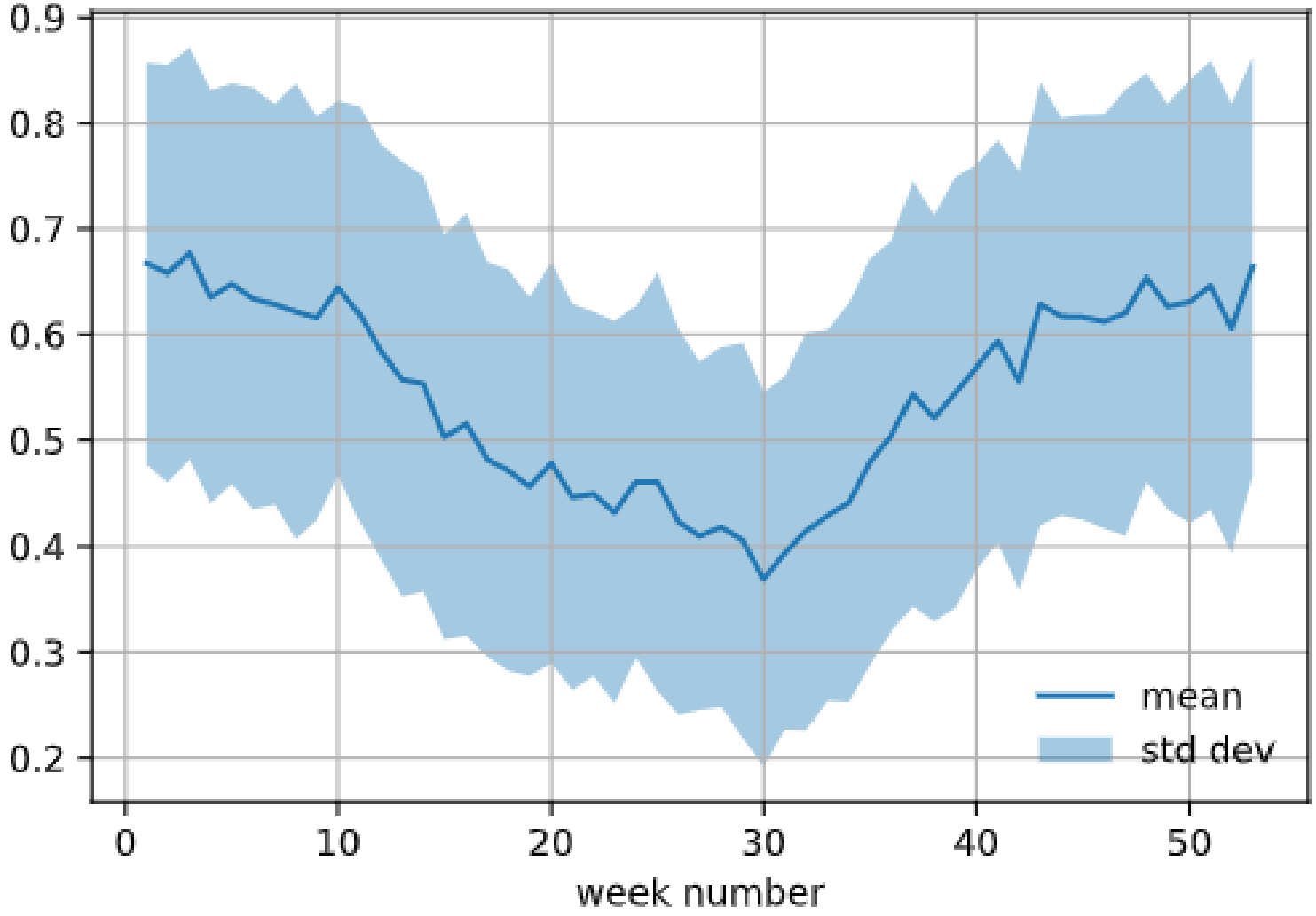


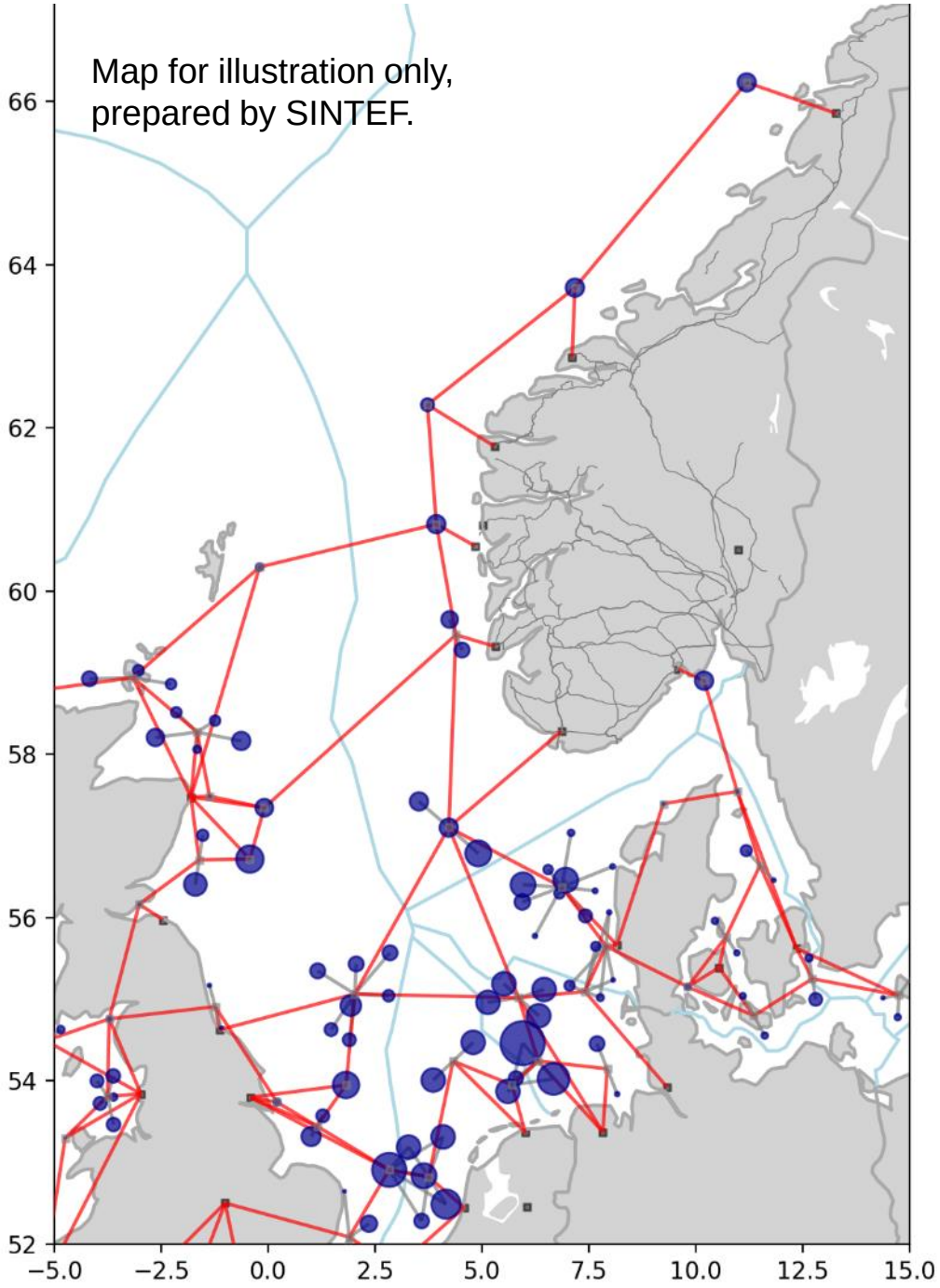
OCEAN GRID

NORTH WIND

The wind generation is normally higher in the winter

Offshore wind weekly generation (pu)





The future offshore grid?

OCEAN GRID

NORTH WIND

Don't miss it!

EERA
DeepWind
CONFERENCE
2023

20th Deep Sea Offshore Wind R&I Conference
Trondheim 18-20 January 2023

Topics

- New turbine and generator technology
- Grid connection and system integration
- Met-ocean conditions
- Operation & maintenance
- Installation and sub-structures
- Marine operations and logistics
- Wind farm optimisation
- Experimental testing and validation
- Wind farm control systems
- Societal impact and controversies
- Environmental impact
- Legal and regulatory framework

SINTEF NTNU EERA European Energy Research Alliance

SINTEF

Technology for a better society

NORTH WIND

www.northwindresearch.no