North Sea
Wind Power Hub
Programme

Modular Hub-and-Spoke concept to facilitate large scale offshore wind

Consortium delivers concept to meet climate goals

NSON side event, Wind Europe Offshore, Denmark | 28 November 2019

North Sea Wind Power Hub consortium

ENERGINET

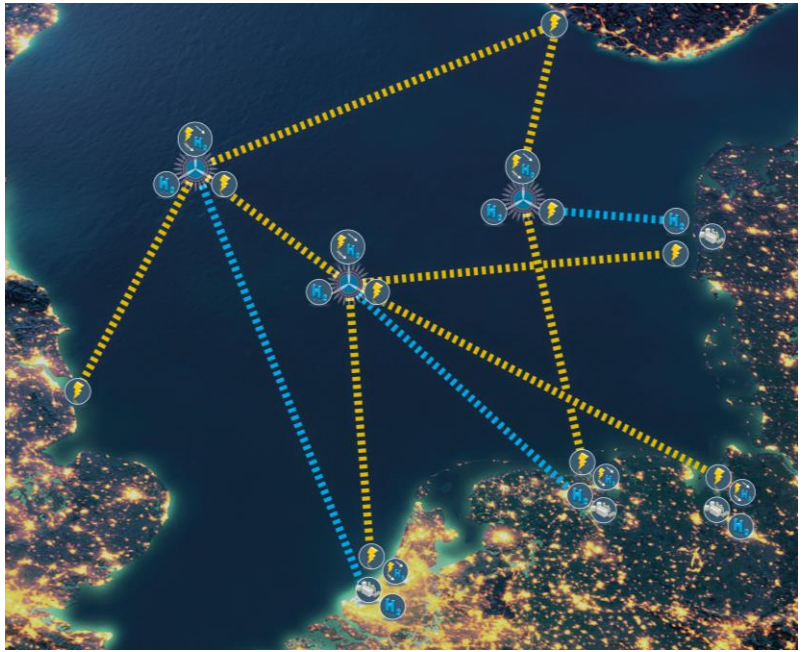
Danish transmission system operator working for a green, reliable and sustainable energy supply of tomorrow

gasunie

European energy infrastructure company serving the public interest and facilitating the energy transition by providing integrated infrastructure services

TenneT

TenneT is a Dutch-German electricity TSO and is one of Europe's major investors in national and cross-border grid connections on land and at sea in order to enable the energy transition.

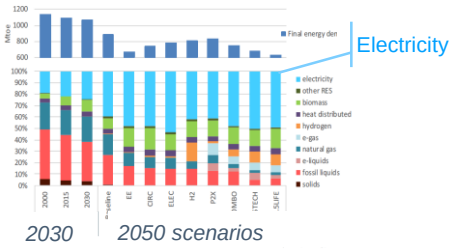


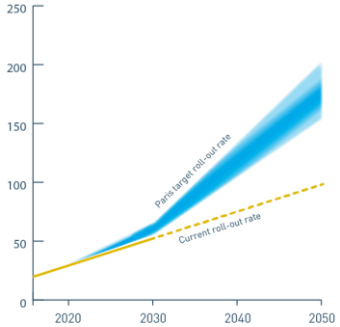
The energy transition and North Sea offshore wind

The Paris agreement implies a radical change in the electricity generation mix for North Sea countries

PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

Share of energy carriers in final energy consumption





Combatting climate change impact to limit global warming to well below 2 °C and pursue below 1.5 °C, ...

… requires a swift and massive change in the energy system, …

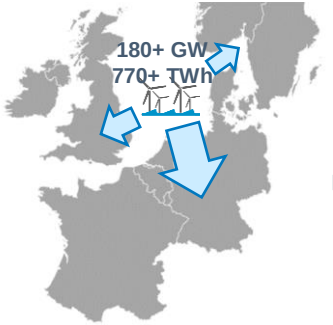
… including an estimated 180 GW of offshore wind, 50-80 GW of inter-connectors[(1)], 140 TWh of seasonal storage and

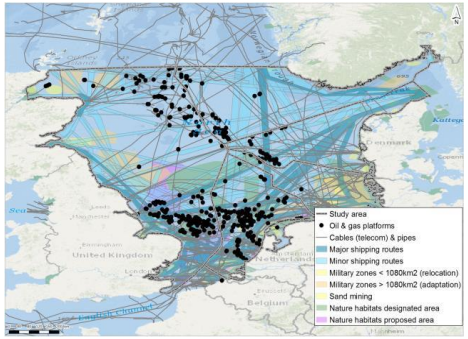
… an accelerated and steady deployment based on cross border spatial planning

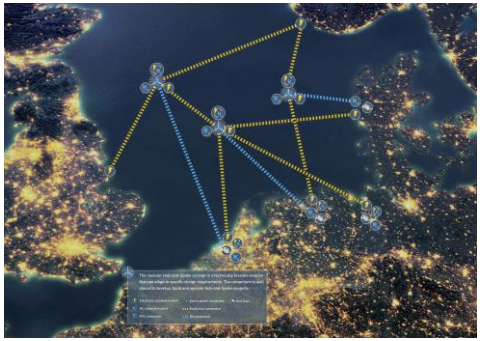
[1] **Translate COP21:** 2045 outlook and implications for offshore wind in the North Seas (Ecofys 2017)

Facilitating the required large scale roll-out of offshore wind

The accelerated deployment of large-scale offshore wind and its integration in the energy system needs international coordination, long term policy targets and a robust regulatory framework







Need for sector-coupling, …

- offshore wind energy needs to be transported to deep inland demand centres
- sector-coupling and grid extension are needed to cope with variable renewable energy generation

… integral system development …

- energy systems should be planned, designed and operated in across energy sectors
- large scale roll-out of offshore wind requires international coordination on spatial planning

and supporting mechanisms

- combining offshore wind connection and cross border interconnection
- connecting wind farms from one country to demand centres in another
- cross energy sector coupling at scale

From vision to modular programme

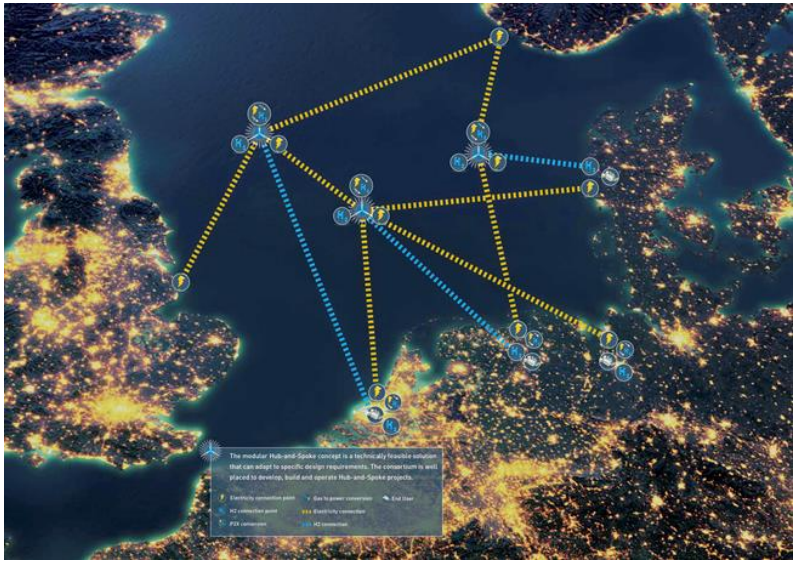
Hub-and-Spoke Modular concept

… to programme and a **step-by-step approach** to unlock the vast offshore wind resource, integrating it into the onshore energy system and continue high level of security of supply.

From vision as presented in 2016 – a 36 GW Hub & Spoke project based on a sand island on the Dogger Bank ....

Broad assessment phase

- >60 people involved from consortium companies
- >25 separate studies, including: regulatory, technical, economic, different island concepts, role of power-to-gas,
- >1500 pages of documentation



How to get there

- ✓ Provide access to markets
- ✓ Facilitate integration of infrastructure assets
- ✓ Provide proper incentives throughout the transition to all stakeholders

- ✓ Secure market outlook to invest and build up supply chain
- ✓ Organise co-utilisation in spatial planning
- ✓ Minimise impact and secure climate goals

- ✓ Recognise long (10+ years) lead time in dynamic transition
- ✓ Enable anticipatory investment beyond project and across energy sectors
- ✓ Include hybrid assets and sector-coupling

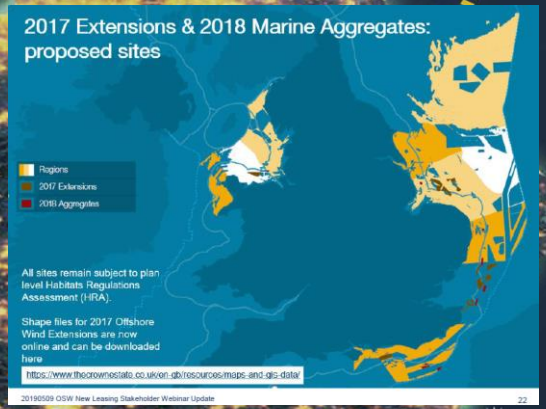
Some relevant developments in other North Sea countries

Norway: consultation on the area Sørlige Nordsjø II which *"borders the Danish sector in the North Sea, and is relevant for direct export of electricity"*

Denmark: directional agreement of new government:

- *Examination of the possibility that Denmark, together with the North Sea countries, develop a common strategy to significantly expand and utilise the offshore wind potential;*
- *Explore the possibility that Denmark will, by 2030, build the first energy island with a minimum of 10 GW connected.*

UK: Crown Estate has started Round 4 for offshore wind leasing including sites close to the NL/DE/DK EEZ



Netherlands:

- Roadmap for 11 GW offshore wind in 2030
- Ambition to develop North Sea as 'Green Powerhouse' with growth up to maximum of 60 GW towards 2050

Source: LCoE mapping model

International coordination and cooperation across stakeholders

The Hub-and-Spoke concept is ready to deliver on climate goals

Close cooperation between

- gas and electricity grid operators to develop the energy grid that facilitates high penetration of renewables
- policy makers to provide internationally coordinated marine spatial planning and the regulatory framework and market design adequate to deliver on the climate goals
- industry players to develop the supply chain and capacity to deliver
- NGOs to create maximum benefits for the environment and realising the climate goals

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