North Sea
Wind Power Hub
Programme

Introduction to the North Sea Wind Power Hub

RGI Webinar-Connecting Europe

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Towards net-zero in 2050

The Paris agreement implies a radical energy system change

This change must be swift and massive

We need huge capacities of offshore wind, interconnection and seasonal storage

We need a steady and accelerated deployment based on transnational planning

- Today, climate policy is largely national, decoupled and incremental. We need a new approach to effectively realise the potential of the North Sea and reach the goals of the Paris Agreement.
- We take a different perspective: harnessing the power of the North Sea requires a **transnational and cross-sector approach** to take the step-change we need.

Vision of the Consortium

- To reach climate neutrality in 2050, significant (300 GW) offshore wind capacity needs to be built
- We consider it our social responsibility to pro-actively facilitate affordable and secure connection and integration of this vast amount of energy
- This requires a series of hub-and-spoke projects, with the ambition to realise the first hub(s) in the early 2030s

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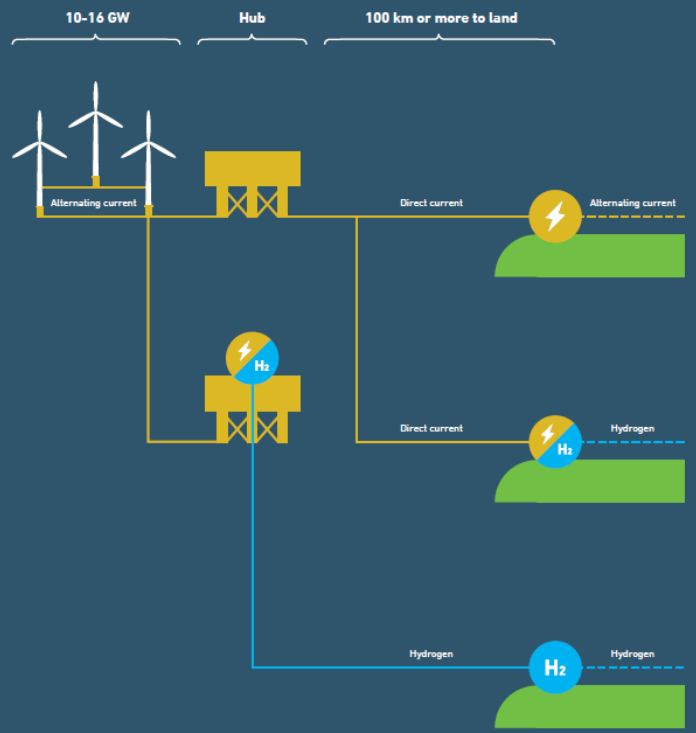
A solution is at hand

The hub-and-spoke model offers the ability to integrate offshore wind at large scale

- **Collect** vast amounts of offshore wind power generated at wind farms and energy islands in the North Sea at a few de-centralised hubs.
- **Connect** these hubs in a flexible network that spans the North Sea and can supply power deep into the European mainland to supply millions of consumers with green energy.
- **Convert** surplus electricity to hydrogen to expand the uses of the green power and reduce CO2 emissions from heavy industry, transport and more.

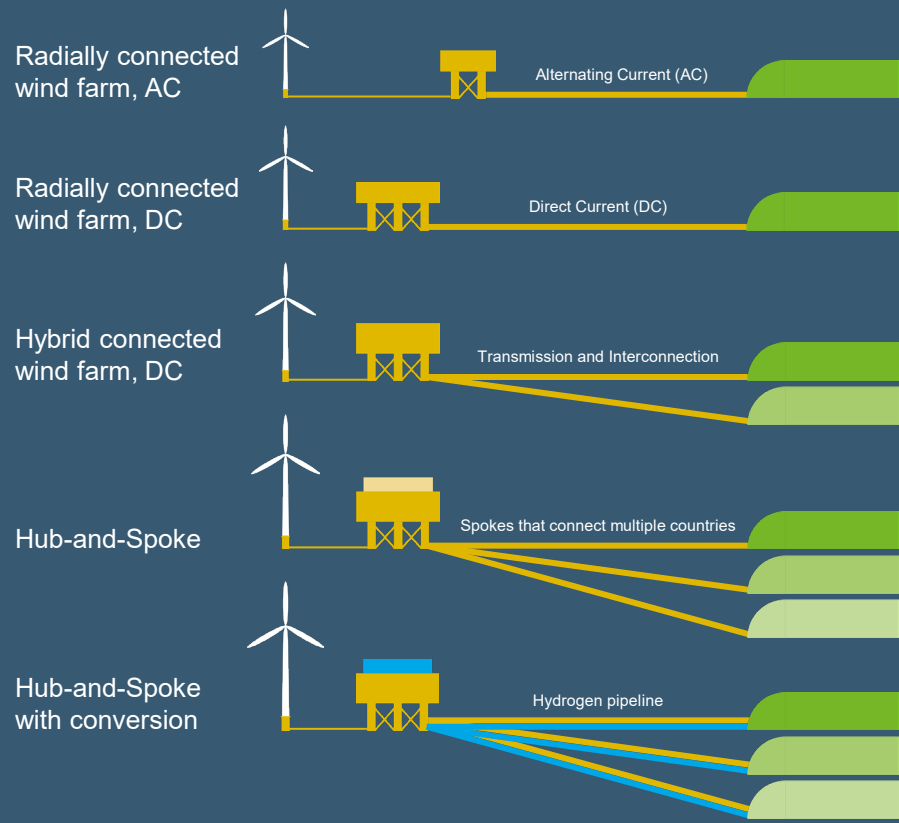


Turning vision into reality

What it takes to make the first hub-and-spoke project a reality in the early 2030's

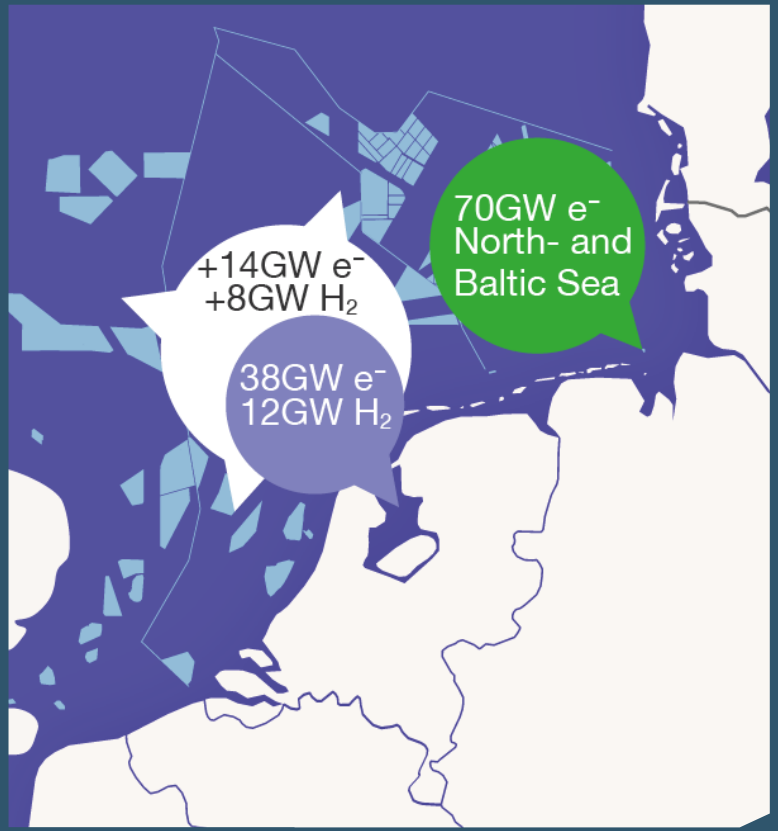
- Intensive development and sharing of knowledge and concepts
- Close cooperation between countries, stakeholders and TSO's
- Integrated decision-making at all levels and across country borders

Hub-and-spoke is a next step in the evolution of offshore wind connections



Main Questions to be answered

- What will the future system look like?
- Where will the energy flows go?
- What are the costs and benefits of a future system
- How to divide costs and benefits between countries
- How much need is there for conversion to hydrogen



Work of the Consortium

We explore four areas

System integration

What are the challenges and drivers to integrate large scale offshore wind in an energy system in transition? Which design principles can be determined for the energy-infrastructure in the North Sea?

Technical feasibility

What are the technical design principles for individual system elements of a hub-and-spoke project?

Costs & Benefits

How do we calculate the costs and benefits of hub-and-spoke projects given their unique characteristics to collect, connect, and convert energy?

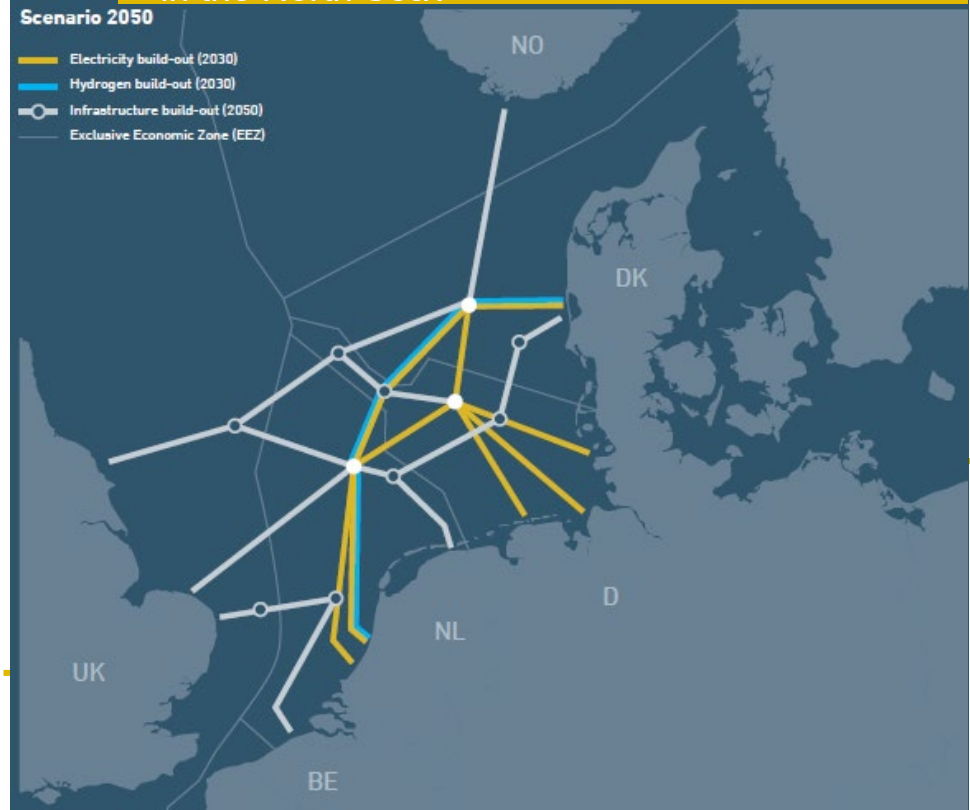
Regulation & market design

What choices are needed by national and European governments to provide sufficient investment clarity for hub-and-spoke project and offshore wind roll-out?

System integration: A blueprint for the new energy highways

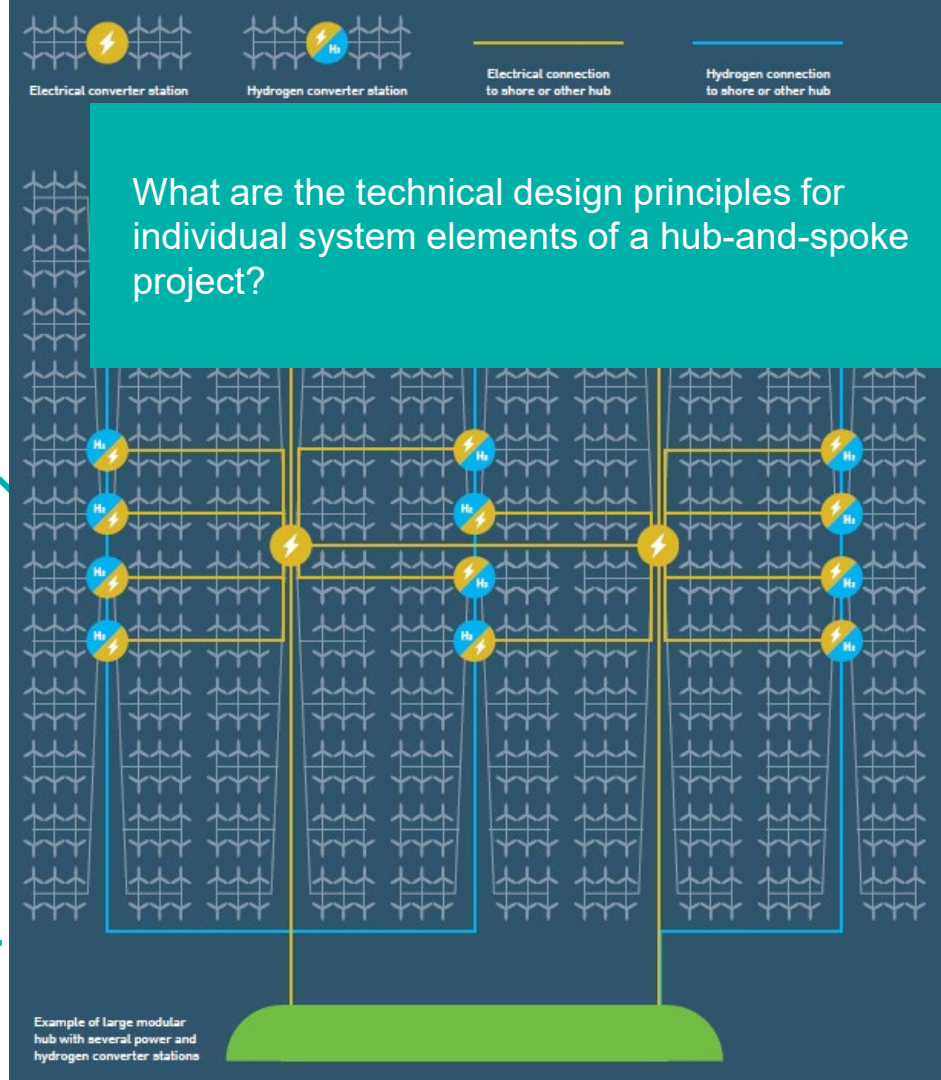
- A coordinated roll-out for 2050 could look as shown here with multiple north-south and east-west energy connections able to transport electricity and hydrogen.
- A coordinated roll-out with multiple energy connections between North Sea countries is much more efficient than just connecting every new wind farm to its home country.
- A 2030 scenario includes Denmark, the Netherlands and Germany in an integrated system. The 2050 scenario also includes Belgium, Norway and the United Kingdom.

What are the challenges and drivers to integrate large scale offshore wind in an energy system in transition? Which design principles can be determined for the energy-infrastructure in the North Sea?



Technical feasibility insights

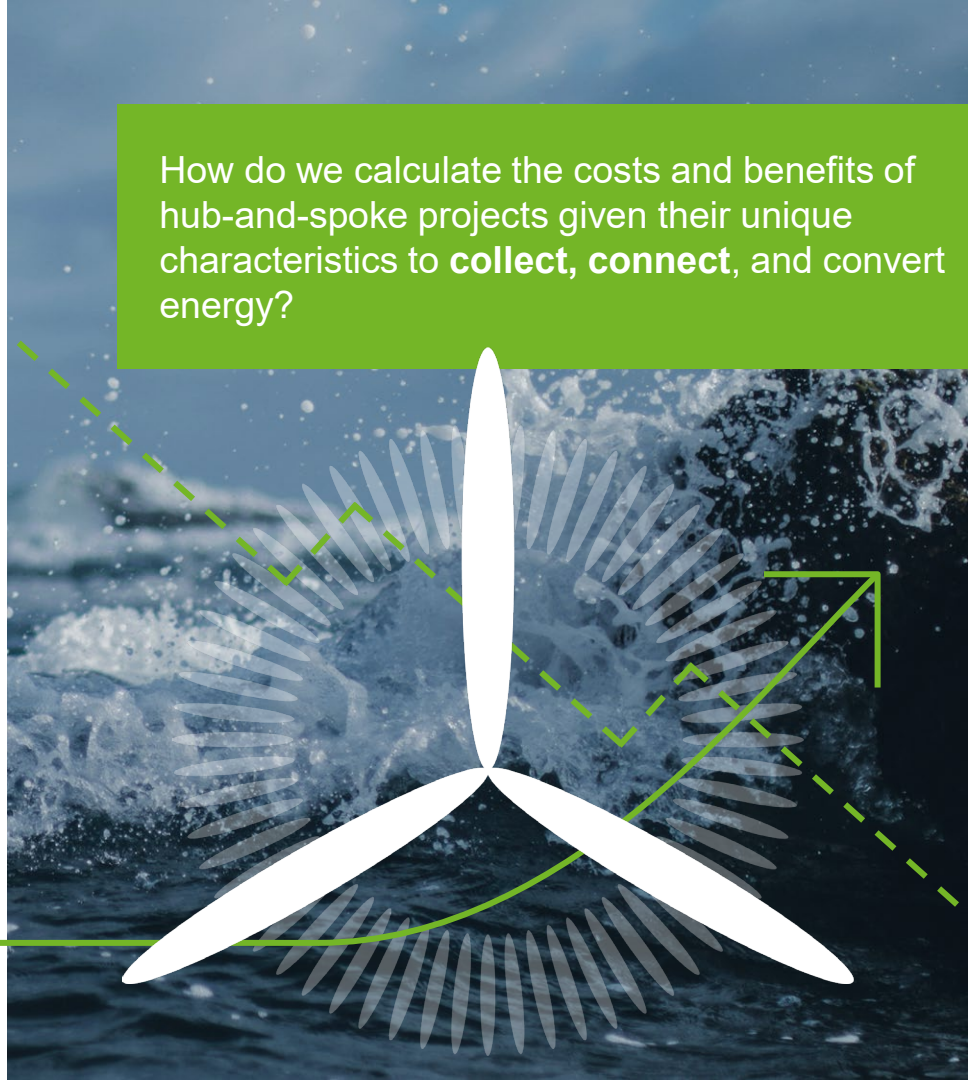
- All elements of a hub and spoke project, including substructure, high voltage direct current (HVDC) infrastructure, offshore electrolysis, and hydrogen infrastructure are technically feasible.
- A modular build-out of hub-and-spoke projects is possible. This can ensure that an initial 2030 project will be compatible with later design choices without tearing down or rebuilding earlier parts.
- The approach requires investment up front today that will only pay off in the long run.



Costs & benefits insights

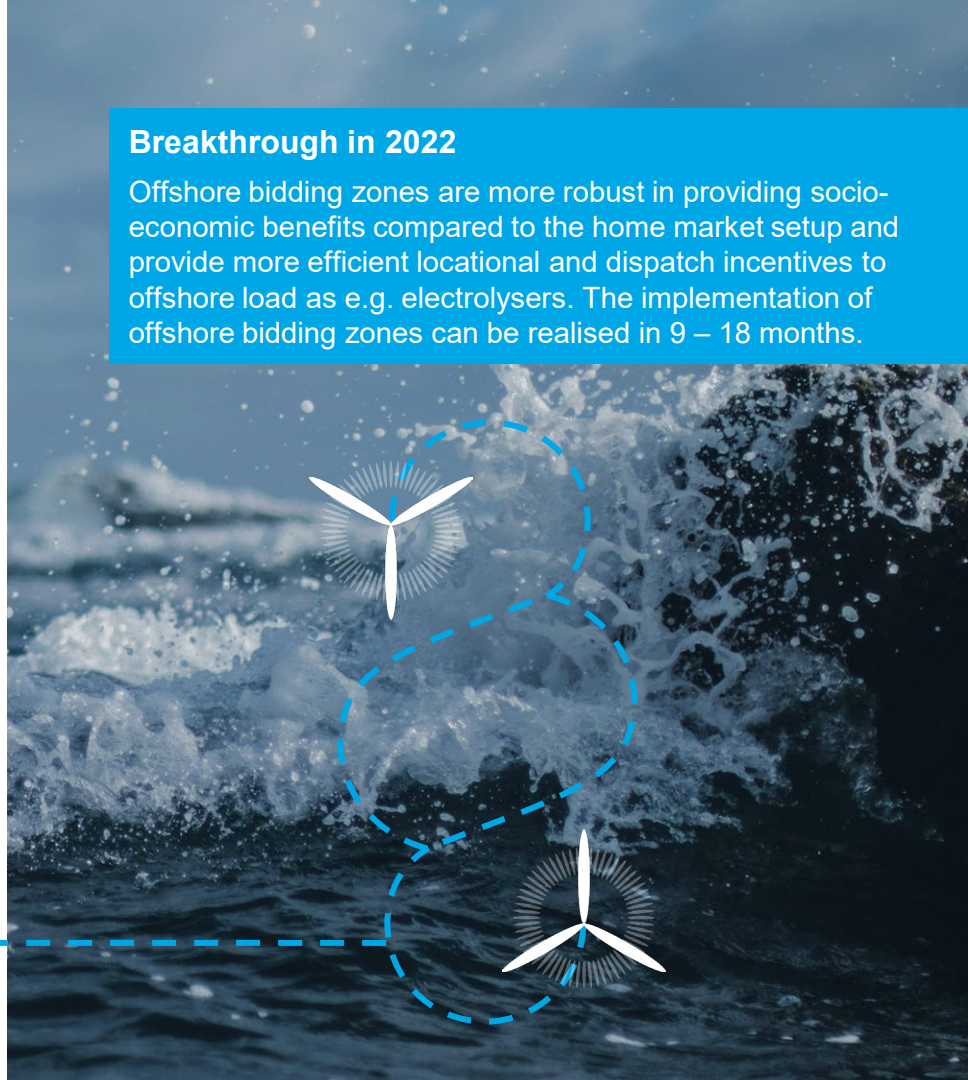
- The true heroes of the wind story will be the offshore hubs. They will make offshore wind at massive scale truly cost competitive.
- Deviations from traditional CBA methodologies are necessary to assess the unique characteristics of a hub-and-spoke concept.
- We identified key drivers for a positive CBA and show that the hub-and-spoke concept is a future-proof way for offshore infrastructure build-out.

How do we calculate the costs and benefits of hub-and-spoke projects given their unique characteristics to **collect, connect**, and convert energy?



Regulation & market design insights

- Financing and cost recovery of hub-and-spoke projects can be largely covered by existing national financial and economic frameworks.
- Many policy and regulatory processes are already underway within Europe, however, many topics still lack clarity or direction
- Important first steps in international cooperation between North Sea countries are being undertaken. This needs to accelerate to move towards actual project development



Breakthrough in 2022

Offshore bidding zones are more robust in providing socio-economic benefits compared to the home market setup and provide more efficient locational and dispatch incentives to offshore load as e.g. electrolysers. The implementation of offshore bidding zones can be realised in 9 – 18 months.

Knowledge

At the North Sea Wind Power Hub, we are developing a solid knowledge base to ensure that countries choose the right solution for unlocking the potential of the North Sea Wind.

- Any -
Cost & benefits
Programme Overview
Regulatory & market design
System integration
Technical feasibility

REGULATORY & MARKET DESIGN

November 2020

Discussion paper – Topical Agenda

The North Sea Wind Power Hub (NSWPH) consortium developed this Topical Agenda to support policy and regulatory developments supporting and accelerating offshore wind deployment in the North Sea.

REGULATORY & MARKET DESIGN

November 2020

Discussion paper – Market setup options for hybrid projects

The North Sea Wind Power Hub addresses knowledge gaps that remained untouched in the previous discussion paper on market setups by showing the impact of the Home Market setup and the Offshore Bidding Zone setup on the existing national legal and regulatory frameworks in Denmark, Germany and the Netherlands.

TenneT offshore at glance (2023)

Making clean wind energy from the North Sea a reality

10,6 GW
Combined transmission capacity of offshore grid connection systems

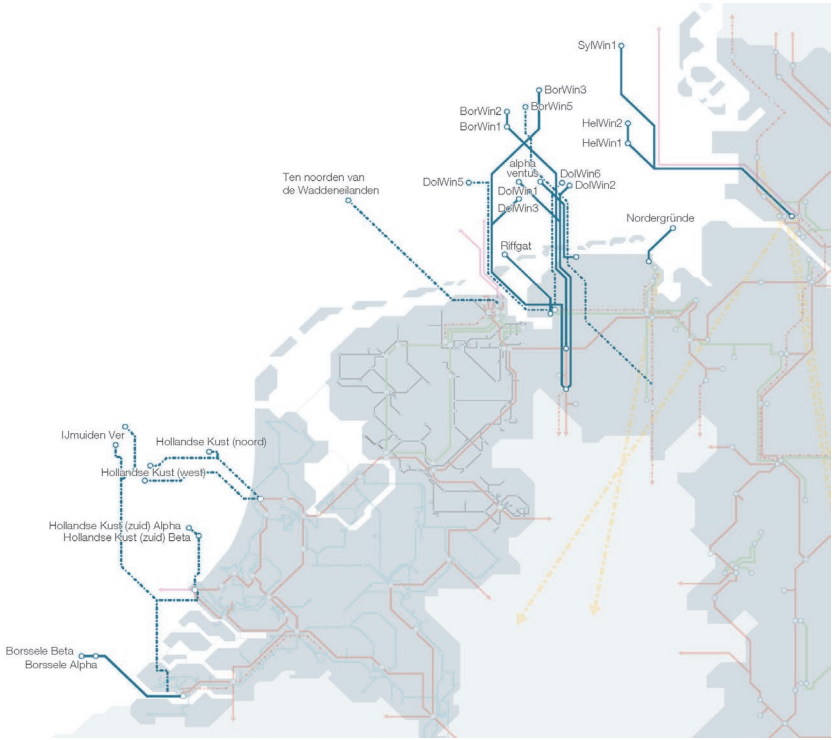
4
interconnectors

total cable system length
3,600 km

17 offshore
grid connections

29 TWh
transmission of offshore wind energy

Length up to
205 km
per connection



Our offshore projects until 2031

We already operate **17 offshore grid connections** in the Netherlands and Germany and four interconnectors across European borders. **With 22 new connections to come until 2031.**

Currently supplying **more than 16 million European households.**

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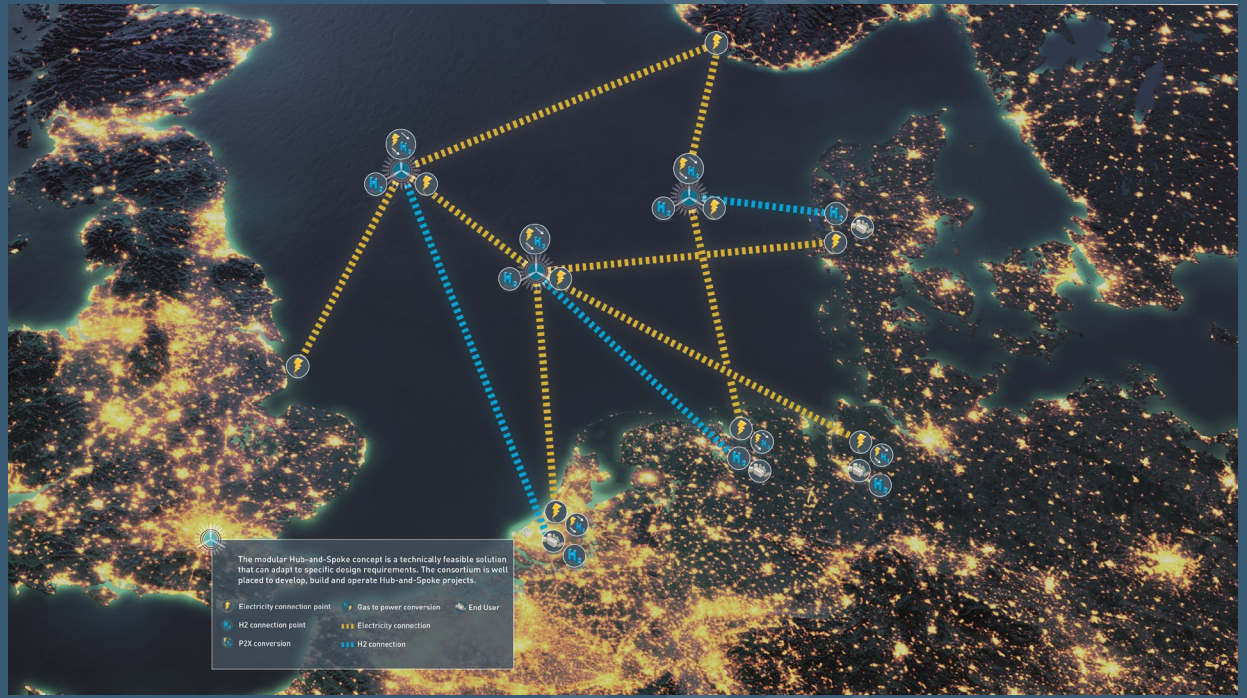

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