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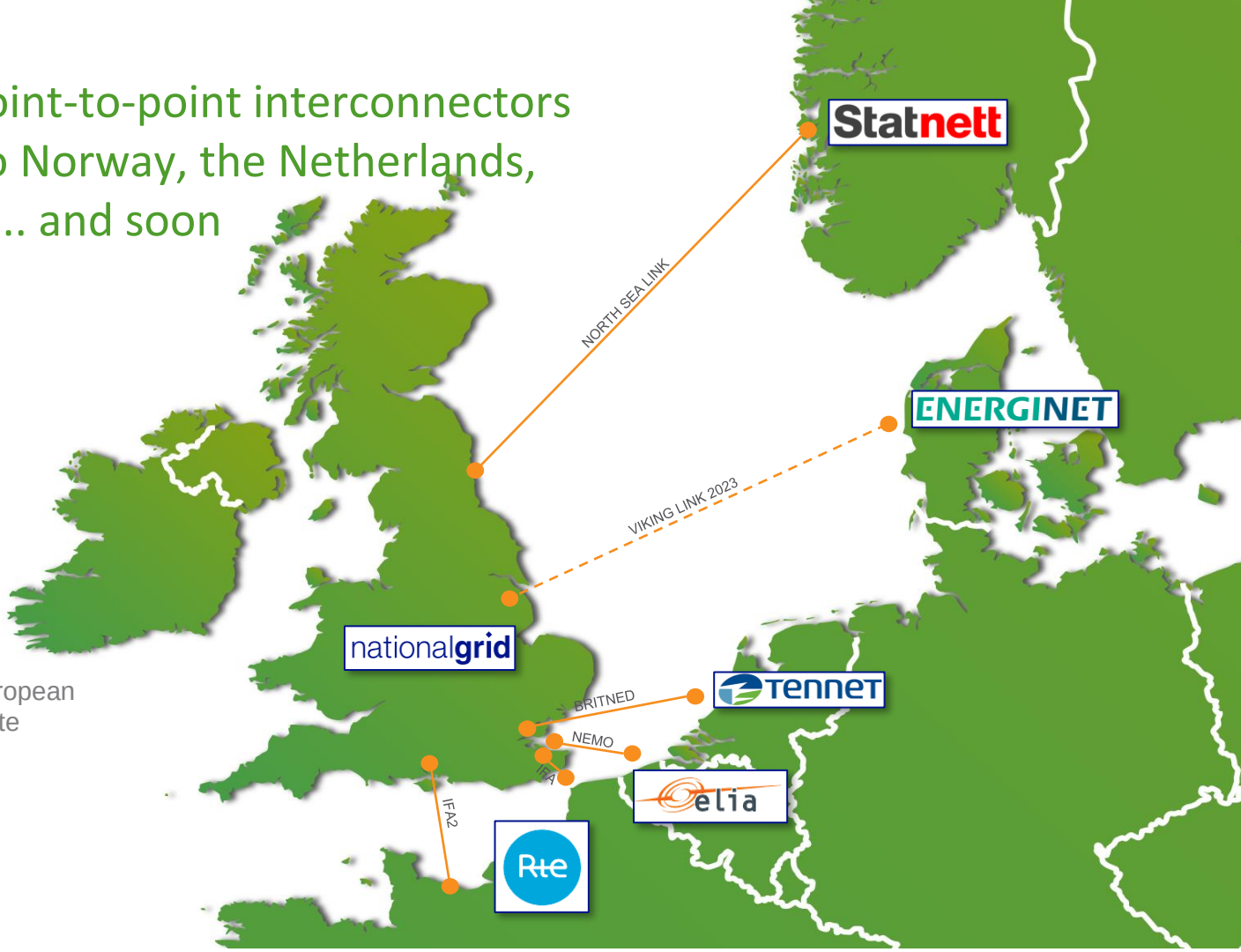
The role of interconnected electricity assets and markets in supporting the energy transition

September 2023

National Grid's point-to-point interconnectors connect the UK to Norway, the Netherlands, Belgium, France….. and soon Denmark



8GW

By 2024 National Grid and our European partners will jointly own and operate ~8GW of interconnector capacity

Interconnectors strengthen security of supply by providing flexible and reliable access to large volumes of electricity

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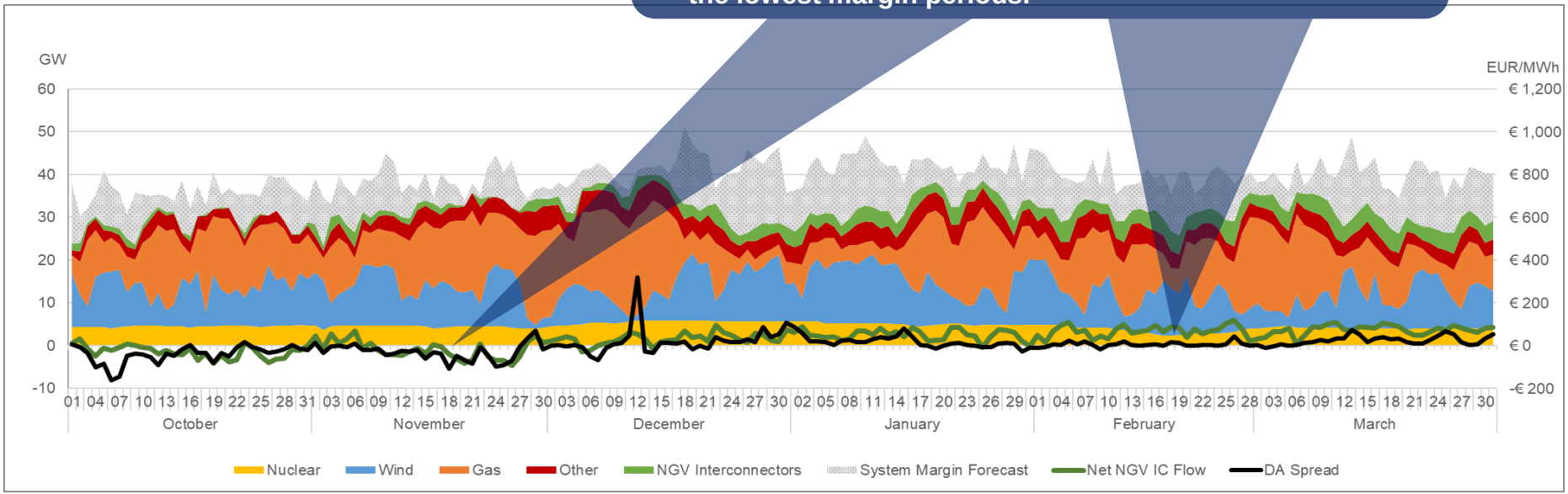
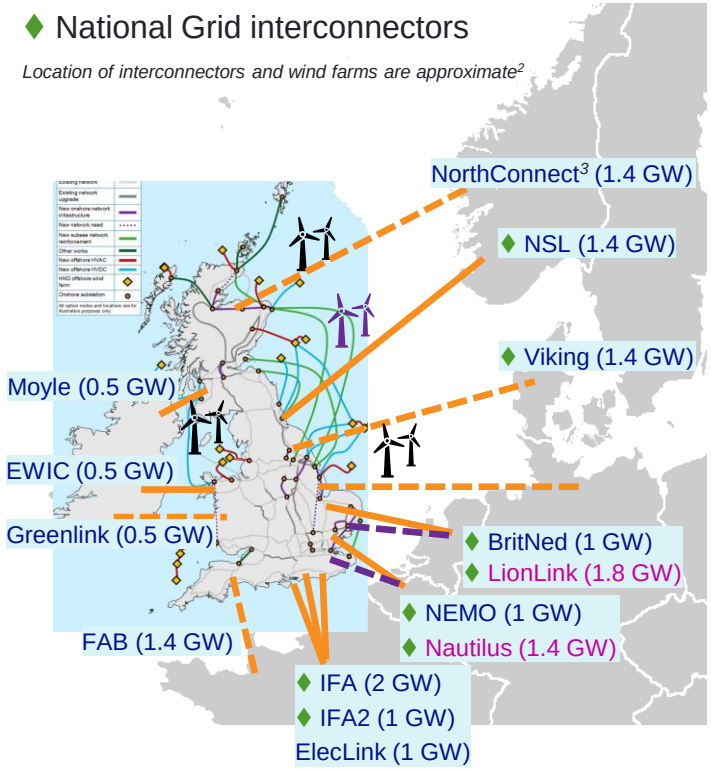
"Close cooperation between European system operators through reciprocal support has played an important role in helping maintain secure supplies for customers in Great Britain and Europe." **UK Electricity System Operator**

- **GB was a net exporter in early Winter, supporting EU, but a net importer later in Winter as EU conditions improved.**
- **Interconnectors quickly switched to net imports during the lowest margin periods.**



The UK's offshore electric networks will support the growth in offshore wind and reduce onshore constraints

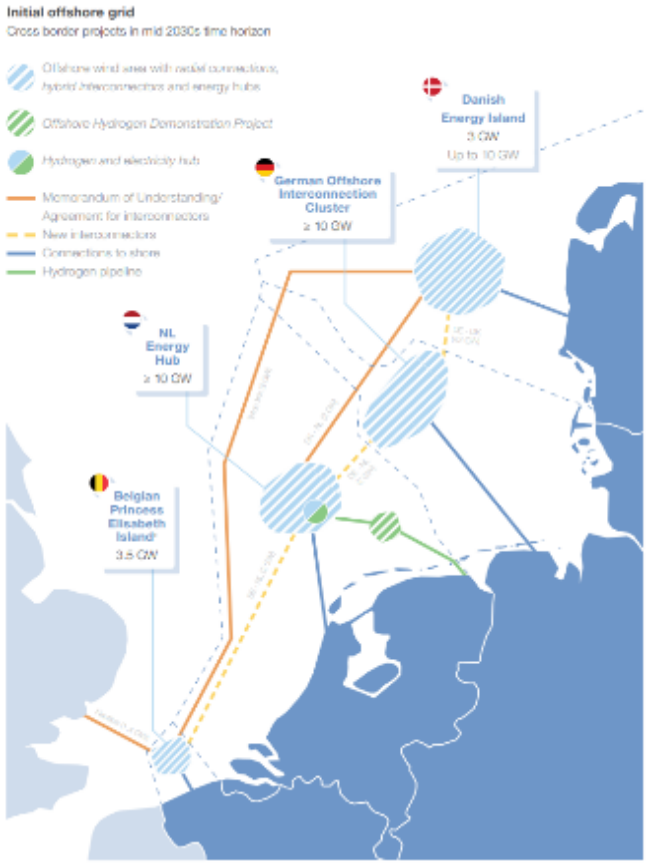
	Current	Under development	Potential in 2030
Interconnectors	**Point-to-point** • # operational: 8 • Capacity: 8.4 GW (incl. IE) • Length: 1,700 km	**Point-to-point** • # in development: **3 (total 4.2 GW)** • # planned: **2 (total 1.9 GW)** **Offshore hybrid assets** • # Multi-Purpose Interconnectors: **2** • Total: **3.2 GW**	**28.4 GW** (North Sea countries incl. IE)
Offshore wind	**Capacity: 13.6 GW** • Turbines: **2,652** • Wind farms: **44**	**Capacity: 6.7 GW** • Turbines: **545** • Wind farms: **6**	**Capacity: 117 GW** (North Sea countries incl. IE)
Offshore Tx	**OFTO network** • Licenced: **24** • Capacity: **9.5 GW** • Circuit: **~2,300 km (2021)**[1]	**Wet wires and bootstraps** • National Grid assets • Ofgem approved ~**6 GW HVDC bootstraps**[2]	**~37,000 km** to enable offshore wind and increased interconnection



Source: [1] National Grid ESO "National Electricity Transmission System Performance Report 2020–21"; [2] Two Eastern HVDC bootstraps 4 GW and one Western HVDC bootstrap 2 GW; [3] ENTSO-E Transmission System Map (link); [4] OFGEM Interconnectors | Ofgem

We are working with partners and industry stakeholders to develop the next stage of interconnection – Offshore Hybrid Assets (OHAs)

- Across the UK and Europe, there is a **shared ambition to achieve net zero emissions and bolster energy security**, which has strengthened following Russia's invasion of Ukraine.
- **North Sea countries have big plans to deploy offshore wind – with targets adding up to 300GW by 2050.**
- **Offshore Hybrid Assets (OHA) will be critical** – they combine the functions of a traditional cross-border interconnector and a transmission connection for an offshore wind farm.
- **But we need more coordinated planning** and **compatible regulation** of offshore development with collaboration between UK and EU partners to ensure successful delivery and alignment of infrastructure.
- **Offshore Hybrid Assets** are the next step in the development of the North Sea and alongside **energy islands** could contribute to a fully integrated **offshore grid** in the longer-term.



Esbjerg Declaration Expert Paper April 2023.
Recently extended to 5 other countries, including the UK.

We have three projects in development that will require close engagement with our partners and Ofgem over the next 6 months

- LionLink is an Offshore Hybrid Asset to the Netherlands via Dutch offshore wind (partnering with TenneT).
- The project is progressing towards key procurement decisions in December and development activities starting with the seabed survey planned for April 2024.
- A joint programme is being put together by both parties to achieve an in service date of 2031.
- Regulatory and commercial agreements with Ofgem and TenneT are being discussed in parallel, with a decision on both expected in Q1 2024.

- Nautilus is an Offshore Hybrid Asset to a Belgium energy island (partnering with Elia).
- The key procurement and development activities are expected to start in May 2024 (seabed survey)
- We face the same regulatory timelines for Nautilus as LionLink (Q1 2024), with parallel negotiation expected with Elia and Ofgem.
- Commercial operations is expected in late-2030.

- Continental is an Offshore Hybrid Asset to Norway via a UK offshore wind farm.
- It is at an earlier development stage, with various design options being considered.
- A connection to Denmark is also being progressed in parallel.
- Commercial operations is expected 2035 to Norway. The Denmark connection would enter operations in 2033.

Summary

- **Interconnectors** contribute to all three aspects of the energy trilemma.

  - They strengthen **security of supply** of electricity
  - They allow consumers to have access to **cheaper electricity** and prevent excessive profits through the Cap & Floor mechanism
  - They complement **renewable energy**, enabling it to be imported and exported between countries

- **Offshore Hybrid Assets (OHAs)** will contribute further to net zero goals by combining interconnectors and offshore wind farms.
- **UK-EU co-operation** on energy post-Brexit is essential to facilitate the development of complex offshore infrastructure like OHAs.

- National Grid have three OHA projects in development – **LionLink, Nautilus and Continental.**

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