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Powering Europe with North Sea Offshore Wind

The impact of hydrogen deployment on grid investments and power prices

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Agenda

- Motivation
- Research questions
- Case study introduction
- European generation capacity
- North Sea wind investments
- Interconnection capacity
- Influence on power prices

Photo credit: Ole Jørgen Bratland, Equinor

Motivation

- There is substantial research on using excess renewable electricity to make hydrogen
- Typical methodology includes a case study of a single project
- Linking with electricity sector is typically poor

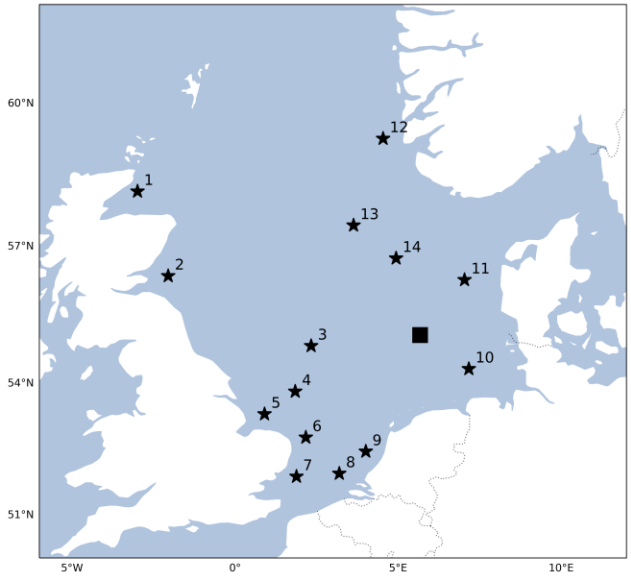
Photo credit: Ole Jørgen Bratland, Equinor

Research questions

- How are investments into the European grid affected by deployment of electrolyzers?
- How does the North Sea contribute to Europe's energy transition?
- How are European grid investments affected by the inclusion of an offshore energy hub in the North Sea?
- How does the hydrogen economy affect the power prices in North Sea countries?

Case study

- Investigate investments into power and hydrogen sectors until 2060
- Power & hydrogen operations explicitly linked
- Focus on the North Sea area

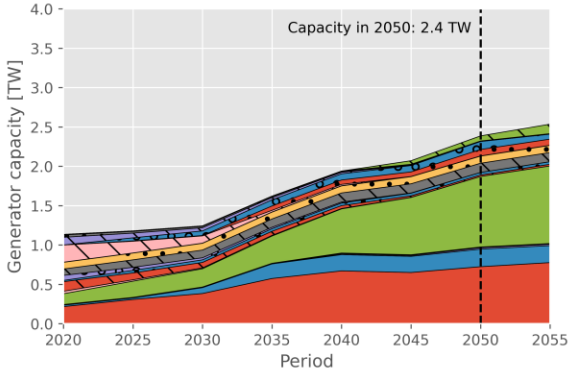


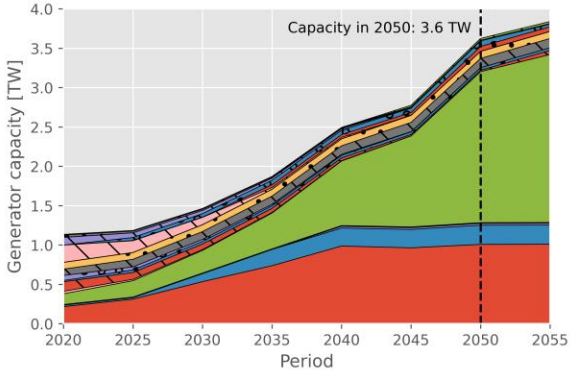
European generation capacity

Without hydrogen

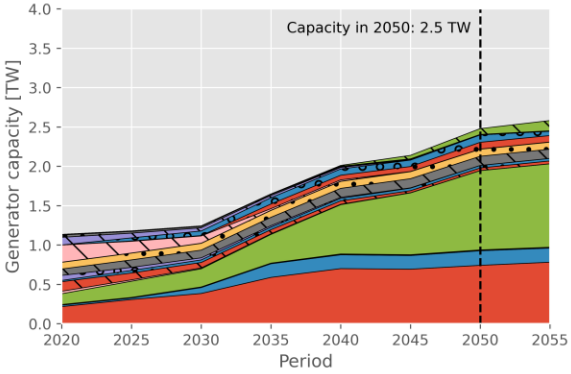
With hydrogen

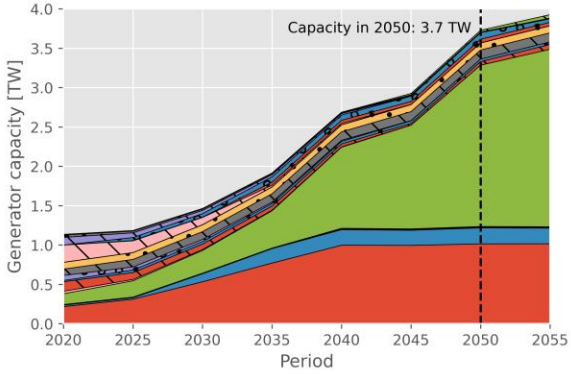
With energy hub





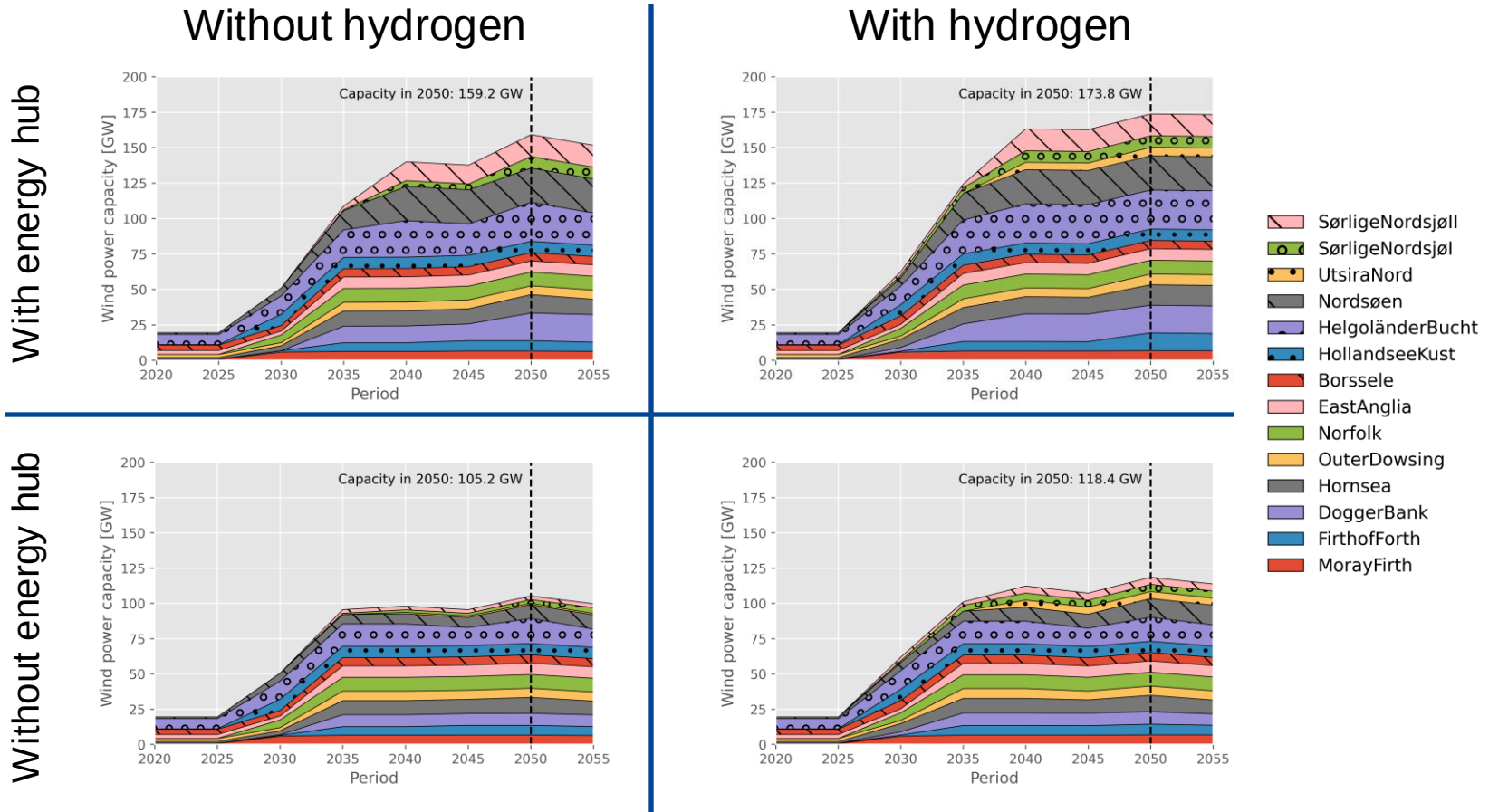
Without energy hub





Bio
Bio10cofiring
Bioexisting
Coalexisting
GasCCGT
GasOCGT
Gasexisting
Geo
Hydroregulated
Hydrorun-of-the-river
Liginiteexisting
Lignite
Nuclear
Oilexisting
Solar
Waste
Wave
Windoffshorefloating
Windoffshoregrounded
Windonshore

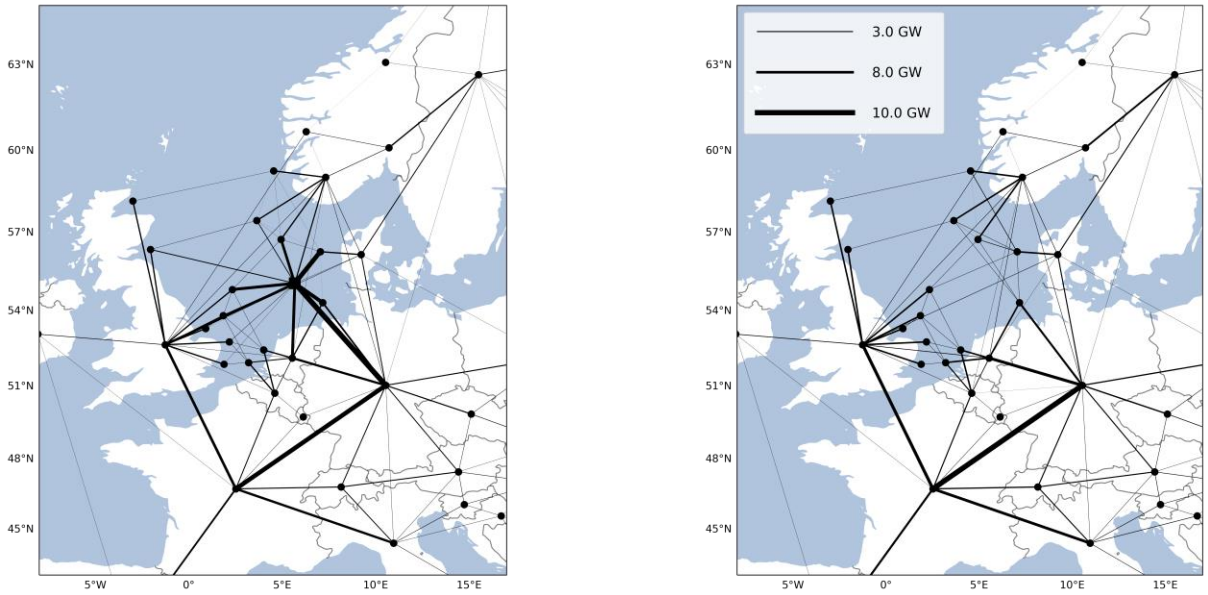
North Sea offshore wind investments



Interconnection capacity

	Without hydrogen	With hydrogen
With offshore energy hub	248.7	264.8
Without offshore energy hub	154.0	165.0

North Sea grid transmission capacity (GW)



Influence on power prices

Price zone	Winter	Spring	Summer	Fall	Yearly average
		Without hydrogen			
NO2	17.0	32.7	12.7	55.7	42.6
Germany	100.0	58.2	38.0	107.3	90.1
France	86.9	43.0	26.7	89.4	76.3
		With hydrogen			
NO2	65.4	39.7	62.6	77.5	63.0
Germany	92.9	56.7	53.8	95.5	86.1
France	84.0	46.3	51.7	83.2	77.8

Mean of expected power prices for each season in 2050. (Euro/MWh)

Summary

- Significant investments into the grid are required to support green hydrogen production
- An offshore energy hub unlocks North Sea wind potential
- Green hydrogen production and the power market are closely linked, and this cannot be ignored

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