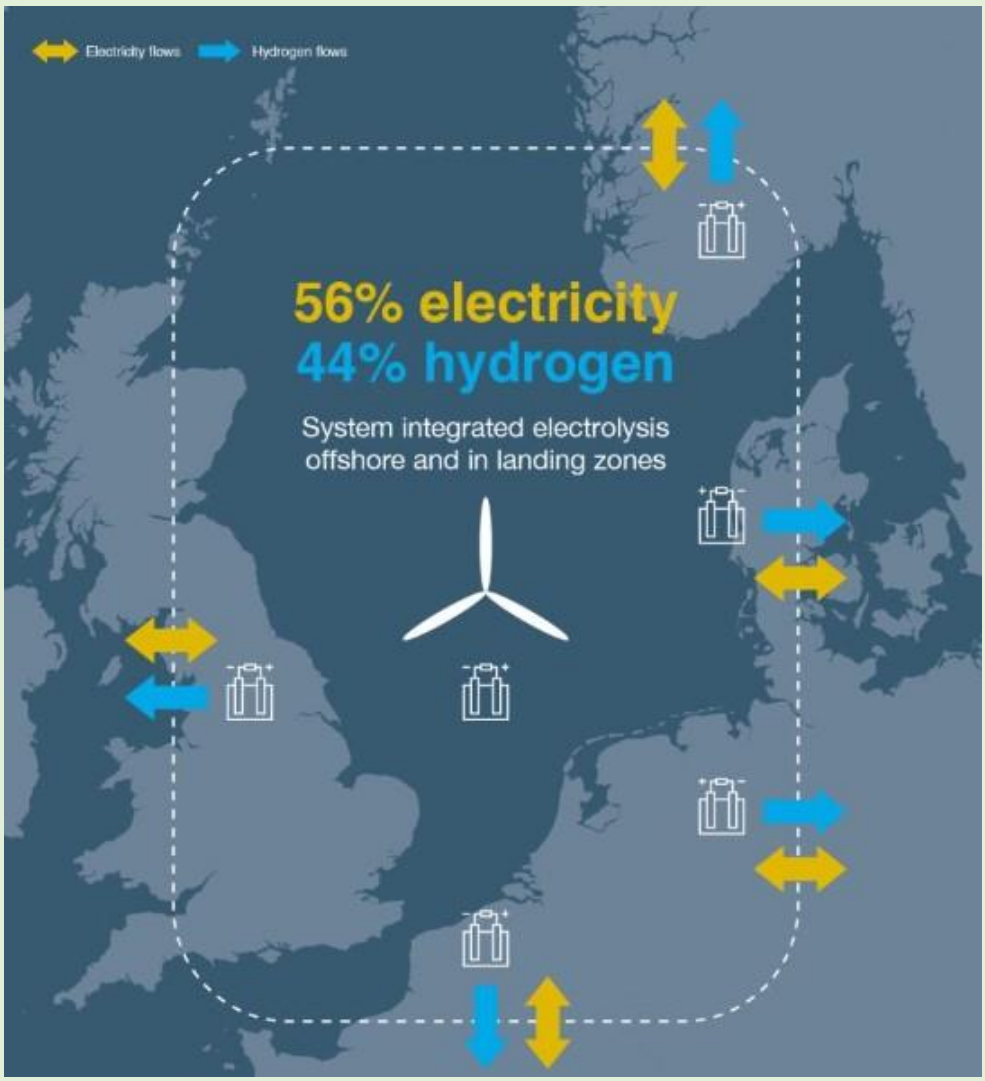
The North Sea

Wind Power Hub Programme



The North Sea Wind Power Hub Programme

A chance to review the rather striking North Sea Wind Power Hub Programme, which has just emerged from Energinet, Gasunie and Tennet - and financed by the EU.

They state:

Europe needs 350GW of offshore wind and the North Sea will house approximately 70% of this capacity.

Hubs-and-spokes allow for 32GW more wind in the North Sea.

The North Sea should be regarded as a renewable energy resource rather than just an electrical resource. In the basecase we find that 44% of the harvested energy is converted into hydrogen.

Increased offshore wind capacity enhances hydrogen self-sufficiency as it enables more European hydrogen production.

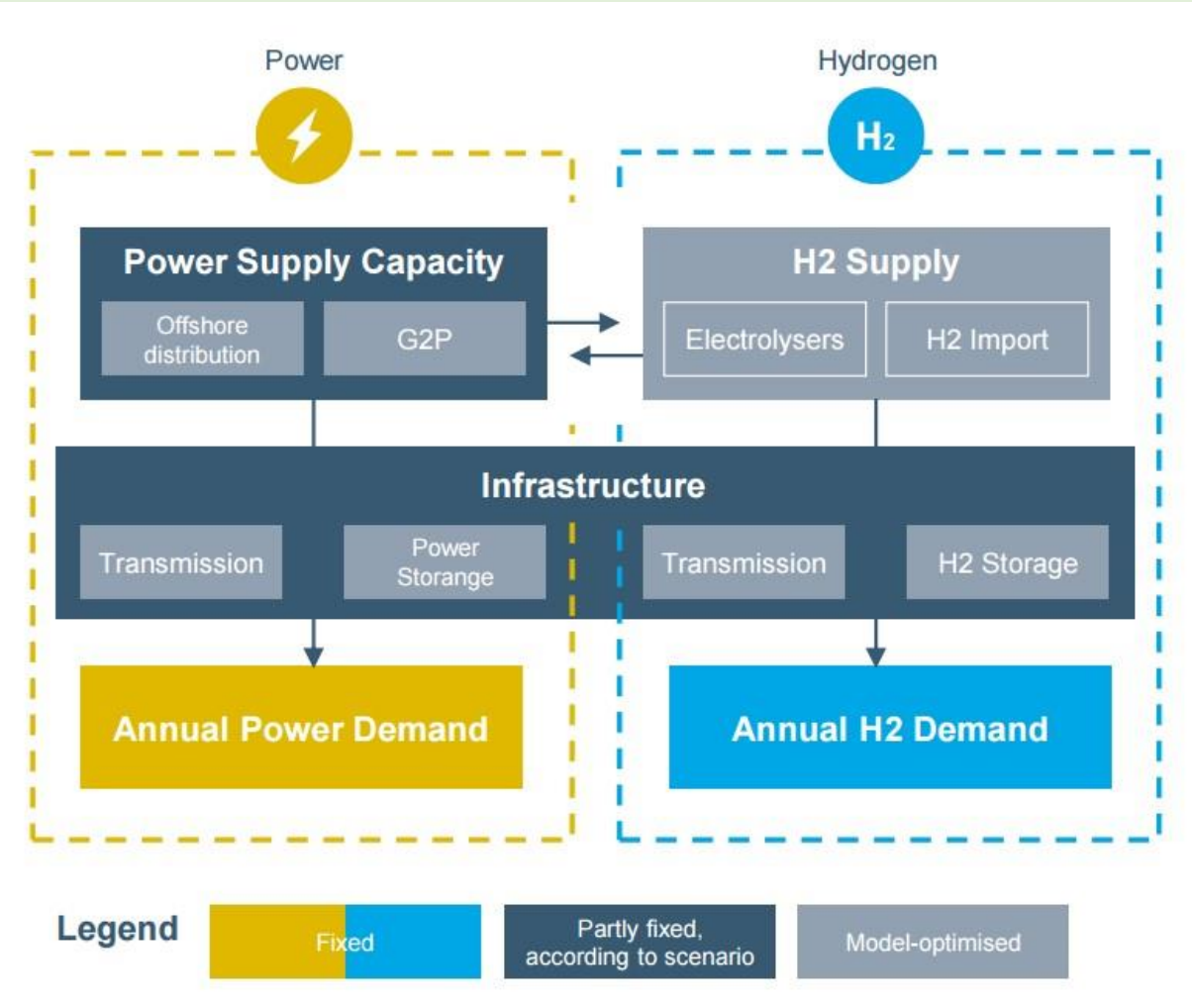
It reminds me of a similarly ambitious proposal when I was working in Scotland and in the 'Isles project', the wind industry in 2011 was looking at whether endless connections to shore were really the best way to get projects away, or whether it should be centralised, and whether hubs might be the solution.

There was even a high-profile launch at Hampden Park, the National Stadium in Scotland.

Isles, an expensive project, which ultimately seems to have fizzled out.

The hubs themselves were not a bad idea, but nobody was quite sure how they would work in practice and whether early movers may suffer delay.

Developers weren't keen that they would lose control over the timetable, and even worse for them, that rival developers might steal a march and be the ones to gain.



One advantage of hydrogen is that it uses pipelines rather than cables. And given the fact that even a rudimentary knowledge of physics knows that electricity and water is a somewhat problematical mix.

Note: Positive values correspond to savings of the indexed (x-axis) scenario against the referenced scenario within the figure's title. Values are annual. Savings per MWh reflect savings in terms of system wide power demand. For a more detailed cost breakdown across scenarios, refer to upcoming sections.

2050	Geo-optimised VRE	DE Free Offshore	DE Fixed Offshore	No Hubs-and-Spokes	Unrestricted Solar	IC Limits
Total System Cost (bn. €)	554	574	575	575	558	576
% Savings against DE Free Offshore	3.55%	-	-0.04%	-0.17%	2.90%	-0.25%

If that could be avoided, it would remove some of the electrical grid, perhaps constraints, especially if some of the existing pipeline network out in the North Sea could be reconstituted in a circular manner

Hydrogen production from offshore wind is based on a mix of both on- and offshore electrolysis

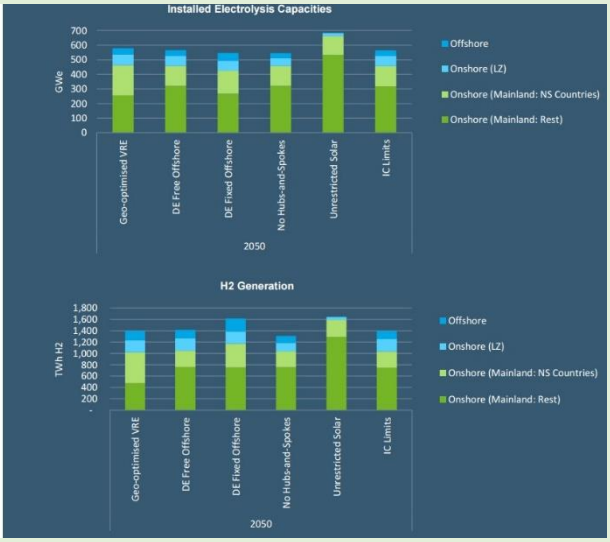
The majority of electrolysers installed in the system are onshore electrolysers in inland regions, as shown in the figure to the right. Much of this electrolyser capacity is **supplied by electricity from solar PV and onshore wind turbines.** A more detailed breakdown can be found in the Appendix.

If the system was to produce hydrogen with offshore wind generation, the model has the option to place the electrolysers in either offshore or in a landing zone.

In 2030, there are no offshore electrolysers while 14 GWe is installed in landing zones. In 2040 however, there is 39 GWe installed in landing zones and 22 GWe offshore electrolysers, showcasing close cost competitiveness when accounting for system synergies. An illustrative cost comparison between onshore and offshore electrolysis is shown in upcoming sections.

Transitioning to 2050 electrolyser capacities are further increased both offshore and in landing zones, where electrolysers also have the advantage of being supplied by radially connected offshore wind farms, which are not part of the offshore grid.

The hydrogen production in landing zones and offshore can be heavily challenged by a higher solar PV buildout. No hubs-and-spokes buildout would also reduce the hydrogen production from offshore sites and in landing zones.



Financial modelling runs throughout the document. The hub and spoke model fares well, one in which the hubs are put in place, and from which then spokes to the various zones and sites then emanate.

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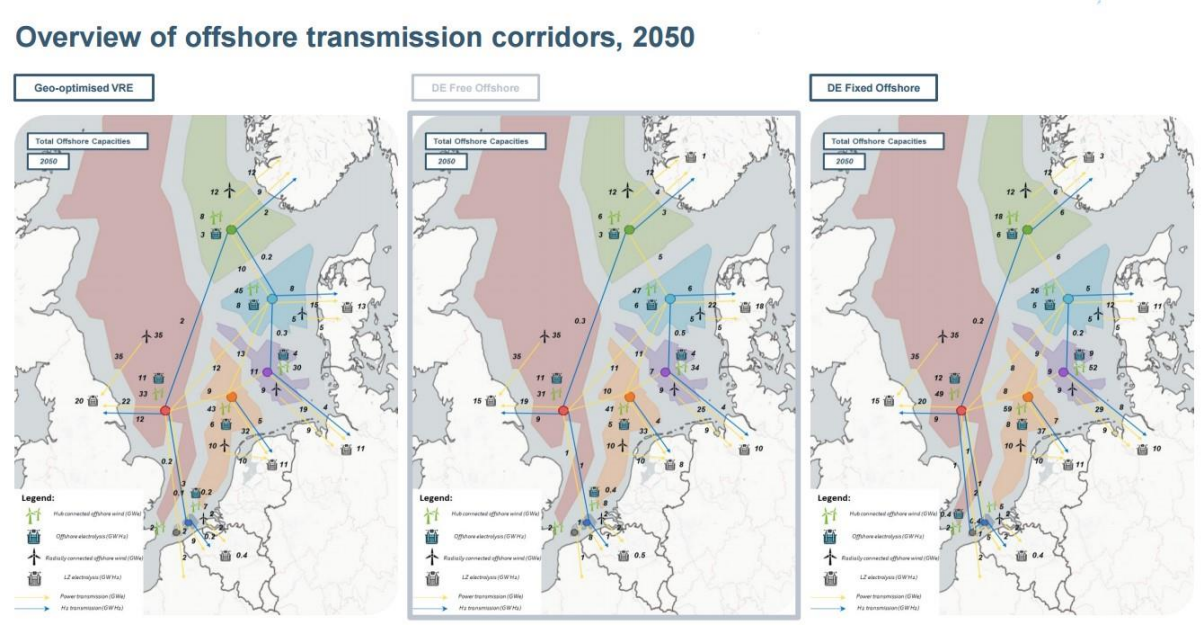
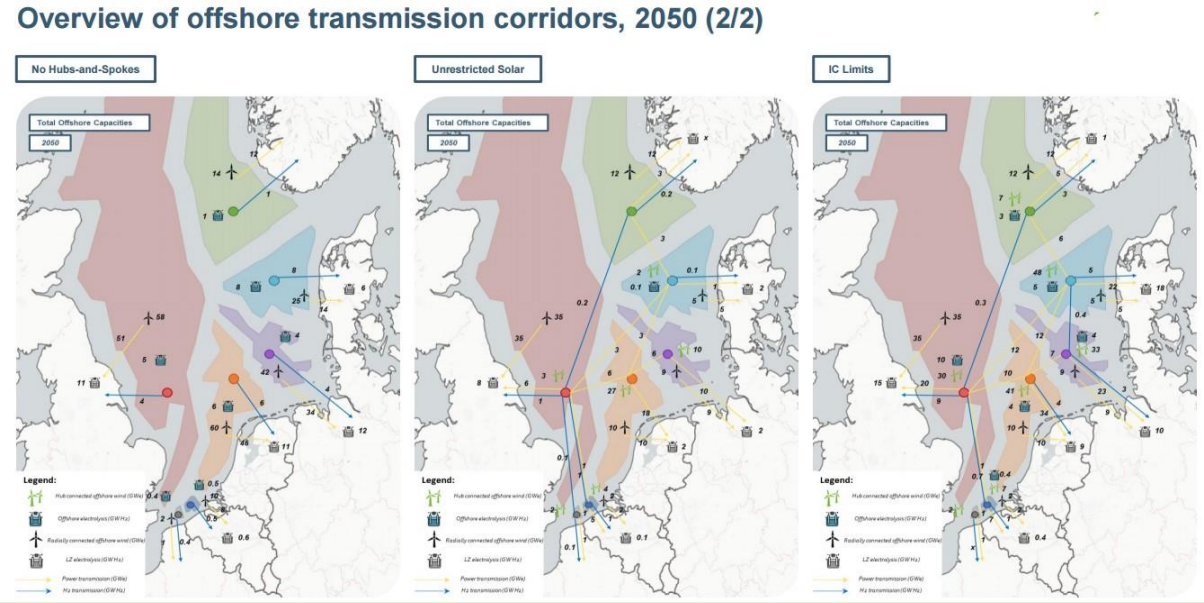
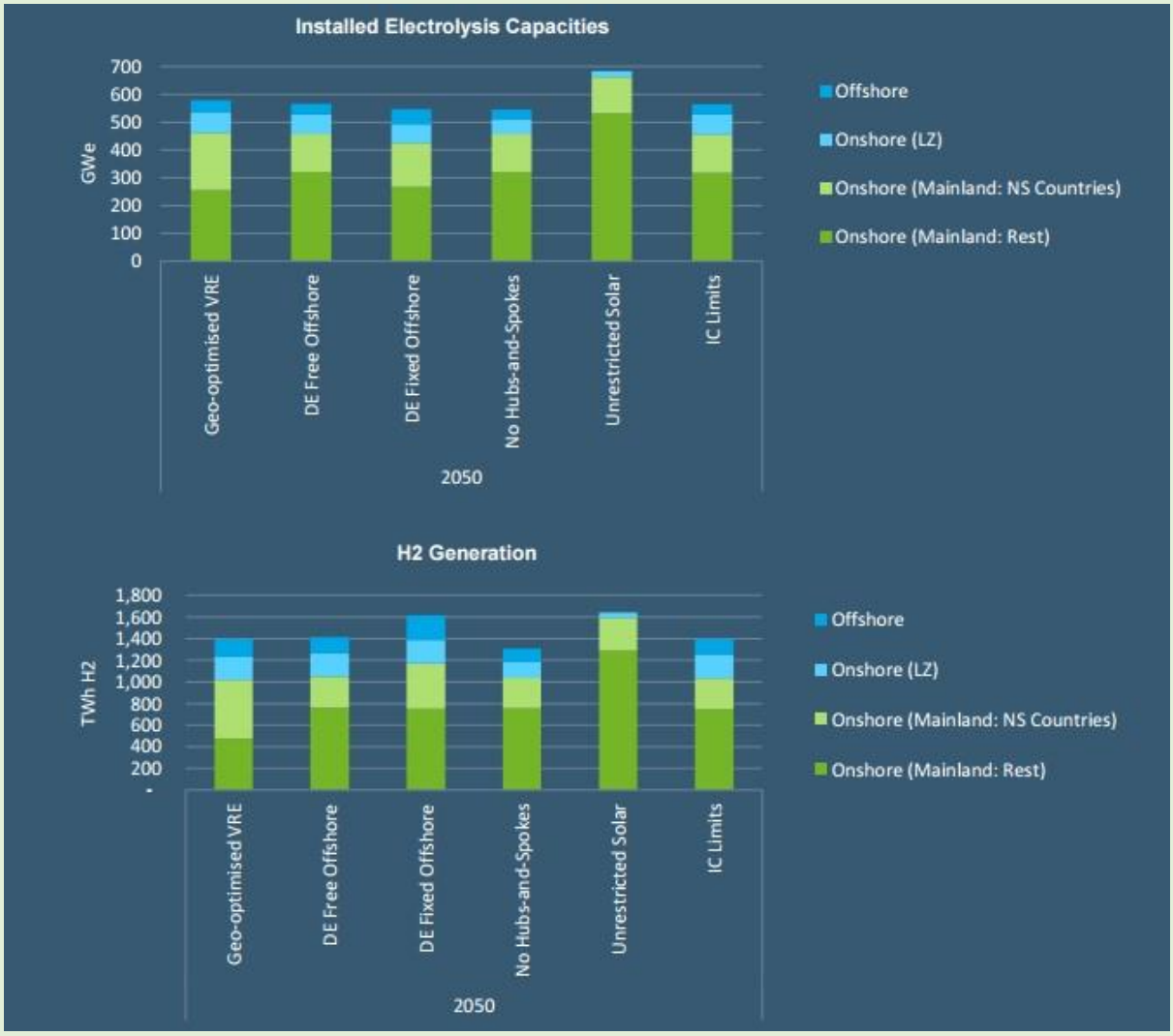
A different regime prevails in the UK, and perhaps it's easier for Europe to think strategically. I'm sure our Transmission Grids, electrical and gaseous are watching most closely



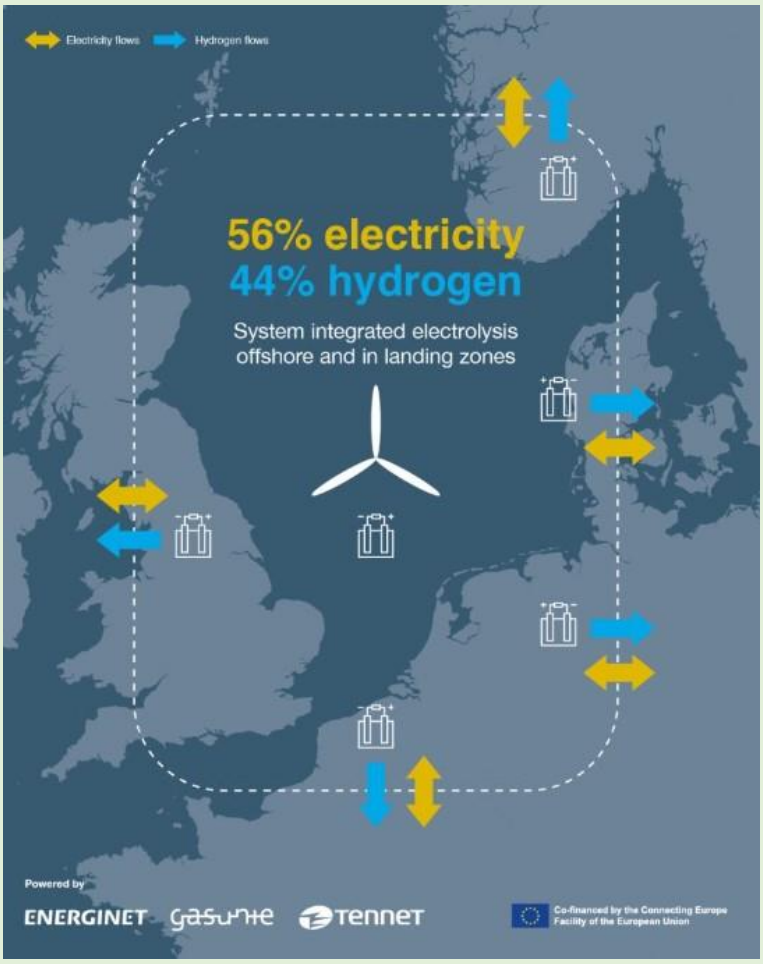
Elections are looming here in the UK, and now in France. As for who pays investors seek long-term certainty and all-party support. Nevertheless this is an important strategic document.





The North Sea Wind Power Hub works with Hubs and Spokes concept may therefore facilitate the integration of large amounts of offshore wind

Whether this iteration gains more traction than did Isles, and whether the whether they gain the significant investments that the energy sector requires going forwards.



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Offshore Wind and Hydrogen