

THE EIGHTH CARIBBEAN SUSTAINABLE ENERGY FORUM
(CSEF-VIII): SESSION 3

Role of Offshore Wind in supporting Green Hydrogen

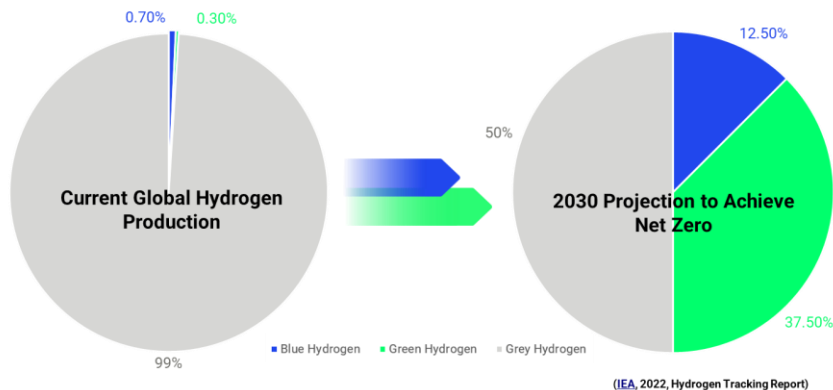
Caroline Coccoli, Offshore Wind Manager, The Carbon Trust

12 January 2024

Global context

Global hydrogen demand – **94 million tonnes in 2021**, equal to **2.5% of global final energy consumption**.

Global hydrogen supply – Majority of hydrogen is directly produced from fossil fuels. **Electrolysis responsible for only 2% of global hydrogen production**.



The conversion of electricity into hydrogen can enable difficult-to-electrify sectors to decarbonise.

However, there are several challenges preventing green hydrogen to scale

- **Capital costs:** Widespread uptake of green hydrogen is contingent on the production costs becoming competitive with grey hydrogen.
- **Nascency of sector:** Demand for green hydrogen is uncertain as most countries lack policies to support green hydrogen production.
- **Renewable energy limitations:** Markets where renewable energy supply pathways have had limitations placed on them through policy decisions make it difficult to scale up green hydrogen production.

Hydrogen production from offshore wind

Hydrogen production could be an alternative or supplementary income stream for offshore wind farms, particularly those in locations with expensive or insufficient grid connections.

Benefits of using offshore wind to produce hydrogen compared to alternative RE sources



Production stability



Increased energy generation

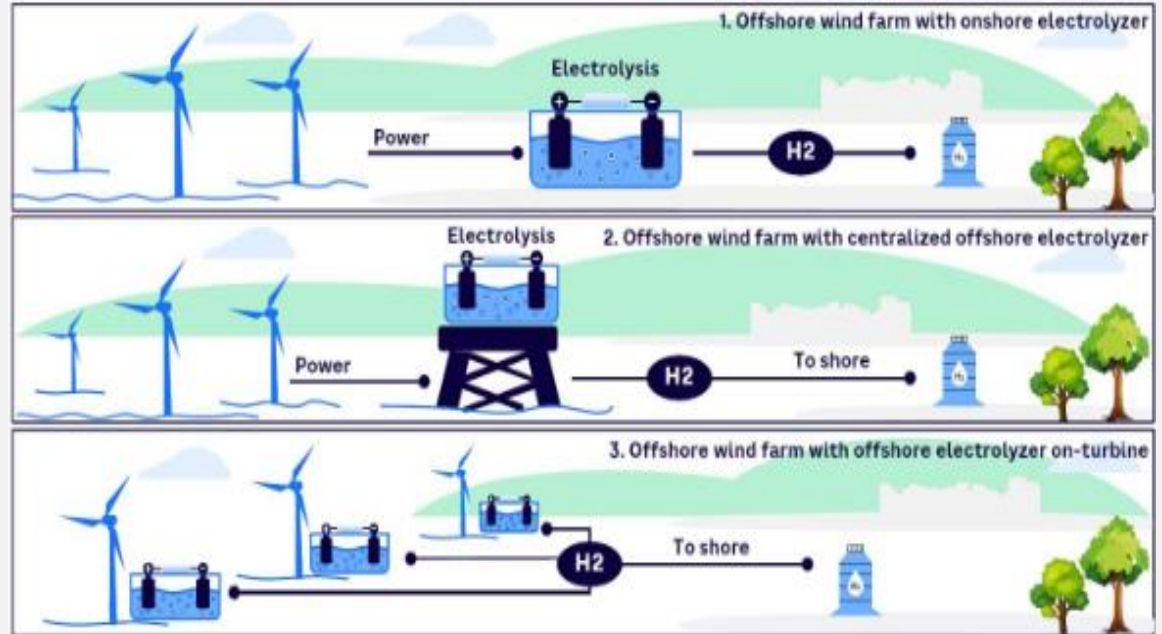


Growing financial incentive



Geographical expansion & integration opportunities

Options for hydrogen integration with offshore wind



Global progress to date

Hydrogen integration with offshore wind is at its nascency.

Dutch eye first tender for offshore wind and green hydrogen

Electricity 20 Mar 2023 10:02



Rosetti Marino to Build Green Hydrogen Platform for Dutch Offshore Wind Farm

Jul 13, 2023



Hollandse Kust Noord offshore wind farm - Credit: CrossWind

Dutch offshore wind farm developer CrossWind has awarded Italy-based Rosetti Marino a new engineering, procurement, construction, installation and commissioning (EPCIC) contract for an offshore green hydrogen production and storage pilot plant called the 'Baseload Power Hub.'

The Baseload Power Hub will be located within CrossWind's Hollandse Kust Noord offshore wind farm, 18.5 kilometers off the Dutch coast. CrossWind is a joint venture between Shell (80%) and Eneco (20%).

In a 'World first', Lhyfe's Sealhyfe Pilot Starts Producing Green Hydrogen in the Atlantic

Jun 27, 2023



Caption: on the right : Sealhyfe offshore hydrogen production pilot (Lhyfe), on WAVEGEM platform (GEPS Techno). On the left : FLOATGEN floating turbine (BW Ideol). On the SEM-REV offshore testing site (Centrale Nantes / OPEN-C) ©Lhyfe

Lhyfe, a green hydrogen production specialist, said Tuesday that its offshore green hydrogen production pilot Sealhyfe recently started producing green hydrogen in what the company said is a world first.

The Sealhyfe platform was recently towed 20 kilometers out into

Global progress to date

But there are a handful of projects at their early implementation stage and governments in Europe have begun issuing tenders for offshore wind developers that include flexibility measures – incentivising hydrogen production.



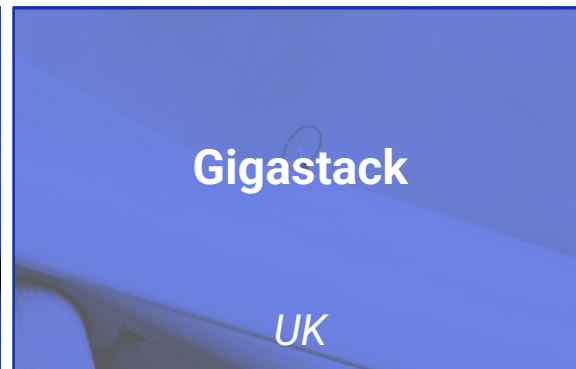
**Copenhagen Airports,
Moller-Maersk, DSV
Panalpina, DFDS, SAS,
and Ørsted**

Denmark



AquaVentus

Germany

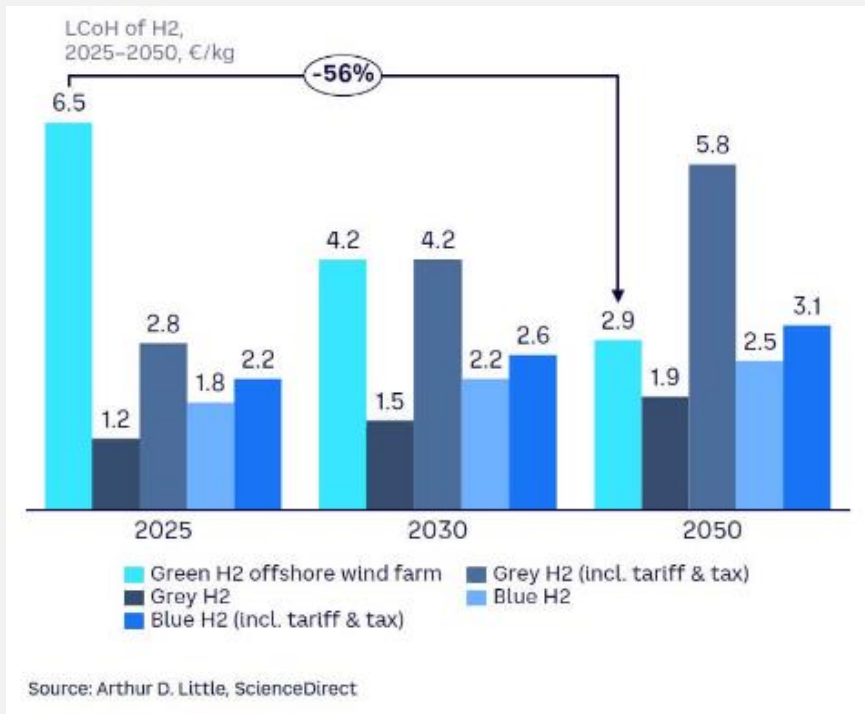


Gigastack

UK

- An industrial scale facility will produce up to **250,000 tons of green fuels** by 2030 using offshore-wind powered electrolysis.
- The green hydrogen produced will be used for buses and heavy-duty trucks.
- Aims to install **10 GW of electrolysis capacity** from offshore wind energy in the North Sea by 2035 (enough to produce **1 million metric tons of green hydrogen** per year)
- Aims to produce green hydrogen from offshore wind by 2025, using electricity from the 1.3 GW Hornsea 2 project to power **100 MW of onshore electrolyzers – PAUSED**

Long-term Economic Viability



Green hydrogen produced from offshore wind farms has the potential to become cost-competitive in the long term.

- LCoH for green hydrogen produced from offshore wind farms will see a **56% cost reduction** by 2050.
- Green hydrogen from offshore wind farms has the potential to become **cost-competitive** with grey and blue hydrogen in the long term (2050).
- In the short term, green hydrogen requires **additional subsidies and financial incentives** to be cost-competitive.

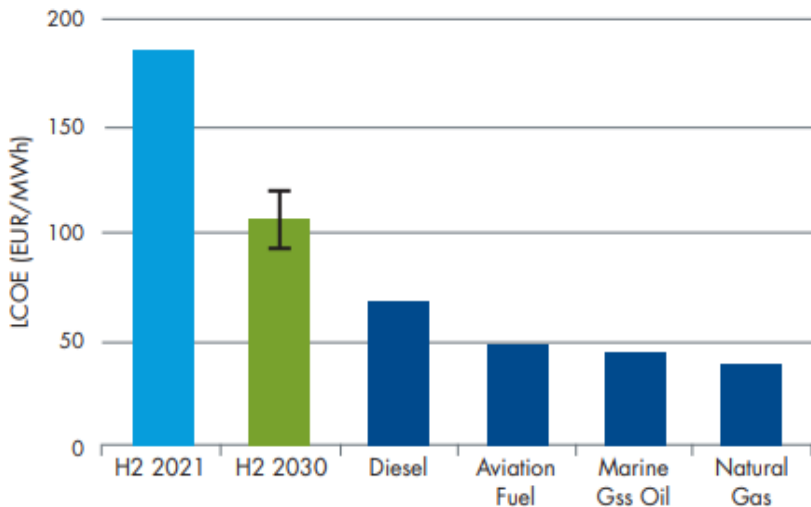
Example Scenario:

Forecasting the levelized cost of hydrogen (LCoH) by type compared to green hydrogen produced from Hornsea 2 (1320 MW offshore wind farm)

Future Global Trajectory

There is a clear case for green hydrogen from a decarbonisation perspective, but financial viability case remains weak. Future production and adoption will be shaped by (i) cost and (ii) regulations.

The biggest barrier to widespread hydrogen adoption is the high cost of producing hydrogen, compared to fossil fuel equivalents.



Source: BVG Associates

Electricity costs account for 50-70% of LCOH. The reduction in the LCOE of renewable energy is key to achieving cost parity with fossil fuels.

Based on the [Clean Energy States Alliance](#)

Policies enabling continued deployment and cost reduction of offshore wind will be important.



Implementation of **competitive auctions** for offshore wind projects.



Setting targets for offshore wind deployment to give industry confidence in future pipeline and unlocking investment.



Implementation of **aligned policies and procedures**, specifically relating to seabed leasing, permitting, interconnection, and auctions



Investment in **coastal infrastructure** such as ports and port-side manufacturing.

Implications for the Caribbean

There is interest from countries in the Caribbean region in developing offshore wind to support a future hydrogen export market. The following measures could help establish a foundation for green hydrogen production and offshore wind in parallel.



FEASIBILITY STUDIES

Study the likelihood of excess offshore wind output and its corresponding timelines, and whether it could be cost-effectively used to produce green hydrogen.



PILOTS

Support small offshore-wind-to-green hydrogen pilot projects to promote learnings and build expertise



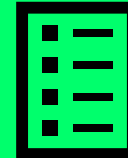
PARTNERSHIPS

Enter into research partnerships between Caribbean countries to study potential opportunities to develop offshore-wind-to-hydrogen projects that can benefit the entire region



ROADMAPS

Prepare roadmaps for green hydrogen development, including electrolyzer and fuel cell targets.



POLICY

Develop policies to address some of the technical and cost barriers to green hydrogen production so that it can be used to decarbonise hard-to-electrify sectors

Our Clean Hydrogen Experts



Andrew Lever

Director

Andrew has over 24 years of experience in the energy and utility sector and has conducted roles that have been pivotal to the energy transition over the last two decades. Andrew is a champion of whole systems thinking.



Bogi Hojgaard

Associate Director

Bogi is an Associate Director in the Energy Transition team with a focus on system modelling and energy flexibility, primarily in the UK. He provided advice to the UK Government the extension of CfDs to Carbon Capture and Storage and hydrogen production.



Rob Bloom

Manager

Rob has 10 years' experience in the hydrogen sector with excellent appreciation of the demand uses and drivers of both fossil and clean hydrogen, combined with a thorough understanding of production, storage, distribution, and end-use technologies.



Hannah Cardiff

Associate

Hannah has experience across both Hydrogen and C&R. She is the Programme Associate on the Clean Hydrogen Innovation Programme, leading the cost reduction potential analysis and stakeholder engagement.