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### **Investors with deep pockets are competing to develop massive offshore wind farms.**

While there are plenty of places on land for wind parks, there are even more opportunities offshore where wind speeds tend to be higher and steadier with fewer objections since they are often removed from where people live. As the costs decline with ever larger turbines, offshore wind is poised for significant growth across the globe.

In mid-June 2023, RenewableUK published its latest Energy Pulse market intelligence data report which shows that the UK's pipeline of offshore wind projects has reached nearly 98GW, while the global pipeline topped 1.23TW. The report said the UK's total pipeline was second globally only to China with 157GW, with the US in third place with 82GW. China leads globally with nearly 30GW in its operational portfolio, followed by the UK with nearly 14GW.

In another sign of the booming offshore wind business, European oil majors BP and TotalEnergies bid a combined \$14.1bn for the right to build 7GW of wind farms in the North and Baltic seas in the world's largest ever offshore wind auction in mid July 2023. Observers hailed it as a turning point for the technology which is now widely regarded to be among the most plentiful and cheapest forms of renewable generation. The auction contributes to Germany's target to increase its offshore wind portfolio to 30GW by 2030 from around 8GW today.

Three of the auctioned sites – each for building 2GW of capacity – are located around 120km northwest of the island of Heligoland in the North Sea, and one with 1GW in the Baltic Sea, some 25km off the island of Rügen.

The cost of developing new offshore wind farms has fallen dramatically in recent years, which explains the interest in the recent auction with investors and project developers outbidding each other for access to attractive sites. Auctions are commonly used to allocate who can build where but have the disadvantage of leaving smaller players out of the game since bigger, more aggressive investors with deeper pockets tend to outbid the smaller ones.

Several utility giants including RWE, EnBW, Edf and Danish turbine manufacturer Orsted complained that the prices bid by the oil companies were excessive, stifling competition. Others believe that the outcome of the auction merely reflects the changing realities of the market plus the rising demand for green power as companies and industries switch to renewables as a central component of their decarbonisation efforts.

BP said it would internally consume some of the electricity produced by the wind farms in refineries, for hydrogen production, as well as the company's growing electric vehicle charging network. The remainder can be sold to other industrial customers as Power Purchase Agreements (PPAs) – a simple, hassle-free way to decarbonise without moving a finger.

US, a laggard in offshore wind is belatedly trying to catch up. A report from UC Berkeley, Energy Innovation, and GridLab claims that offshore wind has the potential to generate up to a quarter of US power supply by 2050. It says offshore wind could inject up to \$1.8trn of investment into the US economy and employ as many as 390,000 workers in the sector by 2050 – far more than the number currently employed in the coal sector. It says 4,000GW of offshore wind potential is available along the US coastline, including 1,000GW in areas with capacity factors over 50%, exceeding most sites onshore. Typical capacity factor for onshore wind in the US is around 35%.

A challenge with all renewable generation – wind and solar – is the variability of the resource. This has attracted specialised firms who claim they can deliver firm output by integrating wind and solar resources into

a portfolio of operating assets. Among the biggest and most successful is Germany's Next Kraftwerke (NK), which recently commenced power trading for a proportion of the Dutch Hollandse Kust Noord (HKN) offshore wind park. It is being built by CrossWind, a joint venture of Shell and Eneco, and is expected to become fully operational at the end of 2023 with a capacity of 759MW. In June 2023, NK announced that it would act as the Balancing Responsible Party (BRP) of the wind farm trading Shell's share of electricity on short-term markets. Eneco will trade its own.

The collaboration between Shell and NK will combine their specialised know-how from long-term hedging to short-term optimisation.

As explained by Hendrik Sämisch, NK's CEO: "At Next Kraftwerke we have many years of experience in managing assets of different sizes optimally on the different wholesale electricity markets and we are experts in providing flexibility for grid balancing", adding: "Once the wind park has been fully commissioned – we'll take care of curtailment for redispatch and reserve power provision to the Dutch transmission system operator TenneT, the developer of the 'offshore power socket' connecting HKN to the grid. Shell is taking care of the long-term hedging and contributes with specialised and reliable wind forecasts thanks to their experience from other Dutch offshore wind parks."

In its role as BRP, NK's job will be to maintain the balance between energy injection and offtake through appropriate trading deals and, if necessary, by curtailing power generation as a last resort. As the park does not rely on guaranteed revenues from subsidies, it needs to optimally respond to fluctuations in market prices. During periods of negative day-ahead and intraday prices, for example, it may curtail the park's generation since it makes little sense to generate losses.

With a projected annual output of 3.3TWh, the HKN wind park is currently among the biggest in Europe – its output meets roughly 2.8% of the current Dutch electricity demand.

As an indispensable intermediary with highly specialised skills, Hendrik Sämisch sees a growing future for its services in a future dominated by variable renewable generation. He said: "European countries have agreed to build out about 111GW of offshore wind capacity by the end of this decade. Projects like HKN make a significant contribution to achieving this goal and accelerating the important and urgent expansion of renewables."

When a new problem, such as the variability of renewable output, emerges sooner or later someone such as NK comes up with a solution.

The other challenge with wind – onshore or offshore – and solar is the need for new transmission lines to move the power to where it is needed. In July the Viking Link, a €2bn, 764km High Voltage Direct Current (HVDC) submarine cable linking the electricity grids of GB and Denmark was completed. It is the sixth cable connecting the UK's grid operator, National Grid, to France (two interconnectors), the Netherlands, Belgium and Norway. As more countries develop and expand their offshore wind generation, interconnectors will become critical for transporting the clean energy to major load centres.

**Figure 1: Capacity factors vary: Generation comes in different varieties**

