WHY CONNECTION TECHNOLOGY IS FLOATING WIND'S NEXT HURDLE

Configurability is central to how Squid is deployed. Rather than dictating the design of a project's mooring system or cable specification, it is designed to work within them. (Courtesy: Encomara)

As floating wind moves from pilot projects to commercial-scale deployment, how the sector designs for disconnection and reconnection will shape the cost and availability of these assets in the future.

By DUNCAN BLACK

As floating wind moves into commercial-scale deployment, developers must consider not only how turbines are installed, but how moorings, cables, and major components will be managed throughout a 25-year design life. Addressing this challenge is increasingly seen as a design question rather than a maintenance afterthought — one that's beginning to reshape how the sector approaches the connection system.

The global market is projected to grow from S3.16 billion in 2026 to S25.4 billion by 2031, at a CAGR of 51.7 percent [1]. Globally, the sector is moving from the pilot to commercial phase, underpinned by policy to support new projects. Europe is a pioneer in this sector, with Scotland home to two operational farms — Hywind and Kincardine — while first power was delivered from the EFGL farm in France in May 2026.

Global national FOW targets currently exceed 40 GW, with active leasing and licensing rounds under way in the U.K., Norway, France, China, South Korea, the Philippines, and Australia. France's AO10 tender, launched in June 2026, is targeting roughly 5 GW of floating capacity in the second half of this year, the largest floating procurement event launched globally to date, while the U.K.'s AR8 round includes two eligible floating projects within a 28 GW pipeline.

Turning this pipeline into deployed capacity means proving designs at commercial scale, not just as single demonstrators, and keeping them running reliably over a 25-year asset life.

Despite these successes, the sector is grappling with challenges to ensure projects secure a financially viable route to market. An essential part of the business and commercial model for any floating wind development is the strategy for major component repair (MCR) and potential repowering in late life. This strategy must cover not just the nacelle, but the entire floating system, including tower, foundation, mooring, and cable components plus ancillaries. Developers are increasingly seeking out innovative solutions to support these challenges, ensuring their projects remain insurable and financially viable over the full asset lifecycle — and in turn, lowering the Levelized Cost of Energy (LCOE).

REDUCING COST THROUGH INTEGRATED DESIGN APPROACHES

Cable and mooring installation is typically carried out as two distinct operations, each with its own vessel spread, specialist contractor, and installation sequence. Mooring lines are pre-laid and pre-tensioned on the seabed, often before the floating turbine arrives on site, then hooked up once the turbine is towed into position. Power cables are installed separately, usually via a dedicated cable-lay vessel, and connected to the turbine and the export system once moorings

The Squid system integrates a floating turbine's mooring lines, power cables, and all subsea connectors into a single deployable unit. (Courtesy: Encomara)

are in place. This sequential, siloed approach mirrors how the two systems are designed and, later, how they're maintained — setting up the same disconnection and reconnection challenges seen in MCR operations.

Tow to Port (T2P) is the current accepted process for MCR strategies. In this practice, the turbine is disconnected from its moorings and electrical cables and towed to port to allow the component changeout to take place quayside by an onshore crane, before being returned offshore. However, this method carries significant operational limitations. According to DNV, subsea cables account for up to 80 percent of insurance claims in the offshore wind sector. Risks include natural hazards and dragged anchors.

When mooring lines and power cables are disconnected, they are typically disconnected independently and controllably lowered to wet-storage on the seabed, with loose lines often tangling on the seabed. Reconnecting them means locating and hauling each one back up in turn. Once the equipment is lowered, the chances of damage rise sharply, and repairing a subsea power cable is not cheap. This also creates a knock-on production problem too, one specific to

A recent study by OSSIAN placed the estimated savings of using the Squid system at 1 billion pounds per gigawatt. (Courtesy: Encomara)

Suspended mid-water, the Squid buoy system integrates power cables and moorings in a wave profile, a similar configuration to that when connected, ensuring high operability and reduced risk of damage to hardware and the seabed. (Courtesy: Encomara)

how wind farms are wired. Turbines on a shared export cable are strung together, so disconnecting one for maintenance can break the circuit for every turbine further down the line, not just the one being serviced. It is not unlike old-style Christmas tree lights, where a single failed bulb took the whole string down, before LED circuits learned to bypass the fault and keep the rest lit.

Part of the reason this issue has persisted is structural rather than technical. Mooring engineers and cable engineers have historically worked in separate silos, each designing to their own brief. Systems have rarely been built with disconnection and reconnection in mind from the outset, because no one owned that problem end-to-end.

If future projects are to reduce maintenance costs and improve availability, disconnection and reconnection can no longer be treated as an afterthought. Instead, they need to be designed into the system from the outset. This shift in thinking is now beginning to emerge, with new integrated approaches aiming to manage moorings and power cables as a single engineered system rather than two separate disciplines. Addressing this means adopting an approach, such as MCR and T2P, and including it in project design specifications as early as possible, rather than treating them as a later-stage fix. The same thinking benefits hook-up operations, too, since reconnection largely mirrors the initial process, along with how insurers view Construction All Risks (CAR) and Delay in Start Up (DSU) cover.

A SINGLE SYSTEM FOR MOORINGS AND CABLES

Disconnectable turret buoy technology has long been used in oil and gas projects, enabling cables and mooring lines to converge through a buoy connected to a ship, so the vessel can swivel free. Recognizing the resemblance, Encomara drew on these principles to develop the Squid connection solution. This system has been developed around that lifecycle challenge, reducing the complexity and offshore exposure associated with connection, disconnection, and T2P operations, while supporting the risk reduction increasingly important to developers, operators, and insurers. Following significant research and development investment, the innovative technology — which has received product design assessment from the American Bureau of Shipping — allows for the pre-installation and pre-commissioning of all mooring and power cables.

The Squid system integrates a floating turbine's mooring lines, power cables, and all subsea connectors into a single deployable unit, allowing both to be installed mid-water before the turbine arrives on site. By combining the associated marine hardware into one unit, it provides a simplified "Plug to Power" (P2P) capability. This results in accelerated installation and cuts both the capital cost and the time needed to get a floating turbine connected, lowering the LCOE by up to 20 percent.

Suspended mid-water, the Squid buoy system integrates power cables and moorings in a wave profile, a similar configuration to that when connected, ensuring high operability and reduced risk of damage to hardware and the seabed. It sits inline where cables run through the base of the floating hull, with mooring lines connecting via short secondary "squid lines," while the main cables pass through it as they would through the hull directly. Once locked into the hull, Squid has no in-service mooring load path and does not swivel, allowing developers to pre-install 100 percent of subsea and marine hardware in advance of FOWT deployment and

maximize pre-commissioning, similar to fixed wind, prior to the turbine's arrival.

The same capability applies at the other end of a turbine's life, when an asset is disconnected for T2P maintenance or repowering. Rather than dropping cables and moorings separately to the seabed, where they can tangle or be damaged, the buoy releases them together and holds them just below the surface, ready for quick reconnection when the floater returns — keeping power and communication continuous. Reconnection reverses the same process. By reducing the time a turbine spends disconnected, the system also increases operational uptime, an important consideration given that turbines sharing an export cable can lose production collectively while any one of them is offline.

This uptime advantage depends on being able to connect and disconnect turbines in the first place, and this is where the buoy-based method's weather tolerance matters most. Because the connection is made at the buoy rather than directly at the vessel, it can be carried out in higher wave heights than conventional vessel-based methods allow, widening the installable weather window significantly. This benefits T2P operations as much as initial installation, since reconnecting a returning turbine faces the same weather constraints as connecting one for the first time. Estimated savings are 2 million to 6 million pounds CAPEX per FOWT and approximately 9 million to 18 million pounds per T2P event in OPEX/revenue impact, depending on the scenario.

A recent study by OSSIAN, funded by Scottish Enterprise, placed the estimated savings of using the Squid system at 1 billion pounds per gigawatt compared to traditional methods as fewer vessel days are required to perform operations using this system. This approach also increases safety, reduces operational costs, and significantly decreases project-associated emissions.

DESIGNING FOR DISCONNECTION

Configurability is central to how Squid is deployed. Rather than dictating the design of a project's mooring system or cable specification, it is designed to work within them, whatever hull, mooring configuration, or connector type a developer has already selected. No two floating wind projects are the same, and equipment varies between developers and installation contractors. A solution that assumes a single configuration would only ever suit a fraction of the market.

This flexibility reveals a broader point about where these decisions are made in a project's lifecycle. Floating wind developments typically progress through conceptual design, pre-front-end engineering and front-end engineering design (FEED) phases, with major equipment contracts placed once FEED concludes. Decisions taken at this stage on hull type, mooring configuration, and cable routing shape what is and isn't possible for the rest of the asset's life.

A disconnection strategy bolted on after these choices are locked in has far less room to work with than one considered alongside them.

This is the wider case for building MCR and repowering considerations into project design from the outset. A system built to simplify disconnection only delivers its full value if that requirement is planned for at the earliest stages, alongside mooring and cable specification, rather than retrofitted once a project's engineering is already fixed.

For developers weighing up the total cost of ownership across an asset's operational life, that means treating disconnection and reconnection capability as a design input from FEED onward, not a problem to be solved when a turbine first needs to come offline.

The projects best placed to manage MCR and repowering costs will likely be those that treated the question as a design parameter from day one, not those that revisited it once construction was already under way. As floating wind moves from pilot projects to commercial-scale deployment, how the sector designs for disconnection and reconnection today will shape the cost and availability of these assets for decades to come.

REFERENCES

[1] Floating Offshore Wind Market Report 2026-2031 [375 Page & 150 Table].

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