Market Challenges and Derisking Tools for Offshore Wind Farms in Offshore Hybrid Projects

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A joint paper of WindEurope & Offshore TSO Collaboration

Introduction

In 2023, the Ostend Declaration by the North Sea countries set ambitious targets for offshore wind power in the North Seas: 120 GW by 2030 and at least 300 GW by 2050. However, these targets are now facing significant challenges. Rising financing costs and supply chain bottlenecks have increased the price of all generation and transmission technologies, except for solar PV. Offshore hybrid projects are complex in the development and need explicit political support to be realised due to their specific character. Additionally, the slow growth in domestic renewable hydrogen production and electrification has created uncertainty for new investments in generation capacity.

Considering these challenges, policymakers will convene in Hamburg in January 2026 to discuss strategies for achieving their offshore wind energy targets. They will also be considering the future competitiveness of European industry, a key concern in these years. A priority will be to establish a future European power system that can ensure low input costs, and working to reduce costs on components in both transmission and generation will be important. In this context, more regional-oriented solutions such as cross-border radials and hybrids are gaining traction.

A more regional approach to building offshore wind farms and the required infrastructure can create a cost-efficient and flexible power system that integrates large amounts of offshore wind energy compared to traditional national-oriented build-out, with improved utilization of wind potentials and grid connections[1]. However, there are obstacles, including the lack of proper cost allocation solutions, which forces countries into slow, complicated bilateral project negotiations. Additionally, the lack of a proper regulatory framework to attract offshore wind to offshore bidding zones, a key component in hybrid systems, complicates the merchant business case for offshore wind, which has driven the success of the radial build-out in recent years.

This joint discussion paper outlines several policy recommendations supported by both the offshore wind developers with WindEurope and the TSOs working together in the Offshore TSOs Collaboration (OTC). These recommendations could help to enable the implementation of hybrid systems and thus support the efficient regional utilisation of offshore wind resources in the future.

[1] Examples: Pathway 2.0 by North Sea Wind Power Hub and Going Like the Wind by Elia.

Sharing of costs and benefits for cross-border offshore infrastructure

Achieving offshore renewable targets in the North Sea requires enormous investments, both in terms of generation and transmission infrastructure. However, the current regulatory frameworks for cost allocation and coverage are mainly national and not aligned among countries, making them unsuitable for OWFs connected to hybrid interconnectors and energy hubs.

Existing tools for the sharing of costs and benefits such as the cross border cost allocation (CBCA) for Projects of Common Interest (PCI) as defined by the TEN-E regulation are not fit for purpose due to shortcomings in the methodology and the procedural lack of early engagement with all relevant stakeholders. Given the widespread benefits of offshore hybrid interconnectors extending beyond national borders of hosting countries, it is also crucial to move beyond national or bilateral cost sharing mechanisms.

- **Develop a collaborative cost & benefit sharing framework for offshore hybrid projects that collectively considers offshore grid infrastructure and offshore wind:**

A transparent and mutually supported assessment of costs and benefit is essential to develop an effective cost-sharing mechanism between all relevant countries. A fair allocation of project costs based on the expected or realised benefits is important to maintain trust and ensure commitment from all stakeholders.

Cost sharing agreements based on a joint assessment of the costs and benefits will involve the countries expected to significantly benefit from the respective projects willing to contribute. To allow for a robust cost-sharing agreement between the relevant political actors, offshore grid infrastructure and offshore generation must be collectively considered. We acknowledge that de-risking constitutes a bottleneck for generation. Cost sharing agreements for generation are likely to, in many cases, contain a form of joint support scheme, such as a Contract for Difference (CfD), and the grid connection of the wind farm involving the various countries party to the agreement. The costs for the support mechanism would have to be shared between the involved countries.

Thus, there is also a need to address the financing challenges for generation projects, which mainly result from too high risks and corresponding risk premia on cost of capital, in parallel to addressing these for infrastructure. A de-risking instrument, described in section 2, would help to reduce the cost of capital and ensure financing for generation. In terms of financing the projects, parts of the financing could possibly be obtained from the European Investment Bank and dedicated cross-border funds to support offshore infrastructure projects. Moreover, to reduce reliance on public funds, efforts should focus on attracting private capital from long-term investors. A solution must fully align with unbundling rules, (i.e. separate funding and financing for transmission and generation), while ensuring that political agreements consider in a balanced manner both transmission and generation financing needs.

Challenges and solutions in offshore hybrid assets – volume, price risks and remaining shortcomings

Offshore Bidding Zones (OBZ) is a transparent and efficient market solution. It reflects structural congestions, physical flows, costs and improve competition for scarce capacity efficiently. While for offshore hybrid assets OBZ is the target solution, as also recognised by policymakers, it could lower market prices for Offshore Wind Farm (OWF) in the OBZ, hence increased support schemes may be required, as OWF investments in an OBZ face unique challenges due to the lack of electricity demand within that zone.

Unlike traditional radially connected offshore generation, where demand is primarily driven by consumption in the home market, OBZs rely on interconnectors to deliver power to consumers. The capacity allocation of interconnectors is determined by socioeconomic optima per market time unit that influence power dispatch. The increased risk for developers is price risk due to the lack of demand in OBZ and volume risk due to the internalised arbitration of interconnector capacity with cross zonal flows. Tools like the Transmission Access Guarantee (TAG), can only partially mitigate the volume risk, as it is subject to the 70% requirement on availability of transmission grid. Consequently, the dispatch of an OWF and the price received, and therefore eventually the revenue flow, is much more uncertain in offshore hybrid set-ups. This increases investment uncertainty for developers, especially given the billions of Euros in CAPEX, required to develop offshore hybrid assets. In contrast, radially connected OWFs typically operate with a more predictable risk profile. They mainly forecast supply and demand within bidding zones, and they are compensated when onshore grid elements are unable to transmit power to demand centres.

When the volume of generation exceeds the capacity of the transmission grid, only part of the volume will be cleared in the market, and the resulting price will be equal to the OWF's bid (which is equal to the marginal cost in a competitive market and is near-zero). As a result, some of the available power cannot be sold to the market, and the value of the power delivered to the grid is zero for the developer. The undelivered power is missed revenue for the offshore wind farm. The price drop transfers value from the developer to end consumers, as congestion income increases accordingly. A well designed CfD (e.g. 2-way capability based CfDs amongst others) could make up for this value transfer.

Two-sided non-production based CfDs

Contracts for Difference (CfDs) are a key policy tool to support offshore wind development. The revised Electricity Market Regulation makes two-sided CfDs the default state aid tool to stabilise revenues for new renewable and nuclear power generation. They provide revenue stability by guaranteeing a fixed price for renewable energy producers, offsetting fluctuations in wholesale electricity prices. In the future, they could play a significant role by protecting against price collapses in OBZs in the absence of any offtake.

Any CfD mechanism must be carefully designed, ensuring it does not disproportionately favour either developers or governments and the costs that are passed to the taxpayers should be kept to a reasonable level to maintain support for renewable energy development. This supportive renewable investment framework should be made available when the market requires it, specifically where offshore wind sites are known to be connected to a hybrid system or offshore bidding zone at the time of the auction.

Generation based CfDs, which link payments to actual wind output, are the current standard, while in new designs like generation-independent ones, so called non-production CfDs payments are not tied to feed-in power. For offshore hybrid projects in an OBZ configuration where the lack of demand and reliance on interconnectors increase volume risks, non-production CfDs could better manage risks for developers while providing the correct incentives to OWFs to provide balancing services needed by Transmission System Operators to ensure system security.

Non-production-based CfD and TAG are both under development, so we should carefully consider how they interact.

- **Enable two-sided non-production based CfDs to de-risk offshore hybrids:**

To address the market risks associated with OBZs, we propose the introduction of 2-sided CfDs in future auctions for projects expected to be part of an OBZ. The non-production feature mitigates the increased volume risk in OBZ. This approach ensures that developers are protected even when electricity cannot be efficiently exported due to insufficient transmission capacity, and where the price leaves no profit margin in a competitive market.

One option is the ***capability-based CfD***, meaning that payments are determined by the generation potential of an OWF, rather than the actual generation output. For this approach simplicity would indicate that the market reference price for the CfD is the OBZ price.

A second option is the ***financial CfD*****.** This approach can provide mitigation for price and volume risk based on a capacity payment awarded subject to competition. In return, the assets owner pays a fictive market revenue of a reference asset to the government that has issued the CfD. For this approach, it is crucial that the reference asset is in the same OBZ and hence subject to the same price and volume effects.

For TSOs with the view to the significant amounts of offshore generation connected to the system, non-production based CfDs bring significant benefits for the operation and integration of these projects, and a potential upside for generators in offering balancing services. Other support schemes often decouple the remuneration of the generation asset from market signals. Non-production based CfDs allow the efficient usage of the power generated, when it has the greatest value for the whole power markets by efficient dispatch signals.

Two-sided CfDs are the most straightforward and effective risk mitigation tool for hybrids, especially as a short-term solution. However, governments may not be willing or able to provide CfDs for the deployment of all hybrid assets. Therefore, a viable commercial route to market should be in place to address the remaining challenges.

PPA shortcomings due to price spreads between OBZ and home-market zone

Renewables Power Purchase Agreements (PPAs) are another option to secure a stable price for the electricity generated. The current regulation states that the power generated must be reliably transmitted to the demand location (bidding zone), which creates the need to safeguard the capacity accordingly early on and for a long time period optimally corresponding to the duration of the PPA.

PPAs face significant limitations in hedging against price risk across bidding zones, as differences between market prices can impact their performance. This risk is even more pronounced in OBZs due to the lack of demand and their reliance on neighbouring bidding zones as the only option for PPA

offtake. The increased volume risk in OBZs can lead to price collapses which can amplify the impact of these price differentials.

Thus, the additional costs and risks associated with delivering PPAs from an OBZ to a home-market zone make the m less attractive compared to intra-zonal PPAs. This additional risk and costs which developers face in PPAs for the hybrid-connected OWF must be acknowledged. There could be different options to mitigate this risk.

- **Complementary hedging of price spread risks with a capability price spread CfD:**

To enable a level playing field in the PPA market, governments could design a two-sided *price spread CfD* that is offered specifically to OWFs connected to an offshore hybrid asset, compensating the risk of market price spreads. The *price spread CfD* payment would be determined by the price spread between the OBZ and the target onshore bidding zone, applied to the forecasted generation volume. Unlike a conventional CfD this instrument would only guarantee the market price in a target market but would not provide full financing of the OWF.

To ensure that these price-spread CfDs do not provide the wrong incentives for market dispatch, more work needs to be done to ensure a good design for this instrument.

Co-authored by:

WindEurope

WindEurope is the wind energy industry association. It advocates for policies and regulations to support the expansion of wind energy in Europe and organises major industry events.

Offshore TSO Collaboration

The OTC was established in 2022 and consists of TSOs from Northern Seas which are working together to develop a sustainable offshore network infrastructure. The OTC's aim is to establish the North Sea as a hub for renewable energy and support Europe's energy security and decarbonisation objectives. These companies work together to drive the development of offshore grids in the North Sea, supporting the political goals set by the Esbjerg Declaration (2022) and the Ostend Declaration (2023).

Endorsed by: