ARUP

Delivering the UK's net zero energy future

Offshore transmission: How do we move as a sector towards investing, planning and delivering offshore assets with confidence?

Roundtable summary

Introduction

With a new UK Government in place, the establishment of Great British Energy and the launch of the National Energy System Operator (NESO) in October 2024, Arup has been convening industry leaders, policymakers and visionaries in a series of roundtables to help realise the UK's net zero energy future.

On the 23rd of September, Arup convened an offshore transmission roundtable with leaders from across the industry representing The Crown Estate, offshore wind and interconnector developers, transmission owners and investors, the National Energy System Operator (NESO), Ofgem, the North Sea Energy Transition Authority (NSTA) and the supply chain. The following is a consolidation of the discussions and insights shared on opportunities and potential solutions to the challenges faced. Please note that it does not represent a formal position of any of the above organisations.

Context

The UK government's ambitions of a decarbonised GB power system by 2030 (Clean Power 2030) mean that new offshore transmission infrastructure is more critical than it ever has been, with the NESO November 2024 report highlighting the new offshore network that must be built to achieve this mission.

Industry is rapidly mobilising the supply chain, investment and the skilled resource needed to deliver the infrastructure required. In parallel, a number of enabling policy, regulatory and market developments and reforms are taking place. This includes the Review of Electricity Markets Arrangements (REMA) and development of regulatory frameworks for an Offshore Transmission Owner (OFTO) build model and for Offshore Hybrid Assets. In the longer term, the recent Beyond 2030 blueprint report provides the NESO's recommendations on future onshore and offshore transmission system upgrades into the 2030s.

The scale of the challenge has meant that industry is evolving beyond the historic point to point grid connection model for offshore wind and interconnectors, reflecting increasing onshore grid capacity constraints, supply chain bottlenecks including port infrastructure, limitations on seabed routes and increasing pressure from communities for more capacity offshore rather than onshore. This is driving towards a more coordinated and integrated approach, to support ongoing cost-efficient development and delivery of an offshore transmission infrastructure to programme, which is essential to Offshore Wind Farm (OWF) and interconnector developers' commercial models and for transmission owners, regulatory incentives (or penalties) for cost and delivery.

However, there is still some significant uncertainty on the programme and requirements for offshore transmission beyond 2030, with strategic plans and regulation still under development, ongoing supply chain constraints and increasing costs to manage a changing commercial and regulatory risk profile. The transition to a more coordinated programmatic approach must be managed to mitigate risks and uncertainty and help accelerate investment in decarbonised energy, build local supply chains and support reduction of constraint costs from a congested transmission network.

Given the importance of offshore transmission to enabling the energy transition and in the face of these uncertainties, how do we move as a sector towards investing, planning and delivering offshore assets with confidence?

A strategy for beyond 2030 in the next 12 months

There is industry consensus on the need for strategic design for onshore and offshore transmission to reach the target of 50GW of offshore wind by 2030, articulated in the Holistic Network Design (HND) and the HND Follow-Up Exercise publications.

This has been refined in light of the Clean Power 2030 mission, bringing forward some additional requirements for the transmission network to achieve power system decarbonisation by 2030. The timely delivery of these assets onshore has been supported by the establishment of the Accelerating Strategic Transmission Investment (ASTI) programme which provided up-front certainty on early construction funding and a clear indication from Ofgem on asset classification (ownership). This has enabled industry to move forwards at a faster pace.

However, beyond 2030 there is no industry agreed offshore transmission delivery strategy at present. The Strategic Spatial Energy Plan (SSEP) and Centralised Strategic Network Plan (CSNP) which will map out network planning in more detail, are not due for publication until 2025 and 2026, respectively. These plans will indicate infrastructure and investment needed but not a coordinated delivery strategy. Development decisions need to be taken in the next year for offshore transmission infrastructure connecting post 2030 to 2035+, in order to effectively engage with stakeholders from communities, planning authorities and investors, to the supply chain to reserve in-demand HVDC asset manufacturing capacity.

Development of a government-backed and industry endorsed, post-2030 offshore transmission strategy should envisage and enable a coherent programme-based approach to plan and build offshore transmission, moving away from a transactional approach. Definition of programme requirements will support timely development decisions, more coordinated engagement with and commitment from the supply chain and community buy-in.

Clarity of governance

Clarity is also needed on who "drives the bus". By this, we mean who defines and owns the offshore transmission strategy and determines how to prioritise and sequence needs. This could be government (i.e. DESNZ) making the 'right decisions', providing some level of certainty for investment and allowing market forces to take over in delivery, with regulatory oversight. Identifying what should be fixed to give the appropriate investment signals whilst providing a balance between central planning and market forces is important, to ultimately ensure best outcomes for consumers whilst achieving the energy transition. Regulation also needs to consider the specific risk characteristics of offshore transmission development including those arising in the transition to a more coordinated approach.

Definition of post 2030 programme requirements will support timely development decisions.

Managing development risks under uncertainty

Developing offshore transmission has a different risk profile to onshore transmission, and often the commercial case can be much more complex and challenging than the technical case. For example, for offshore wind, significant financial commitments are required prior to obtaining Contracts for Difference (CFDs), in order to secure asset manufacturing capacity in advance. In principle, risk is best allocated to the party that is best able to manage it. However, in the current environment, with a constrained supply chain and financial investment decisions not finalised until after CFDs are secured, more commercial risk is taken by developers to then manage through the design and construction process, and during asset transfer to OFTOs (for OWF developers). This is making it more difficult to be competitive. The Offshore Wind Industry Council, whom Arup support via our RenewableUK membership, is exploring options on how to take a more joined-up approach to supply chain engagement, to help reduce this element of risk.

Large strategic supply frameworks are being established with HVDC equipment manufacturers by transmission system operators in other countries and increasingly by large OWF developers, to help reserve manufacturing capacity. Ofgem is currently consulting on an Advanced Procurement Mechanism for the RIIO T3 price control period which would help transmission owners to book supply chain capacity in advance of certainty regarding project need, a positive step. Buyers' clubs may be a feasible option for smaller OWF developers to pool members' collective buying power.

Regulation needs to consider the specific risk characteristics of offshore transmission development.

There are trade-offs between consumer costs, developer costs, level of risk and level of energy system resilience to reconcile in the transition to net zero.

Regulation that provides the right signals under uncertainty

There are also challenges in building a business case for a more coordinated offshore transmission approach where the offshore regulatory regime is still unclear e.g. for offshore hybrid assets. Pilot projects can provide valuable lessons for technical, commercial and regulatory derisking. However, these require regulatory clarity on how anticipatory investment will be treated where additional functionality is designed-in for a future third party connection for example.

The approach that government and Ofgem take in helping to manage offshore transmission development risks under uncertainty requires further consideration. There are trade-offs between consumer costs, developer costs, level of risk and level of energy system resilience to reconcile in the transition to net zero. It is important to ensure that our ambition for short term goals does not result in challenges for future transmission build and decarbonisation of demand in the 2030s and early 2040s. Systems-based thinking is needed to develop the right strategy to guide investment and regulation under uncertainty, identifying the most material actions for the energy transition in each timescale (short, medium, long term).

Recommendations

- Urgent development of an industry informed, coordinated offshore transmission strategy beyond 2030 that unlocks investment and creates the conditions for timely delivery.
- A governance framework that defines roles and responsibilities for delivery of this strategy, including coordinated decision making and risk management under uncertainty.
- Identification of what key aspects of regulation need to change now to provide more certainty and whether any reforms are creating too much uncertainty.

Coordination of offshore investment at programme level

Government development of an overall coordinated plan for marine energy and other major infrastructure is a key enabler for a coordinated offshore transmission plan given the increasing amount of activity in the North Sea.

This should include selection and prioritisation of spatial routes in collaboration with The Crown Estate and other stakeholders/users and signposting the location of strategic coastal hubs to support the development of a range of offshore infrastructure. For clarity, please note that this does not mean the restriction of marine areas to single users/sectors.

Further industry collaboration is needed to better understand marine synergies, assessing opportunities for value creation across energy vectors such as oil and gas electrification, carbon capture, usage and storage (CCUS), island connections, and novel solutions such as energy islands. A systems-based approach that includes all marine infrastructure under development could effectively enable improved coordination on those aspects where the most material impact can be made. The Crown Estate has recently developed a Marine Delivery Routemap, a digital spatial tool for decision support, to help stakeholders explore trade-offs in design and cost based on granular marine spatial data and better identify opportunities to coordinate and to minimise impact on sensitive marine and coastal environments and ecosystems. As well as deconflicting space for energy infrastructure with other uses of the sea space such as fishing, civil navigation and defence, to minimise delivery risks during design.

For the supply chain, mapping of major bottlenecks for offshore infrastructure deployment could support identification, prioritisation of and investment into coastal hubs. This could include ports, vessels, skilled technicians, across the whole construction supply chain, mapped to local energy supply chain plans and opportunities and local skills/training. This would be enabled by a greater level of certainty of pipeline via an offshore transmission strategy and a package of investment signals for whole energy system opportunities e.g. from the Strategic Spatial Energy Plan (SSEP).

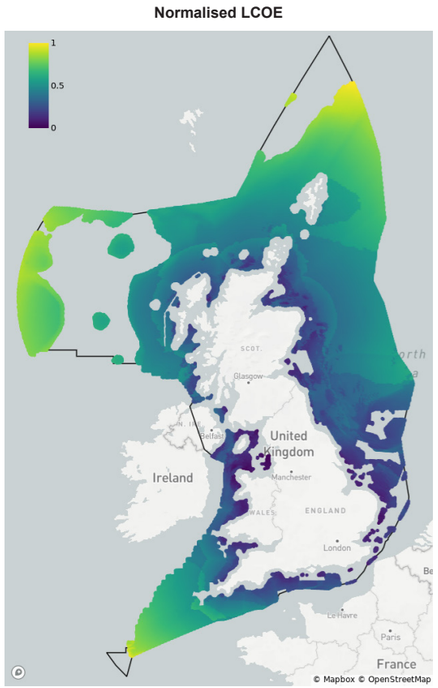
Mapping of major supply chain bottlenecks for offshore infrastructure deployment could support identification and prioritisation of investment into coastal hubs.

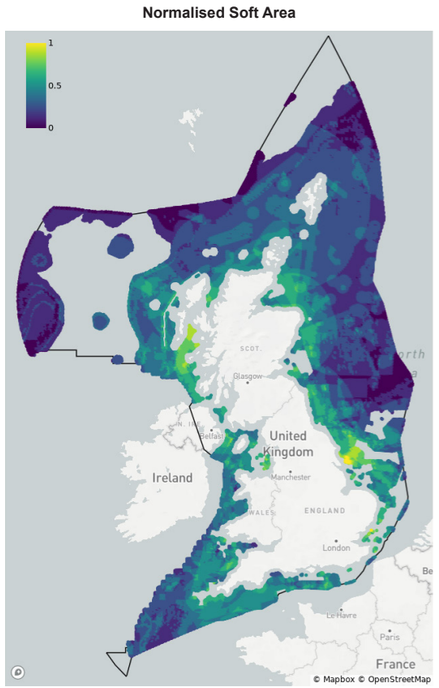
There are positive signs of increasing levels of coordination between offshore wind developers, interconnector developers and (onshore/offshore) transmission owners on the planning of offshore assets. Existing regulatory frameworks do not materially incentivise this which can create barriers when considering how technical and commercial risk can best be managed between different parties for more novel approaches such as Offshore Hybrid Assets (interconnectors with one or more wind farms connected to them), non-radial assets and OFTO build.

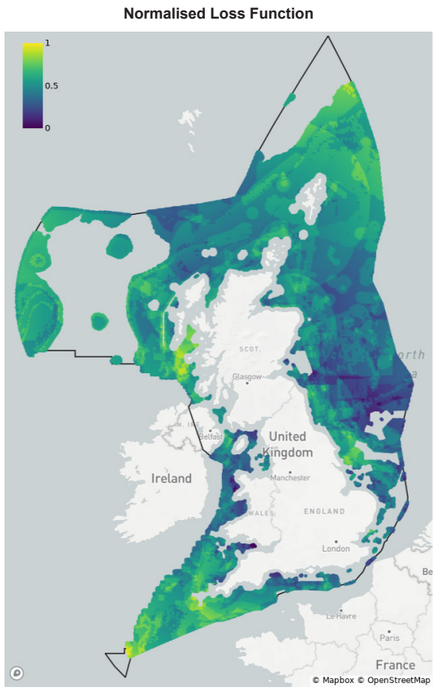
A design collaboration structure, in the form of a framework or playbook, could help support management of risk between different parties during offshore transmission development and development of associated regulation. This could incorporate lessons learnt as experience in coordinated development, design, deployment and technology grows.

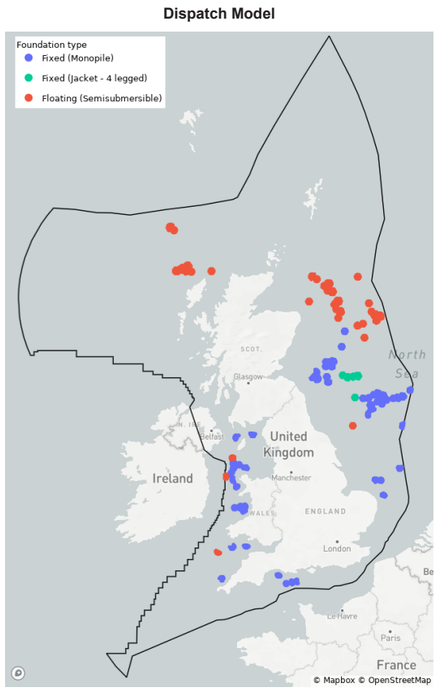
Recommendations

- Development of a collaborative and programme-based approach for marine infrastructure, based on greater transparency of the totality of the programme of work. This can also accelerate the pace of investment in critical and constrained supply chains and supporting infrastructure, such as ports. Some common underwriting of commitment would also be beneficial.
- A design collaboration playbook for coordinated offshore transmission development which can also inform regulation.
- Development of a common set of shared marine and coastal data, that can be used to explore greater offshore coordination and improve derisking of marine and coastal environmental impacts and mitigations.









Coordinated care for coastal communities and ecosystems

Offshore transmission needs to connect to the onshore grid to deliver power to large demand centres.

Offshore connections which are sometimes clustered along the coast, have the potential to increase disruption for local communities and coastal ecosystems. These communities need to be and feel listened to, engaged with and developers need to ensure social value is realised in those communities.

Communities are seeing little value from offshore transmission connections at present. More coordinated and targeted community engagement i.e. not piecemeal for each connection, alongside creation of real social value and economic opportunities from the construction and operational needs of offshore energy infrastructure, should provide significant benefits to coastal communities and support local buy-in. National strategies such as the Strategic Spatial Energy Plan (SSEP) should inform and support improvements in early engagement with communities, envisaging and incorporating an offshore energy infrastructure strategy.

Development of strategic coastal energy hubs could be an effective route to grow local supply chain, skills and community buy-in. Government support of early case studies e.g. North Humber, can accelerate this, providing a blueprint for other regions and helping to build a nation-wide investment case for the supply chain. This could potentially be via GB Energy.

A coordinated offshore transmission strategy that maps out a programme of works by locality and time will enable greater coordination of multiple regional connections across the conceptual and design stage through to operation, and the derisking of marine and coastal environmental impacts and mitigations.

Recommendations

- A national energy strategy led by government that supports realisation of regional economic, social and environmental benefits in coastal areas most impacted by offshore transmission and enables early, coordinated engagement with communities.
- Early investment support for development of coastal energy hubs from GB Energy.

Conclusions

The offshore transmission roundtable enabled exploration of some of the biggest challenges, risks and opportunities for offshore transmission development, a crucial enabler for the energy transition. Technical risks were considered alongside commercial challenges and regulatory uncertainty.

However, the discussion was primarily focussed on potential solutions and mitigations to these, that will support the efficient delivery of offshore transmission at pace. This may include twin track development of offshore transmission priorities and strategy in the shorter term and longer term, reflecting the desired outcome by 2050 but also the greater uncertainty over this timeframe. All parties see the benefit of increasing collaboration and coordination, within the constructs of some level of competition, to deliver the scale of offshore transmission needed and to produce the best, balanced outcomes for consumers, investors, communities and nature.

The recommendations provide a focal point for key actions needed over the next few months and we look forward to following up early in 2025 on progress made.

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