Department for
Business, Energy
& Industrial Strategy

Offshore Transmission Network Review: Enduring Regime and Multi-Purpose Interconnectors

Closing date: 23rd November 2021

September 2021

Any enquiries regarding this publication should be sent to us at:
offshore.coordination@beis.gov.uk

Foreword

Offshore wind is one of the great success stories of decarbonisation. A decade ago, we had just over 5GW of installed capacity and we thought that reaching 10GW by 2030 would be a challenge. We have already reached that 10GW level, and have recently adopted a target of 40GW by 2030 and committed to achieving net zero emissions by 2050. Achieving the UK's net zero and renewable generation ambitions could require as much as 100GW of offshore wind by 2050. This increase in scale has been made possible by a stable regulatory framework that apportions risks to those best able to manage them and exposes the sector to competition to drive down costs. The costs of generation have come down from £79-119/MW in the first Contracts for Difference (CfD) allocation round to £39-41/MW in the latest auction in 2019. Competition is also at the heart of the OFTO regime, under which Ofgem runs competitive tenders for the ownership of offshore transmission assets.

The current point-to-point, uncoordinated approach to connecting offshore wind was designed when offshore wind was a nascent sector. Leaving the developers in control of the design and build of the transmission reduced the risks to consumers of underwriting investment to connect new projects, and left developers in control of the delivery. However, the scale of expected deployment has changed, and constructing individual transmission links will not deliver the best outcome for consumers, the environment, or local communities. Left unaddressed, this uncoordinated approach could pose a major barrier to future deployment of offshore wind.

In delivering our net zero commitments, it is important that we do not inadvertently cause unnecessary damage to valuable ecosystems or contribute to biodiversity loss. Taking a more coordinated approach to offshore transmission can reduce environmental impacts as a result of fewer cables being needed and careful planning to avoid environmentally sensitive areas. A more strategic approach would be better able to consider the full environmental impacts at an earlier stage in the process.

The distinction between an offshore network and an onshore network is becoming increasingly artificial. Generation built offshore needs to be accommodated by the onshore network, and already elements of the onshore network are physically offshore. Taking a more holistic approach to network design will ensure that we are able to deliver a more efficient electricity system that not only accommodates offshore renewables, but also better considers the requirements on the onshore network.

The government recently consulted on proposals for a cross-vector Future System Operator (FSO), which would encompass all current Electricity System Operator (ESO) roles, and new and enhanced roles across electricity and gas that will be needed to manage an increasingly flexible and dynamic system. The FSO consultation outlines the need to think holistically about the energy system as a whole, with the potential for an FSO to take on a key role in holistic and coordinated onshore and offshore network planning and potentially in recommending electricity network designs.

The Offshore Transmission Network Review ("the Review") was established to review and address deployment barriers in the current regime and to deliver a more coordinated transmission network for offshore wind with a view to achieving our net zero ambitions. We therefore propose developing a new enduring regime that takes a more strategic approach to windfarm development and considers the offshore transmission system holistically with the onshore network to deliver a more coordinated approach and reduce the cumulative impacts of transmission. This will retain the competitive elements that has made the UK a leader in offshore wind and has contributed to the reduction in costs but will apply them to a more strategically designed network to deliver consumer benefits and reduced local impacts. We are also considering how best to facilitate Multi-Purpose Interconnectors, which offer benefits by combining market-to-market interconnection and offshore transmission.

Contents

General information

Why we are consulting

The Offshore Transmission Network Review aims to deliver improvements in the way that offshore generation is connected to the onshore transmission network and facilitate a more supportive approach for multi-purpose interconnectors (that combine market-to-market interconnectors with offshore transmission). We are seeking stakeholder views to help develop an approach to the way that new projects coming forward through future seabed leasing rounds will be connected. At this stage we are asking for views on the high-level approach, and will use the responses to help develop more detailed proposals, on which we might consult at a later stage. This two-stage approach is intended to ensure that we are able to implement the changes as early as possible.

Consultation details

Issued: 28th September 2021

Respond by: 23rd November 2021

Enquiries to:

Email: offshore.coordination@beis.gov.uk

Consultation reference: Offshore Transmission Network Review: Consultation on Enduring Regime and Multi-Purpose Interconnectors

Audiences:

We expect that the following stakeholder groups might be interested in responding: offshore wind developers, floating wind developers, interconnector developers, offshore wind technology providers, Offshore Transmission Owners (OFTOs), Transmission Operators (TOs), the System Operator (SO), oil & gas sector, hydrogen sector, environmental and local community interest groups, individual stakeholders from regions particularly affected by offshore wind deployment, Devolved Administrations.

Territorial extent[1]:

England, Wales and Scotland

[1] The specific parts of the offshore transmission process are devolved matters, and we make clear the territorial extent in the relevant sections of the document

How to respond

Respond online at: https://beisgovuk.citizenspace.com/energy-efficiency/enduring-regime-offshore-transmission

or

Email to: offshore.coordination@beis.gov.uk

Please note that due to COVID-19 we are unable to accept postal responses

When responding, please state whether you are responding as an individual or representing the views of an organisation.

Your response will be most useful if it is framed in direct response to the questions posed, though further comments and evidence are also welcome.

Confidentiality and data protection

Information you provide in response to this consultation, including personal information, may be disclosed in accordance with UK legislation (the Freedom of Information Act 2000, the Data Protection Act 2018 and the Environmental Information Regulations 2004).

If you want the information that you provide to be treated as confidential, please tell us, but be aware that we cannot guarantee confidentiality in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not be regarded by us as a confidentiality request.

We will process your personal data in accordance with all applicable data protection laws. See our privacy policy.

We will summarise all responses and publish this summary on GOV.UK. The summary will include a list of names or organisations that responded, but not people's personal names, addresses or other contact details.

Quality assurance

This consultation has been carried out in accordance with the government's consultation principles.

If you have any complaints about the way this consultation has been conducted, please email: beis.bru@beis.gov.uk.

The proposals

Summary

The purpose of this consultation is to seek stakeholder views on possible approaches for an enduring regime to plan, develop and deliver offshore transmission. We will use the responses from this consultation to continue the development of options and preferred delivery model. The new regime would apply to projects (and associated offshore transmission infrastructure) which will be coming through future seabed leasing and ScotWind rounds and commencing operations post 2030.

The document sets out and considers four fundamental questions, the answers to which will be used to steer the development of possible approaches. We invite comments on these questions, and will use these responses to inform a further development of policy proposals.

Fundamental questions:

1. Is there a need for upfront strategic planning of offshore wind generation?
2. Is there a need for holistic network design[2] and what are the fundamental design choices?
3. What are the possible delivery models?
4. What should the timing of transmission delivery be?

The document also investigates approaches taken in other countries and whether elements of these approaches should be considered.

Although a detailed assessment of the possible options is still in progress, based on stakeholder engagement and feedback so far, we believe there is a need for a more strategic approach to the siting of offshore wind. We consider that a more centralised design of associated transmission will be needed to reduce the environmental and local impacts of offshore transmission and prevent this becoming a barrier to deployment. A strategic approach will also be better able to incorporate Multi-Purpose Interconnector (MPI) projects, which combine market-to-market interconnection and direct connections to offshore windfarms, and provide better alignment between the onshore and offshore elements of the regime. This may also include consideration of whether any adjustment may be required to the legal framework governing MPIs.

We would like to understand stakeholder views on this approach so that we will be in a position to legislate if changes to primary legislation are required to implement an enduring regime.

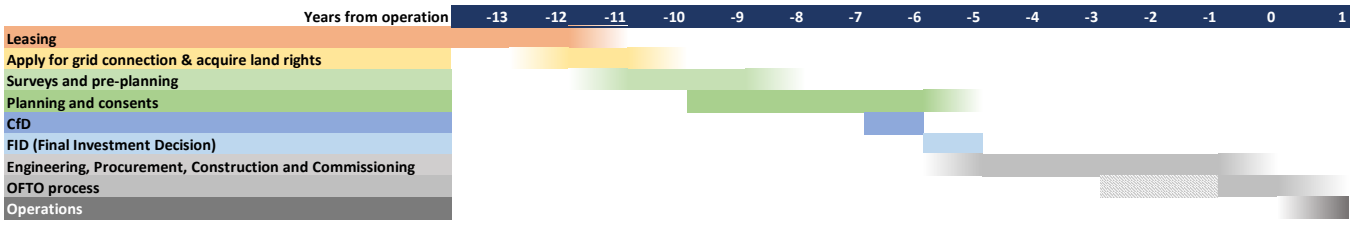
[2] An integrated approach to coordinated network design both offshore and onshore, which takes into account the location and capacity of upcoming generation and future reinforcement needs; see Annex 5 - Glossary.

Introduction – the benefits of a more integrated approach to offshore transmission

The current regime takes a developer-led approach to designing and delivering offshore transmission, which has resulted in individual connections for each windfarm. Analysis by National Grid ESO[3] found that 'an integrated approach for projects to be delivered from 2030, compared to the status quo, could deliver savings to consumers of up to around £3 billion (or 8 per cent) and could facilitate a 30 per cent reduction in the new electricity assets associated with these offshore connections.' Furthermore, in their responses to the joint Open Letter from BEIS and Ofgem in July 2020[4] most stakeholders highlighted the need for taking a more strategic approach to planning and delivery of offshore wind and associated infrastructure, and recognised the significant risks of continuing with an uncoordinated approach.

The current approach to developing offshore transmission should be seen in the context of the end-to-end process for developing a windfarm (See Figure 1 below and Annex 1 for detail). The process starts with the leasing of the seabed which is the key factor in the determination of the location of the windfarm. After obtaining a seabed lease, the developer will apply to National Grid Electricity System Operator (ESO) for a grid connection. National Gid ESO looks at available connection points and makes an offer based on the lowest cost of transmission, including any reinforcement works required to accommodate the generation output – this therefore may not be the closest connection point. Once the connection point has been offered, the developer will plan cable corridors, undertake surveys, and start preparing for the planning and consenting processes.

Figure 1: Indicative offshore wind development timeline



This approach was designed when offshore wind was a nascent sector and the focus was on reducing costs by giving developers significant flexibility in all aspects of a project's design, from siting to design and delivery of transmission. Leaving the design and delivery of offshore transmission in a developer's direct control allowed investors to become comfortable with the sector, without considering any third-party delivery risks. Similarly, for projects seeking government support through a CfD (Contracts for Difference), the timing of CfD allocation, which takes place at a later stage in the process (following the granting of consent as opposed

[3] National Grid ESO (2020) 'Final Phase 1 report in our Offshore Coordination project' https://www.nationalgrideso.com/document/183031/download

[4] BEIS, Ofgem (2020) https://www.ofgem.gov.uk/sites/default/files/docs/2020/08/increasing_the_level_of_coordination_in_offshore_electricity_infrastructure.pdf

to being done upfront alongside leasing, as in the German regime[5]) has led projects to develop individual transmission solutions to avoid being exposed to CfD award risk from other projects.

The above approach has been very effective – the UK is the world leader in offshore wind deployment and the costs continue to fall. However, other risks have increased in importance along with the scale of deployment. The impact of individual transmission links on the environment and local communities is causing increased consenting risk. We are already seeing significant local opposition to a build-up of onshore infrastructure resulting from an uncoordinated approach to offshore transmission. This risk has the potential to be a significant barrier to deployment of offshore wind at the scale we need to deliver net zero.

The huge increase of deployment needed to achieve the UK's offshore wind targets also creates new opportunities for cost reduction through shared infrastructure, and increases the potential benefits of coordination, which will not be delivered by the approach followed to date.

Overall, we consider that the benefits of an integrated approach to offshore transmission and the level of ambition for offshore wind means the current approach will, in the future, not be fit for purpose. We therefore propose developing a new enduring regime that takes a more strategic approach to network infrastructure. It would need to consider the offshore transmission system holistically with the onshore network to deliver a more coordinated approach and reduce the cumulative impacts of transmission. Unless we do this, these impacts and associated risks will only increase as deployment accelerates, potentially creating a significant barrier to achieving the government's ambitious decarbonisation and offshore wind deployment targets. In developing a new approach, we would seek to find the appropriate balance of risks and costs for a more mature sector that we expect to play a vital role in delivering net zero.

Scope of the enduring regime

Under the Offshore Transmission Network Review ("the Review"), our starting point is that the entirety of the end-to-end process for developing a windfarm should be within the scope of the review. This includes:

- Informing seabed leasing;
- the grid connections process;
- the planning and consenting process, including the policies set out in the relevant marine plans;
- the regime for determining who designs and constructs the transmission asset;
- the allocation of government support such as the CfD renewables support mechanism;
- the approach to transmission charging.

This requires time to implement necessary changes and at the same time not create delivery risks for projects that are already in development. Because the enduring regime enables a

[5] See p.26 for section on 'Approaches taken in other countries'.

complete re-think of the entire offshore wind development journey, it focuses on projects that will come through future seabed leasing rounds (The Crown Estate leasing rounds beyond Offshore Leasing Round 4 (Round 4), plus Crown Estate Scotland leasing rounds beyond ScotWind). Projects that have already started the development process are being covered by the other workstreams within the Review.

Projects that are further through their development are covered by two other workstreams within the Review:

- **Early opportunities**. This workstream is focussed on facilitating the coordination of well-advanced in-flight projects through making changes within the current regulatory framework. In delivering this workstream, we will focus on projects which are at a relatively advanced stage of the development process to implement changes to their planned connections in order to avoid consequences such as causing major commercial impacts and delays, and exposing projects to legal risks.
- **Pathway to 2030**. This workstream is focussed on less-advanced projects (projects which have won seabed leases in 2021 or will do so by 2022). It seeks to deliver increased coordination as soon as possible, whilst maintaining the pace of offshore wind delivery required to support the government's target of 40 GW of offshore wind by 2030. The approach that is proposed for this workstream is:
    - to develop a generation map showing where the offshore wind projects that have secured a seabed lease are expected to be sited and when they are expected to connect to the system;
    - to produce a holistic network design, based on the generation map and other relevant information, to deliver greater coordination across the onshore/offshore boundary; and
    - to develop a model for the delivery of the coordinated infrastructure, set out in the holistic network design, to connect offshore generation by 2030.

Multi-Purpose Interconnectors are being considered across all other workstreams in the Review.

Ofgem's "*consultation on changes intended to bring about greater coordination in the development of offshore energy networks*" covers early opportunities, holistic network design and MPIs [and is open until 8 September 2021].[6]

Fundamental questions

In order to arrive at possible models for the enduring regime, we have structured our thinking around four fundamental questions:

[6] Ofgem (2021) https://www.ofgem.gov.uk/publications/consultation-changes-intended-bring-about-greater-coordination-development-offshore-energy-networks

1. Is there a need for upfront strategic planning of offshore wind generation?
2. Is there a need for holistic network design and what are the fundamental design choices?
3. What are the possible delivery models?
4. What should the timing of transmission delivery be?

A range of potential models can then be derived from different combinations of responses to these questions. The broad approaches into which the models fall are discussed in the section later (‘A range of options’, p.26) which introduces a range of options from incremental changes to a fundamental review of the process. Individual options and further considerations are set out in Annex 2 and Annex 3 respectively. It is worth noting that the Pathway to 2030 workstream is also exploring options for questions 2 and 4 above, which may influence enduring regime choices. However, the Pathway to 2030 workstream is working towards different timings and not all elements of its approach might be relevant for the enduring regime. When developing the enduring regime, where appropriate, we may build on the approach being developed under the Pathway to 2030 workstream and advance that approach further.

A further option (2b) is considered in ‘A range of options’ section, reflecting on approaches taken in other countries, most notably Germany, where a single process is used to grant financial support, seabed rights and a connection agreement.

Towards a Strategic Plan

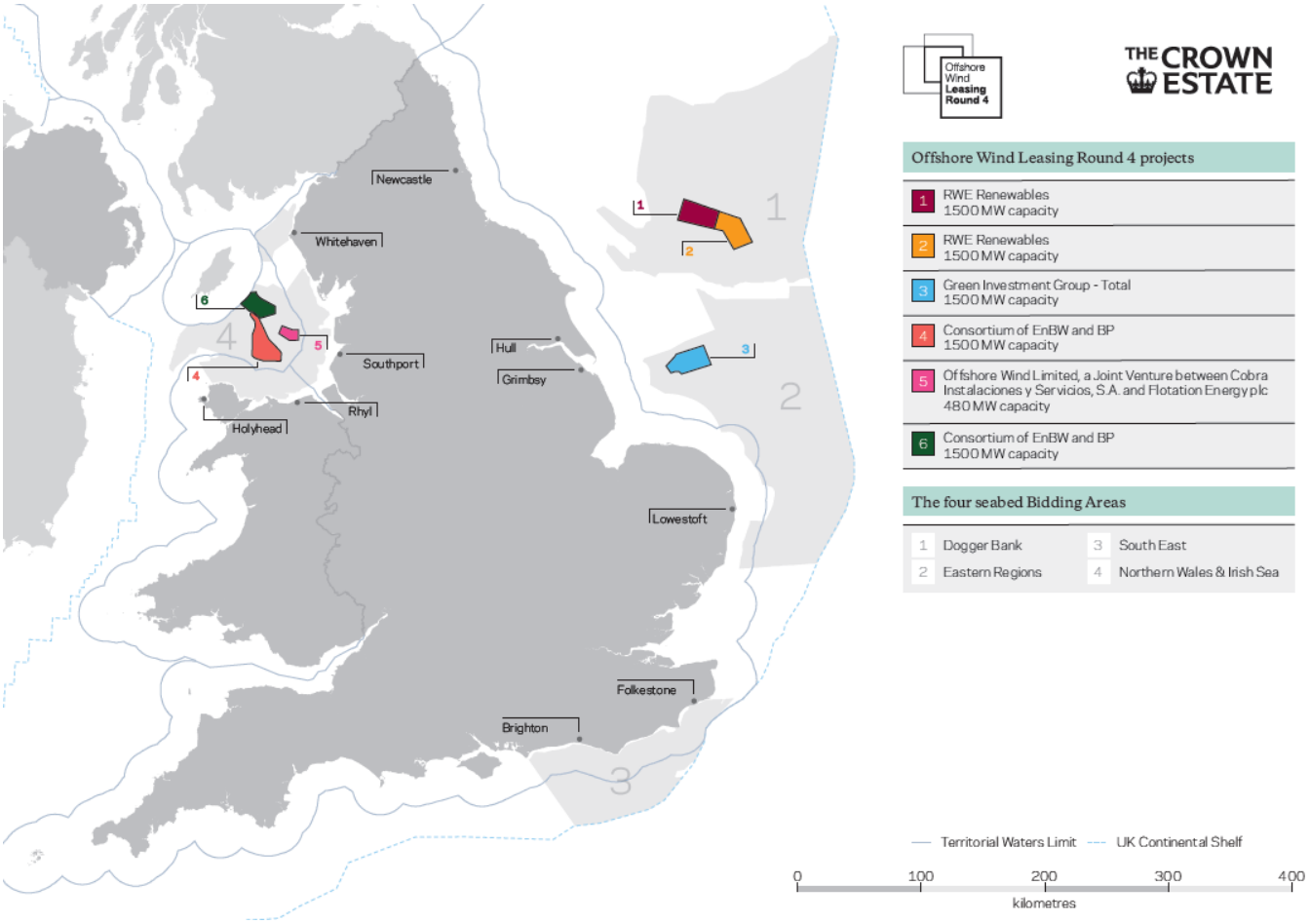
Currently, windfarm locations are determined through a combination of the seabed leasing rounds and developer choice. So far, in light of the market-led development framework in the UK, the leasing rounds have tended to make large areas available, often spread around the coast. For example, the most recent leasing round by The Crown Estate[7] covered four geographically distinct areas. The successful projects are spread over three of these areas, with one project in the Eastern Region off Lincolnshire; two projects in the Dogger Bank area; and three in the North Wales and Irish Sea area (see Figure 3).[8] Although significant opportunities exist for coordination of grid connections for most of the Round 4 projects given where they are located, it is acknowledged that continuing this approach in the future is unlikely to deliver the full benefits of coordination given the risk that projects are not close enough to share infrastructure and/or are not coming forward at a similar time.

Currently, both projects and plans go through statutory environmental impact assessment processes, and it is often only at the project level that the scale of likely effects becomes known and the opportunities for avoidance, minimisation and mitigation can be applied in practice. Where residual effects cannot be addressed in another way, compensation becomes

[7] The Crown Estate’s 4th leasing round announced results in February 2021 and environmental assessments are expected to conclude in spring 2022.
[8] The Crown Estate (2021) https://www.thecrownestate.co.uk/round-4/

a requirement. Defra has recently consulted on best practice guidance for developing compensatory measures in relation to Marine Protected Areas.[9]

Figure 2: The Crown Estate Offshore Leasing Round 4 Tender Outcomes



Source: TCE (2021) https://www.thecrownestate.co.uk/round-4/

A more strategic approach would consider the role that offshore wind and offshore transmission can play in delivery of net zero in an efficient way. This could include, for example, planning the deployment of offshore wind taking account of network considerations (e.g. locations with lower costs of necessary network reinforcement/nearer centres of demand), interactions with other development, activities and uses of the marine and coastal environment. This includes Carbon Capture Utilisation and Storage (CCUS), oil and gas platforms, and other wider strategic considerations such as the impact on environmentally sensitive areas, in particular the location of onshore and offshore protected sites designated for their environmental/biodiversity value. This could provide a forward schedule for leasing of the seabed and a schedule of CfD[10] auctions. It would be an important signal to the sector and supply chain, enabling longer-term investments to be made with greater confidence and for developers to plan their investments. Providing more foresight would help create market

[9] Defra (2021) https://consult.defra.gov.uk/offshore-wind-and-noise/mpa-compensation-guidance-consultation/
[10] Throughout this paper we refer to the CfD as the default renewable support mechanism. The same considerations would apply to any competitively allocated support mechanism.

certainty and support the development of a strong pipeline of projects and a robust supply chain.

A more integrated approach

A strategic approach would also inform the geographic areas for wind farm development and indicative cable corridor routes. It would consider the environmental impacts of these, the need to avoid environmentally sensitive areas both onshore and offshore, and consider the latter in combination to optimise the reduction of impacts. It would follow the 'avoid, minimise, mitigate, compensate hierarchy' and seek to avoid, as far as possible, the need to find biodiversity compensatory measures. It would also consider other uses of the marine environment, such as fishing, shipping, aggregates, oil and gas. Many of these elements are already included in the approach taken by The Crown Estate based on the marine plans for England and the Welsh National Marine Plan, and in Crown Estate Scotland's approach to identifying areas for leasing based on a Marine Plan for Scotland. We would build on these approaches, ensuring we work with the marine planning authorities to integrate transmission network planning into the revision of marine plans at the appropriate time. In addition, a strategic approach would set out when and where we expect offshore wind to be developed, which would enable reinforcements of the onshore transmission network to be planned at the appropriate time. This would help to ensure that onshore capacity constraints do not become a barrier to deployment of offshore wind.

A strategic plan could also identify the following: connection points into the onshore transmission network and any reinforcements needed for the existing transmission network (currently identified by the National Grid ESO through the connections process); corridor routes for offshore cables (currently done by developers based on the connection point); zones for associated infrastructure (offshore platforms; onshore converter stations and sub-stations, currently done by developers and TOs); and interactions with any 'bootstrap'[11] reinforcements to the onshore network. A high-level spatial approach would be better able to consider the environmental impacts mentioned above. The Crown Estate recently undertook a study looking at the spatial constraints on the East Coast, which provides a good evidence base for the region and highlights the importance of coordination from a spatial perspective. The experience gained through this study could inform a wider assessment.[12] It would enable an integrated approach to the infrastructure planning of multiple windfarms, in combination with potential routes to shore and the most appropriate grid connection points. This strategic approach would seek to ensure the most optimum locations for the end-to-end infrastructure (rather than separately as is currently the case) to avoid areas of particular environmental value or to plan effective mitigation early on, for example, by considering impacts on designated landscapes in accordance with responsibilities and obligations for National Parks and AONBs (Areas of Outstanding Natural Beauty). Depending on the status of a strategic plan, it may be subject to the relevant environmental assessments (including a Habitats

[11] See Annex 5 - Glossary.
[12] The Crown Estate (2021) Offshore Wind Evidence and Change Programme - finding space for offshore wind | The Crown Estate

Regulation Assessment (HRA) and Strategic Environmental Assessment (SEA), as required[13]) and consider the cumulative and in-combination effects. This approach is identified as needed to support the scale of deployment planned, given that our seas are increasingly congested.

Although it would be possible to deliver some of the benefits of coordination in the absence of a strategic plan, we think these would be small by comparison. They would likely be opportunistic changes where windfarms near each other happen to be following a similar timeframe (and so could potentially plan to share transmission infrastructure), or where a future windfarm in the area can reasonably be expected. It is unrealistic to expect changes to the latter stages of the windfarm development process to be able to deliver significant benefits if the early stage does not plan coordination. If the location and timing of generation development is not planned to maximise coordination, it becomes harder to achieve this later in the development process.

Possible components of a strategic plan

In addition to the approach outlined above, we set out below (in Fig. 3) some potential components of a strategic plan. Many of these activities are already undertaken by The Crown Estate and Crown Estate Scotland or by relevant marine planning authorities. However, these activities currently take place at different times and are not integrated across different organisations and processes.

Figure 3: Possible components of a strategic plan

What could a strategic plan contain?		
Target generation capacity	Level of interconnection	Network capacity view
Mapping of potential generation & MPIs	Mapping of sea floor constraints	Network reinforcement need
Community impacts	Strategic Environmental Assessment	Spatial planning

A strategic plan would present a vision out to 2050 with interim objectives consistent with the Climate Change Committee recommendation for a decarbonised power sector by 2035. This would consider realistic ranges of offshore wind deployment necessary to reach our decarbonisation targets, which could then inform the timetable for seabed leasing rounds and potentially allocation rounds for financial support. In considering timings, the plan would provide greater certainty for the shorter- to medium-term and be more indicative for the longer-term. For example, for the 10- to 15-year horizon it could set out a timetable for seabed

[13] Noting that the requirements regarding SEA are themselves subject to change as part of wider planning reforms.

leasing, including mapping of potential areas for generation sites and cable corridors; and high-level details of the holistic network design to ensure transmission capacity is available. For the 20 to 30-year horizon it could show aggregate deployment ambition for the decade with less spatial detail. This would require the plan to be kept up to date and the status of the plan and governance arrangements would need to be determined, providing the opportunity for alignment across the various bodies responsible for elements of the process, including government departments (notably BEIS and Defra), The Crown Estate and Crown Estate Scotland, the Marine Management Organisation, the Devolved Administrations, Marine Scotland, the Transmission Owners and the National Grid Electricity System Operator, and how these are managed.

There would be a requirement for stakeholder engagement in the development of a strategic plan. The strategic plan would also need to be updated regularly to ensure that it continued to represent a sound basis for leasing rounds and for decisions around network design. It may be appropriate to align these updates with carbon budget periods, which would suggest updating on a 5-year cycle.

Possible trade-offs

It is important to explore some of the potential trade-offs inherent in adopting a strategic approach. If seabed leasing maximises opportunities for coordination, this could result in a smaller number of potential projects. This would reduce the diversity of projects competing in any CfD auction, which could reduce the competitive pressure in the auction. There are also fundamental questions around the role of the CfD in project selection if we are following a more strategic centralised approach. Essentially, if we take a more centralised approach to identification of sites, then there is less scope for developers to choose the sites that they feel are best suited to offshore wind and can help deliver lower costs. This is an inevitable trade-off with greater levels of deployment – that increased pressure on the use of the sea leads to less choice on where offshore wind can be developed. A further challenge is created if the network is planned for those projects that have secured a seabed lease, but where some of those projects ultimately fail to secure financing or fail to build at all. To reduce the risks of anticipatory investment[14] (AI) in transmission, it may be worth considering closer alignment between seabed leasing and CfD auctions. In some countries the renewables support, seabed leasing and connection offers are combined into a single competitive process – this is considered further later in this document.

Questions:

1. **We think that a more strategic approach to the planning and development of offshore wind is needed to achieve the Review's objectives. Do you agree? Please explain your answer.**

[14] See Annex 5 - Glossary.

2. **If you agree, do you have any views about the scope of the strategic plan? For example, should it cover generation or be limited to transmission?**

3. **What governance arrangements would be appropriate for a strategic plan? For example, who should be the lead organisation, and what roles and responsibilities would other partner organisations have?**

4. **How should stakeholders be consulted during the development of a strategic plan?**

5. **What time period should be covered by a strategic plan and how frequently do you think it should be updated?**

Holistic network design

The current approach leaves the design of the offshore transmission to each developer for its individual project, which has resulted in transmission being developed as simple point-to-point assets. Similarly, cross-border interconnector projects are currently designed by individual developers, resulting in no integration with offshore wind generation. Although it is possible for developers to work together to design shared infrastructure, there are commercial and other barriers[15] that would need to be overcome. It seems very unlikely that a developer-led approach would be able to deliver any of the more complex coordinated offshore network configurations without providing very clear information about future development and strong incentives that would allow the developers to benefit from taking on additional risks. In particular, a developer-led approach to network design would not give enough confidence to allow the TOs and the ESO to properly consider any necessary reinforcements of the onshore network. Furthermore, a developer-led approach is unlikely to take into account cumulative impacts of the infrastructure on environment and communities, or account for potential future entrants seeking to connect in the region. A developer-led approach to shared infrastructure also introduces a new risk that the other developers expected to use the shared infrastructure fail to reach a final investment decision (FID). It may be possible to mitigate this through changes to the CfD or changing the approach to anticipatory investment – this would have significant limitations and is explored later in the document.

There are likely to be benefits from a centralised approach that could consider the location, capacity and timing of offshore wind development and translate this into a holistic network design which integrates the offshore transmission network with onshore transmission, CCUS (Carbon Capture Utilisation and Storage) and potentially hydrogen as an energy vector. This benefit is irrespective of whether the location, capacity and timing of the generation could in the future be determined by a strategic plan or are, as is currently the case, the result of developers' decisions. To deliver this objective, the Review considers requiring the ESO to

[15] This could include the agreements needed regarding the approach to consenting, mitigation and compensation and acceptable risk sharing between private and public sector to ensure private sector funding and minimising costs where possible or appropriate.

develop a holistic network design under the Pathway to 2030 workstream. The Pathway to 2030 workstream has set up a Central Design Group within which the ESO will consult and collaborate with the TOs and consult with stakeholder groups as the design is developed. While the work currently being done under the Pathway to 2030 workstream takes place within the existing regulatory framework, moving permanently to a holistic network design approach could mean the ESO extending its current remit towards the role of a strategic network planner or another party taking on this role. We are considering this potential role as part of the work on the future of the System Operator, on which we recently consulted.[16]

A centralised approach to network design may change the approach to offering financial support. At present, developers are in control of the generation and the transmission costs and will factor both into their strike price bid. Based on a strategic spatial plan it would be possible to complete the high-level network design at an early stage in the overall development process, i.e., before the seabed leasing rounds. This would give developers greater information about their transmission charges ahead of leasing and allow the leasing round to also incorporate a grid connection offer. The current approach only provides an indicative grid connection offer pre-leasing. Making this a firm offer that is known at the time of leasing would be an improvement from the developers' perspective. We would need to consider changes to the methodology for calculating the offshore component of transmission charging.

In turn, the CfD award risk presents challenges to the holistic network design. For the Pathway to 2030 workstream, the holistic network design is expected to be based on a 'generation map' showing the location, capacity, and completion date of the windfarms to be connected. The network design will be less efficient if there is uncertainty about when or whether certain projects complete. If the network design is based on assumptions that turn out to be incorrect, then either the network would be overbuilt, resulting in greater costs to the consumer, or the design would need to be changed late in the process to accommodate additional generation, increasing the risks that it is not ready in time and potentially negating some cost benefits a holistic network design can deliver. However, with the volume of wind required to meet future targets, the excess grid connection capacity from an overbuilt network could be made available to future seabed leasing rounds, thus reducing the risk of oversized or stranded transmission assets in the longer term.

Holistic network design is one of the key areas of focus in the Pathway to 2030 workstream, and more details of the design considerations can be found in Ofgem's consultation[17]. We intend to draw heavily on the approach taken under that workstream. We will have the opportunity to reflect on the final approach taken in Pathway to 2030 as we develop more detail for the approach.

Questions:

[16] BEIS (2021) https://www.gov.uk/government/consultations/proposals-for-a-future-system-operator-role.
[17] Ofgem (2021) https://www.ofgem.gov.uk/publications/consultation-changes-intended-bring-about-greater-coordination-development-offshore-energy-networks

6. **We think that there is a need for a Holistic Network Design that plans offshore transmission for the long-term as an integrated part of a transmission network, Do you agree? Please explain your answer**

7. **If you agree, do you think a Holistic Network Design should also include onshore transmission?**

8. **Who do you think is best placed to undertake a Holistic Network Design? Please explain your answer.**

Delivery models

The key questions regarding delivery models are about who is best placed to undertake which activity in the process of delivering offshore transmission, and at what point it is it most appropriate to include competition. The current delivery model gives the developer the choice between a 'developer-build' model and an 'OFTO-build' model[18]. So far, all offshore transmission has followed the 'developer-build' model, under which the developer retains full control and responsibility for the design, planning and construction of the transmission. Once the transmission has been commissioned, Ofgem run a tender to identify an independent offshore transmission owner (OFTO) to take over the asset for the operational period. The OFTO pays the developer the 'efficient-build cost' (mechanistically determined by Ofgem), and in return receives an annual 'management fee' for the term for which the licence is granted (typically 20-25 years).

It is important to ensure that risks reside with those that are best able to manage them and that the appropriate incentives are in place. The matrix of options below builds on the approaches developed for Pathway to 2030; because the enduring regime would apply to future projects, we have more ability to change the process. However, we also want to make sure that the changes are made in time for the next seabed leasing round so that the new enduring regime can apply to those projects from the start of their project development.

The choice of timing of competition will depend on what goals the mechanism primarily aims to achieve. The current developer-build OFTO approach leaves the risks during the construction process with the developer, as they are well able to manage those risks. Including competition at this late stage means that the OFTO is taking on responsibility for a fully operational asset and does not face any of the risks of construction. This attracts investors looking for a stable, low-risk investment in return for lower returns, which reduces the cost of finance for the long-term operation of the transmission asset, delivering significant saving to the consumers. We recently published a consultation on competition in onshore electricity networks.[19] In that document, we set out how different constraints could suit different types of competition (e.g., early- or late-stage competition) in onshore networks. While this consultation focuses on

[18] See Annex 5 - Glossary
[19] BEIS (2021) https://www.gov.uk/government/consultations/competition-in-onshore-electricity-networks

offshore connections, parallels can be drawn between the two. The introduction of onshore competition also provides an opportunity to potentially remove the current regime's distinction between onshore and offshore and move towards a single integrated approach.

At the other end of the spectrum, holding a competitive process early has the potential to incentivise greater innovation, but the successful bidder would be exposed to the risks of development and construction and would increase the returns investors expect, to reflect the greater risks faced during the earlier stages of the project.

Table 1: Possible Offshore Transmission Delivery Models

	Holistic Network Design	Detailed network design	Pre-construction (e.g. consenting)	Construction	Operation
1. TO build and operate	ESO	TO	TO	TO	TO
2. TO build, ITO[20] operate	ESO	TO	TO	TO	ITO
3. TO design, ITO build and operate (Late-competition)	ESO	TO	TO	ITO	ITO
4. Early ITO competition	ESO	ESO or TO	ITO	ITO	ITO
5. Very early ITO competition	ESO	ITO	ITO	ITO	ITO
6. Developer design and build, ITO operate	ESO	Developer	Developer	Developer	ITO
7. Current approach – OFTO regime	N/A	Developer	Developer	Developer	OFTO

Option 1 – TO build and operate.

After the high-level design is completed by the ESO, the TO would be tasked with the detailed design and construction as an extension of their onshore remit. In this model, there is no competition and the TO retains ownership of the transmission for the operational lifetime of the asset. This has the potential to allow for faster delivery as there is no need to run a tender

[20] In this paper we are using the term ITO (Independent Transmission Operator) as the competitively appointed company that would take ownership of the transmission at the relevant stage. It should be considered analogous to OFTO or CATO, but without prejudice to the mechanism.

exercise, simplify the end-of life process and the decisions around replacement of parts of the asset, reinforcement or integration with new transmission in the future. However, the lack of competition may not deliver the best value for money.

Option 2 – TO-build, ITO-operate

This approach includes a competitive stage after the transmission is commissioned, similar to the current OFTO approach, but with the detailed design and construction carried out by the TO. This is likely to bring in cost-savings similar to those seen under OFTO.

Option 3 – TO design, ITO build and operate (Late-competition)

This model would require the ESO to undertake the high-level design, and the incumbent TO to undertake the detailed design and consent the shared infrastructure, with the subsequent appointment of an ITO to construct and operate it. By exposing the construction to competitive pressure, it may be possible to reduce the costs associated with this step. Although the planning risks are dealt with prior to the competition, there are still construction risks and investors would require a higher return to reflect this.

Option 4 – Early ITO competition

This model holds the competitive process after the detailed design, but before the planning and consenting stage. This could introduce risks that the detailed design does not fully consider the challenges of taking the project through the planning process, potentially increasing the chance of rejection.

Option 5 – Very early ITO competition

Holding the competition before the detailed design would allow for more innovation in the project design potentially reducing overall costs. However, it would also leave significant risks, which would lead to a higher cost of finance. It is unclear how significant the potential innovation benefits would be, considering that the high-level design has already been completed.

Option 6 – Developer design and build, ITO operate

After the holistic design is completed by the ESO, it would be the developers' responsibility to complete the detailed design and construct the transmission. A competitive tender process would be carried out to transfer ownership of operational assets to an ITO.

Developers would maintain control of the construction process, including completion dates etc. Accordingly, construction risk stays with the developers. However, for shared assets this would require complex partnerships between developers. There are challenges associated with having several developers get together to deliver a coordinated offshore transmission infrastructure that will serve other, competing developers, as well.

Developers would have to collaborate with other developers to develop the detailed network design. This collaboration has the potential to create issues arising from a lack of clear alignment of commercial interests. For example:

- How to decide between design options that benefit one project more than another?
- Who will deliver the joint infrastructure (one developer tasked by the others or an "offshore delivery consortium" formed by all developers concerned)? This consideration applies to the consenting stage as well as the tendering and construction stages.
- How will costs and risk be shared?
- What happens if one of the developers becomes insolvent or fails to secure finance for its project?

These competitive tensions could present a barrier to the delivery of coordinated solutions that deliver the greatest benefits to consumers the environment and reduce local impacts.

Option 7 – Current approach – OFTO regime

Under the current approach, the development risk for projects that ultimately do not progress is borne by the generator with no underwriting or support from the consumer. By holding the tender at a late stage once the risky stages are complete, it is possible to get the long-term savings for the consumer without exposing the consumer to the risks if a project does not deliver.

Consideration of delivery models

Some of these options have the ITO taking on responsibility for very different activities with very different risk profiles. We would be interested in views from stakeholders as to what would deliver the greatest benefits. For example, options 1, 3 & 4 have the ITO coming in for the operational phase, once construction and commissioning are complete. This stage has a low risk profile with fixed returns for a long period and would attract low-risk investors accordingly. By contrast the risks associated with taking a project through development and construction are significantly greater and would attract investors looking for a greater reward. We also note that some of the approaches outlined would mean that a centrally-designed project is exposed to greater risks, and it is likely that the consumer will need to underwrite these risks more than they do currently. For example, the developer is currently fully exposed to the risks of consents not being granted, under a more centralised approach it may be necessary for the consumer to bear some of these risks. A detailed risk analysis and determination of risk sharing between the private sector and the consumer will be required to identify impacts on costs, optimal business models and attracting private sector funding.

Beyond what is being considered as part of the Review, there is ongoing work in this space. Ofgem recently consulted[21] on the model relating to early-stage competition and National Grid ESO have undertaken an Early Competition Project which was published in April[22].

Questions:

9. **Which delivery model would provide the appropriate balance of incentives and cost savings, given the Review Assessment Criteria (Annex 4)? Please explain your answer**

Timing of detailed design and delivery of transmission

Under the current approach, the design and delivery of transmission takes place largely in parallel with that of the generation asset.[23] This is consistent with the developer-build model as the two assets are effectively developed as a single project and the delivery risks are managed by the same entity. If the entity that designs, develops, and delivers the transmission is separate from the entity developing the generation, then there are decisions to be made about whether the transmission is designed and delivered early or late in the process.

Early: Building on the Holistic Network Design which will have a medium level of detail, it will be necessary to develop detailed designs both for the onshore and the offshore elements of the network setting out the technical details required for a contractor to start construction of the transmission. Subject to the transmission obtaining seabed rights, this could be done early in the process (i.e. ahead of the seabed leasing for the generation) for both the onshore and the offshore network, giving more certainty to the developers. At an extreme, it could be possible to time the planning approvals for the transmission (both onshore and offshore) so that decisions are made before developers bid for the seabed lease. This would reduce the risk to developers (and therefore costs as a result of a reduction in risks) of taking on a commitment without certainty that the transmission would be consented. However, early delivery of transmission would make it very challenging to efficiently design the network with the uncertainty of whether projects will subsequently reach FID. This would increase the risk of underutilised transmission capacity in the event that one or more generators do not ultimately come forward, or come forward later. Although it would be possible to reduce the impacts of this by ensuring that other developers could make use of the available capacity in the future (e.g., through a 'use-it or lose-it' approach to leasing), this would nevertheless be a real cost to the consumer. Such an approach would also likely require establishing and setting out upfront common technology standards to ensure that technological solutions used for the wind farm assets and transmission assets are compatible.

[21] Ofgem (2021) https://www.ofgem.gov.uk/publications/consultation-our-views-early-competition-onshore-electricity-transmission-networks
[22] National Grid ESO (2021) https://www.nationalgrideso.com/future-energy/projects/early-competition-plan
[23] In practice, the transmission asset is normally completed in time for the first turbines to begin exporting power while installation of turbines continues. This allows the developer to begin generating revenue as soon as possible.

In addition, this approach would present significant timing challenges as the work to develop the high-level design and the detailed design would take some time and could extend the end-to-end process. This would also make it unlikely that this approach could be taken for the next seabed leasing round.

Later: Alternatively, it would be possible to finalise the design for the transmission later, with more certainty around the generation it is intended to connect – for example, once the generation has secured government support or made an equivalent financial commitment such as entering into construction contracts. This would reduce the risk to consumers of underutilised transmission, but increase the risk to generators of stranded assets if the transmission is delayed or not delivered. It may be possible to reduce this risk through changes to the planning policy and marine licencing regime, and by ensuring that environmental and local impacts are fully considered in the strategic plan. However, there will always be residual delivery risks for the transmission, and it will be necessary to consider whether it would be appropriate to provide guarantees to mitigate these risks from a developer's perspective. If additional assurances are required, we would need to consider who is providing the guarantees and how this affects the risk allocation between the developer and the consumer.

Question:

10. At what stage should the detailed design and construction of transmission be conducted? Please be clear about which approach your comments relate to.

Approaches taken in other countries

The UK's model is one of the most decentralised approaches used. As set out in the introduction, this approach has proved very effective at allowing offshore wind the space to innovate and develop from a nascent technology into a mature technology. As a mature technology with the potential for very significant deployment over the next few decades, it is unlikely that such a decentralised approach can be sustained considering the impacts it will have. It is therefore useful to compare this with a more centralised approach to consider the relative merits. It is interesting to note that more centralised approaches tend to be used where there are more spatial limitations, for example countries with less suitable area for construction of windfarms or less coastline on which to land cables and build the required infrastructure.

Under the German system, the seabed leasing is combined with the competitive process for government support. This process grants successful bidders the exclusive right to apply for a permit to build and operate a windfarm on the site for which the financial support was auctioned. There is no separate auction for the seabed lease, and the remuneration for the seabed use is included in the permit fee (the amount of which is determined by statute with no competitive element). In addition, the award entitles the windfarm to be connected to the offshore grid by the TSO (who is responsible for delivering the offshore grid) at the place and time determined in a unified plan for offshore wind energy and grid deployment.

To support this model, the German government conducts, at its own cost, some of the preliminary site surveys that would otherwise usually be performed by the developers. The survey results are published and made available to all bidders. This way, potential developers spend less money upfront to gather the site information required for the calculation of their support bids. All bidders have the same level information, thus potentially increasing the level of competition in the auction. In addition, this procedure is intended to accelerate the permit process (which comes at a later stage) as the documentation gathered in the preliminary surveys is in any case required when applying for a permit for an offshore windfarm.

Unlike in the UK, the connection to the onshore grid is constructed, owned, and operated by the German TOs, which are therefore responsible for taking the transmission through the planning and consenting process.

The Netherlands take a yet more centralised approach, with construction permits for generation being granted alongside the seabed lease award and connection agreement. All windfarms are of a standard size (or multiple thereof), which enables the TO to take a standard approach to offshore substations and cables delivering economies of scale from the supply chain.

A range of options

We have identified two broad categories of possible options: those that retain the developer-led approach but make incremental changes to incentivise coordination, and those that introduce centralised holistic network design and delivery for offshore transmission. In the sections that follow, we set out the key changes to the main elements of the current regime that these broad approaches would entail.

- Approach #1 – Incremental change
- Approach #2a – Holistic Network Design and Delivery
- Approach #2b – Holistic Network Design with combined seabed lease and financial support

The individual options that fall into the broad categories are set out in Annex 1.

Approach #1: Incremental change

Rather than continuing with the holistic network design being developed for the Pathway to 2030, this approach retains the current developer-led approach to the design and delivery of offshore transmission and introduces new incentives to encourage cooperation.

Anticipatory investment. By changing the methodology for determining the 'economic and efficient build cost' of transmission and the approach to cost recovery, Ofgem could allow the generator to be reimbursed for the cost of constructing larger, shared transmission assets that would also serve other generators. This could be either generators coming forward in the

same CfD allocation round, or generators targeting future rounds. Ofgem recently consulted[24] on possible approaches to this that could be applied to 'early opportunities' projects and inclusion in this consultation is without prejudice to what in concluded there.

The changes to cost recovery would flow through the transmission charging methodology and could result in the risk being borne entirely by the developer making the investment; by the developer(s) that stand to benefit from the investment; by the consumer; or shared between those parties. This would enable the generator to benefit from reduced costs, while potentially protecting them from the risk that the associated generation fails to progress (this risk could be shared with other parties). These reduced costs would help make the generator more competitive in the CfD auction, or be internalised in the project, increasing its rate of return. If it translates to reduced CfD costs, then the consumer would also stand to benefit. More discussion on the relative merits of these approaches is given in Ofgem's consultation.

Changes to the CfD. If generators were able to bid jointly, or to submit 'linked bids', they would be able to benefit from the reduced costs of sharing transmission without being exposed to the full risk of non-delivery of the other project. Essentially, their bid would only be accepted if the other bid also cleared. This is likely to result in decreased competitive tension, given that both bidders would seek to be selected and could converge on very similar price points in an effort to ensure this (effectively reducing the liquidity of the auction). It may be possible to allow developers to submit fall-back bids in the event that their linked bid does not clear. This approach would create significant complexity for the CfD process, and many questions would need to be worked through, for example, whether the projects would have joint contracts, and the impacts of one project failing to deliver by the long-stop date. A more directive approach could be to require all projects to demonstrate that they have considered coordinated approaches as a prequalification requirement for the CfD, though, this would be very difficult to administer in practice.

Changes to the connections process. To support these incentives, the ESO could make changes to the connections process to facilitate coordination, for example, by directing clusters of projects to shared onshore connection points. This approach would consider all projects in one area together to enable better consideration of the cumulative impacts on the onshore transmission system.

Changes to planning policy. To support the positive incentives, it may be appropriate to make changes to planning policy to favour coordinated transmission where this is feasible.[25] However, determining what is feasible would be difficult and could introduce a degree of subjectivity.

These approaches, or a subset of them, could also be implemented alongside a strategic plan which could help increase the opportunities for cooperation between developers.

[24] Ofgem (2021) https://www.ofgem.gov.uk/publications/consultation-changes-intended-bring-about-greater-coordination-development-offshore-energy-networks
[25] This would only apply to projects in England

Approach #2a: Holistic Network Design and Delivery

This approach builds on that being developed under the Pathway to 2030 workstream which was the subject of Ofgem's recent consultation on changes intended to bring about greater coordination in the development of offshore energy networks[26]. This involves the ESO developing a network design to connect offshore generation that also takes account of onshore transmission requirements and reinforcements. This is to be developed in collaboration with the onshore TOs, and potentially other stakeholders through a working group guided by terms of reference aligned to the Review Assessment Criteria (Annex 4). For the enduring regime, it is likely that we would want a more formalised arrangement, with clear designation of responsibility and ensuring we have the right split of responsibilities and incentives between the ESO and the TOs.

The detailed design for any onshore reinforcement would be undertaken by the entity delivering the infrastructure, which is currently the relevant onshore TO. In the future this could also potentially be a competitively appointed transmission operator (CATO) or it could be delivered as part of an integrated transmission solution resulting from the Holistic Network Design.

This approach does not require a strategic plan that sets out the location of offshore generation in advance, as can be seen in its application in the Pathway to 2030. In the Pathway to 2030 approach, this role is fulfilled by the generation map which identifies where and when offshore generation will connect. However, a strategic plan would be of broader scope and consider further time-horizons. This would reduce the risks of anticipatory investment to allow the network design to be conducted with greater confidence that the generation would be forthcoming in the areas expected. This would apply to the onshore transmission equally and would help to ensure that capacity on the onshore network does not delay deployment of offshore generation. It may be appropriate to change the planning policy and marine licencing regime to reduce the risk of rejection for infrastructure that is covered by the strategic plan, particularly if the strategic plan included robust assessment and mitigation of environmental impacts. Where ancillary regimes fall under the competency of the devolved administrations, we will look to explore the scope for collaborative working to ensure our approach is consistent with the devolution settlement.

Who does the detailed design for and delivers the offshore infrastructure would depend on the delivery model selected, which could include National Grid ESO, TOs and developers / ITOs (Independent Transmission Owners). This therefore creates a number of variations on this approach.

Similarly, this model is compatible with either early or late delivery of transmission infrastructure. Different configurations of this broad approach are shown in the Annex 2.

[26] Ofgem (2021) https://www.ofgem.gov.uk/publications/consultation-changes-intended-bring-about-greater-coordination-development-offshore-energy-networks

However, there are some challenges with a more anticipatory approach to transmission, particularly considering that the award of government support is relatively late in the process and until this point there remain significant delivery risks for any project. This award risk is the primary reason that, under the current approach, onshore works are not approved until a project has been granted a CfD. We would need to become comfortable with this risk or change the process to reduce it.

Approach #2b: Holistic network design with combined seabed lease and financial support

To address the challenges outlined above, in addition to the holistic network design, it could be possible to combine the seabed lease auction with the allocation of government support into a single competitive process. This would avoid the challenges associated with having two sequential competitive processes and the need to maintain competitive tension in both. To ensure competition, there needs to be a risk of being unsuccessful, which encourages participants to bid competitively. This risk makes it very difficult to plan the transmission network efficiently – we would either have to accept a risk that the network is designed for more capacity than will ultimately come forward, or we would need to ensure flexibility to adjust the detailed design. This approach also features the holistic network design, which separates the processes for design and delivery of transmission and generation.

A single competitive process would provide much greater certainty around the siting and timing of generation, enabling the transmission to be designed with much less uncertainty. This would enable it to be moved earlier in the process, but with a reduced risk of underutilised capacity. It would also be possible to include the connection offer in this process, further reducing uncertainties for the generator.

However, this approach would introduce significant changes for both the approach to seabed leasing and the CfD framework. Changes of this nature would need to be agreed with The Crown Estate, Crown Estate Scotland, and national and devolved consenting bodies, to reflect the roles they have in the process. Presently, developers need to have secured planning permission before they can pre-qualify for the CfD auction. This ensures that only projects that have considered their environmental impact can participate. It also reduces the delivery risk after CfD award and shortens the time between CfD award and first power.

Two possible variants could be considered. The first would be to leave the project developer to seek planning approvals after the CfD award and to make adjustments to the CfD framework to accommodate these changes. This would increase the time between CfD award and project delivery, increasing delivery risks. To account for this, it may be necessary to reduce the non-delivery penalty or include new flexibilities for delivery dates to account for the greater uncertainty. It may also be possible to conduct surveys ahead of leasing and to provide the results and site data to bidders.

The alternative would be for the seabed lease to come with planning permission already granted. The current planning system can allow a degree of flexibility through the 'Rochdale envelope'.[27] We would need to consider whether the proposed approach would require additional flexibility beyond this. Even so, it could reduce the ability for developers to innovate and make best use of the latest available technologies. However, a more standardised approach to network development could have economies of scale and reduce the costs of transmission.

Question:

11. Do you have any views on the relative merits of these high-level approaches?

1. Incremental change

2a Holistic network design and delivery

2b Holistic network design with combined seabed lease and financial support

Facilitating Multi-purpose interconnection

Background

The objective of the Review's MPI workstream is to consider the role of MPIs in meeting net zero through combining offshore wind connections with links to neighbouring markets, and how the transmission regime can support the delivery of MPI projects.

BEIS recognises a number of potential benefits in facilitating the deployment of MPIs. The deployment of both cross-border interconnection and offshore wind is important in reaching net zero emissions by 2050, both for the UK and for our North Sea neighbours. By combining the functions of offshore transmission and cross-border interconnection, MPIs have further potential benefits when compared to the counterfactual (conventional interconnection deployment). These potential benefits include reducing the number of landfall points of onshore grid connections, and therefore the environmental and local community impacts, reducing the capital and operational costs, alongside reducing the curtailment of wind with associated benefits of higher infrastructure utilisation rates[28,29]. In Ofgem's recent consultation published on 14 July[30] (the 'Ofgem consultation'), the Early Opportunities and MPI chapters explored how MPIs could potentially be facilitated in the near term through incremental

[27] This gives developers planning approval with a degree of flexibility to determine some more precise technical details of the project later, see Planning Inspectorate Advice Note here: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2013/05/Advice-note-9.-Rochdale-envelope-web.pdf

[28] National Grid ESO (2020) https://www.nationalgrideso.com/news/final-phase-1-report-our-offshore-coordination-project

[29] See separate Impact Assessment

[30] Ofgem (2021) https://www.ofgem.gov.uk/publications/consultation-changes-intended-bring-about-greater-coordination-development-offshore-energy-networks

changes to the existing framework, and considered the importance of market arrangements to MPI licence classification and models.

For the enduring regime, we are able to take a less constrained approach and consider whether changes to legislation would better enable MPIs to contribute to delivering the benefits of a coordinated approach to transmission infrastructure. Our approach will in part be informed by the outcome of the Ofgem consultation and may conclude that 1) an enduring regime for MPIs can be provided within the existing framework, 2) an enduring regime for MPIs can be provided within the existing framework, though legislative change would support and reinforce this regime, or 3) legislative change is required to provide for an enduring regime for MPIs. If legislative change is necessary, we would look to apply these changes as soon as possible to support MPI projects targeting connection prior to 2030, as well as future projects.

The facilitation of two main concepts for MPIs was considered in the Ofgem consultation.[31] These are based on the current development models for offshore transmission and interconnection:

1. the OFTO-led model where a radial connection to shore from a GB offshore windfarm is combined with a further direct connection from the GB wind farm to the electricity network or windfarm of a neighbouring country. The build-out provides for cross-border electricity flows in addition to the offshore wind connection.
2. the interconnector-led model where a point-to-point interconnector cable also includes direct connections with offshore windfarms which use the interconnector as their connection to market.

For the enduring regime, in addition to these concepts, we will also need to consider the potential for new approaches to be introduced, including offshore hubs, which could connect higher wind capacities to a number of countries and also incorporate the deployment of alternative technologies (including storage and power-to-x conversion[32]).

Towards an enduring regime

An important barrier presented in the Ofgem consultation is asset definition within the current legal framework.[33] The regulation of activities in the electricity system of Great Britain is based on the primary licensable activity of the asset, as provided for within the Electricity Act 1989 ('the Act'). At present, the Act does not provide for the specific activity of MPI assets, and the dual function of component assets of MPIs presents challenges to how their activities should be licensed, given the provisions of the Act.

For example, the current legal and regulatory framework in Great Britain treats interconnection and offshore transmission as distinct activities – these are defined in the Act, and involvement

[31] Ofgem (2021) https://www.ofgem.gov.uk/publications/consultation-changes-intended-bring-about-greater-coordination-development-offshore-energy-networks
[32] See Annex 5 - Glossary
[33] Ofgem (2021) https://www.ofgem.gov.uk/publications/consultation-changes-intended-bring-about-greater-coordination-development-offshore-energy-networks

in these activities without a licence is prohibited. There is no corresponding definition of, and provision for, a licence for MPIs. The Act defines an interconnector as "wholly or primarily" for the purpose of the conveyance of electricity between Great Britain and another country or territory. In an MPI project, the additional function of transmitting wind-generated electricity to shore may mean that the interconnector definition is no longer fulfilled; there are analogous considerations in the potential award of an offshore transmission licence (for transmission lines constructed "wholly or mainly" for conveying electricity generated offshore), where the line to shore additionally functions as an interconnector. Furthermore, the Act forbids an interconnector licensee to simultaneously hold a transmission licence – so, in an MPI, both activities cannot be regulated through separate licences for each component part. The key provisions of the Act relevant to the legal framework and licencing of any proposed component MPI assets are set out further in the table below.

Table 2: Provisions of the Electricity Act 1989 relevant to Multi-Purpose Interconnectors

Description and reference	Content of the Act
An interconnector licence is required for an asset that meets the definition of an interconnector (s4 EA 89)	'so much of an electric line or other electrical plant as […] subsists wholly or primarily for the purposes of the conveyance of electricity […] between Great Britain and a place within the jurisdiction of another country or territory'
An OFTO licence is required for an asset that undertakes offshore transmission (s6C and s64(1A) EA 89)	OFTO licence is required to authorise any activity that 'forms part of a transmission system to be used for purposes connected with offshore transmission'… with offshore transmission defined as 'the transmission within an area of offshore waters of electricity generated by a generating station in such an area.' The definition of 'transmission system' in this context is such that an OFTO licence is required for transmission lines constructed 'wholly or mainly for the purpose of conveying, to any other place, electricity generated [offshore]'
It is not possible for the owner of an interconnector to hold multiple licences per asset (s6(2A) EA 89)	'The same person may not be the holder of an interconnector licence and the holder of a licence falling within any of paragraphs (a) to (d) of subsection 1' ie … an electricity generation licence, transmission licence, distribution licence, or supply licence.
It is not possible to have common ownership or control of transmission,	Under ownership unbundling, the same person or persons are generally not entitled to control a producer or supplier and, at the same time, control or exercise any right over a

generation, and interconnection assets (s10A-O EA 89)	transmission system operator or transmission system

There are potential considerations being explored and consulted on as part of the Ofgem consultation to resolve the ambiguity of licencing an MPI within the current legislative framework.

These considerations have been set out in Ofgem's consultation[34] and include:

- Different assets (interconnection, transmission, generation) being owned and operated by different legal entities
- Each asset being licenced separately based on its primary function, that being interconnection, transmission, generation
- Determining the primary function of each component asset of an MPI and establishing a means to assess and monitor usage
- Ensuring the secondary activity of component assets is effectively regulated, potentially through licence modification

Approach

BEIS and Ofgem are working closely together within the Review's MPI workstream, and the evidence provided within the Ofgem consultation will inform our approach to an enduring regime for MPIs.

For an enduring solution we will need to consider the following:

1. the viability of the considerations set out above forming the enduring basis for the definition and regulation of MPIs within the current legal framework, which may conclude that no legislative change is required;
2. the merit in the considerations set out above being reinforced through legislation to provide a legal underpinning and clarity for the enduring regime; and
3. the necessity of legislation to allow for an alternative option for the definition and regulation of MPIs, which could include defining the MPI asset as a distinct class which combines elements and activities of interconnection, offshore transmission and generation.

In determining the approach, the time and resource implications of a legislative approach will need to be assessed against the relative benefit or need of this option, in terms of providing additional certainty and consistency with other assets. Any legislative approach will also need to consider various compatibilities to ensure it is appropriate and does not have unintended consequences. A key consideration in this work will be ensuring that any potential change in legislation is compatible with different commercial models and unbundling provisions,

[34] Ofgem (2021) https://www.ofgem.gov.uk/publications/consultation-changes-intended-bring-about-greater-coordination-development-offshore-energy-networks

alongside understanding the consequential impact of legislative change on the licencing regime and relevant codes. In addition, any legislative change will need to be conscious of compatibility with potential definitions and changes introduced in the European Union[35] to which projects from GB may connect. The legal, regulatory and market arrangement approaches will need to be compatible for such projects to proceed alongside the Trade and Cooperation Agreement[36] and its application to cross-border interconnector infrastructure.

Question:

12. **Does the current legal and regulatory framework, and Ofgem's options to regulate within that framework as described in the Ofgem consultation, provide an adequate enduring solution for the regulation of MPIs? If not, please indicate why not and what changes you think may be needed**
13. **Do you have any views on the merit or necessity of defining a separate MPI asset class in UK legislation, or other legislative change? What might be the disadvantages of this approach?**
14. **What changes might be needed to the current UK regulatory framework to address regulatory developments in other jurisdictions?**

Conclusions

At this stage it is not possible to identify a preferred option from the range of possible approaches outlined in this document. However, there are some high-level conclusions that can be drawn.

Considering the challenges to delivering coordinated transmission in an efficient manner without exposing the consumer to undue risk of anticipatory investment, we think that strategic planning will be central to the delivery of the objectives of the Review. This is consistent with early stakeholder engagement calling for coordination to be considered at the very early stages of the offshore wind development process. However, questions remain around the scope of any strategic planning and how roles and responsibilities would be determined.

We think that the commercial barriers to competing projects working efficiently together are high and that a developer-led approach is unlikely to deliver the degree of coordination that would deliver the objectives for the Review, even if supported by new incentives.

We therefore think that there is likely to be greater benefit from continuing the Holistic Network Design with coordinated delivery. This would build on the approach being developed for the Pathway to 2030, but there are likely to be some differences to reflect the different timescales

[35] European Commission (2021) https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2020%3A741%3AFIN&qid=1605792629666
[36] European Commission (2021) https://ec.europa.eu/info/relations-united-kingdom/eu-uk-trade-and-cooperation-agreement_en

under consideration. We are aware that a move away from a developer-led approach to a more centralised approach is a very significant change, and we will use the responses to this consultation to develop further detail on the range of options for assessment against the Review Assessment Criteria (Annex 4)[37]. In the MPI workstream, Ofgem has consulted on early considerations for facilitating MPIs within the current legal framework. To achieve our objective, we will need to understand the viability of those interim changes to form the enduring regime for MPI regulation, and also consider whether changes to legislation are necessary or would better enable MPIs to contribute to delivering the benefits of a coordinated approach to transmission infrastructure.

Next Steps

The two-stage approach outlined at the beginning of this document is intended to bring about change as soon as possible. Your responses to this consultation will ensure that we will be in a position to legislate if that is required to implement our preferred approach. In parallel, we will continue to develop the possible enduring regime models further, including carrying out a detailed assessment of options against the Review Assessment Criteria (Annex 4). We will do so in conjunction with the other Review project partners and will seek to incorporate stakeholder input from this consultation once concluded, as well as any relevant feedback from the currently ongoing Ofgem consultation. We would look to finalise the detail of an enduring regime through secondary legislation, which might involve further consultation(s) at a later stage.

We will also look to learn from the experience being gained through the Pathway to 2030 workstream, which will set up important foundations for an enduring regime. This workstream is targeting those projects that have already secured a seabed lease, but are at an early stage of development. Through this workstream, the ESO will continue developing a holistic network design, based on a map of generation we expect to connect by the early 2030s, with a view to completing the design by the end of January 2022. Building on the ongoing Ofgem consultation, a minded-to position on a preferred medium-term delivery model for offshore transmission should be reached this year, followed by an Ofgem consultation on the details of the preferred model and a subsequent Ofgem consultation on how to implement it.

Our enduring regime proposals are intended to apply to projects coming through future seabed leasing rounds, i.e., projects which are due to be operational post 2030, and we will continue to work closely with The Crown Estate and Crown Estate Scotland as they develop their plans for future leasing rounds.

In the MPI workstream, the response to this consultation will, as well as the evidence provided within the earlier Ofgem consultation, inform our future approach as to an enduring regime for MPIs, including whether legislative change, for example defining a separate MPI asset class,

[37] See Annex 4

may be beneficial or necessary to facilitate MPIs. Potential legislative change would be progressed along similar timelines to those of the Enduring Regime workstream.

Consultation questions

1. **We think that a more strategic approach to the planning and development of offshore wind is needed to achieve the Review's objectives. Do you agree? Please explain your answer.**

2. **If you agree, do you have any views about the scope of the strategic plan? For example, should it cover generation or be limited to transmission?**

3. **What governance arrangements would be appropriate for a strategic plan? For example, who should be the lead organisation, and what roles and responsibilities would other partner organisations have?**

4. **How should stakeholders be consulted during the development of a strategic plan?**

5. **What time-period should be covered by a strategic plan and how frequently do you think it should be updated?**

6. **We think that there is a need for a Holistic Network Design that plans offshore transmission for the long-term as an integrated part of a transmission network, Do you agree? Please explain your answer**

7. **If you agree, do you think a Holistic Network design should also include onshore transmission?**

8. **Who do you think is best placed to undertake a Holistic Network design? Please explain your answer.**

9. **Which delivery model would provide the appropriate balance of incentives and cost savings given the Review Assessment Criteria (Annex 4)? Please explain your answer**

10. **At what stage should the detailed design and construction of transmission be conducted? Please be clear about which approach your comments relate to.**

11. **Do you have any views on the relative merits of these high-level approaches?**

    1. **Incremental change**

    2a. Holistic network design and delivery

    2b. Holistic network design with combined seabed lease and financial support

12. **Does the current legal and regulatory framework, and Ofgem's options to regulate within that framework as described in the Ofgem consultation, provide an**

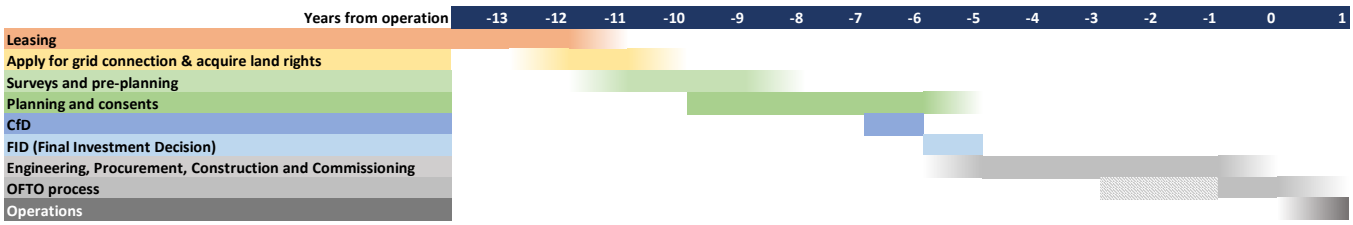
adequate enduring solution for the regulation of MPIs? If not, please indicate why not and what changes you think might be needed.

13. **Do you have any views on the merit or necessity of defining a separate MPI asset class in UK legislation, or other legislative change? What might be the disadvantages of this approach?**

14. **What changes might be needed to the current UK regulatory framework to address regulatory developments in other jurisdictions?**

Annexes

Annex 1 – Overview of the key stages in the offshore wind development journey



Leasing – In order to construct an offshore windfarm (or another type of an offshore asset) and associated infrastructure in UK waters, developers need to obtain rights for the use of the seabed – a seabed lease. In England and Wales, seabed leases are allocated by The Crown Estate (TCE) through 'Leasing Rounds' and the tender stage of Round 4 has recently concluded. Through the leasing rounds in England & Wales, pre-defined areas of seabed called 'Bidding Areas' are made available to developers. There are capacity limitations both on individual bidding zones and on individual developers. Subject to the outcome of the relevant environmental assessments, those successful in the leasing process are granted an 'Agreement for Lease' (AfL). However, accession to lease will only take place following successful completion of consents. Until then, developers pay an annual option fee to TCE. In Scotland, seabed leases are allocated by the Crown Estate Scotland (CES) through 'ScotWind Rounds' with the first one of those currently underway. CES lease according to the Sectoral Marine Plan prepared by Marine Scotland (a directorate of Scottish Government) and the seabed available to lease is defined by the Plan Option areas. There are limits on the aggregate area of seabed awarded in the first cycle of ScotWind Leasing, and for each Plan Option area. Successful ScotWind leasing applicants are awarded an 'Option Agreement', with a one-off sum an 'Option Fee' payable when entering the Option Agreement. Accession to lease will take place following successful completion of consents. **Grid connection** – In order to bring the electricity generated offshore to the shore, developers have to apply for a connection to the onshore grid to National Grid Electricity System Operator (ESO). Early on, before securing the AfL, developers can start considering their preferred point of connection as well as the required Transmission Entry Capacity (TEC) i.e. how much generation they will want to bring to the shore (in MW). Once a developer secured the seabed rights and had their cable route approved by the TCE, they can start the formal connection offer process often referred to as CION process (Connection and Infrastructure Options Note). Through the CION process, the National Grid ESO (in collaboration with the developer and relevant Transmission Owner (TO)) will assess several potential connection sites and through taking into account various parameters, determine which one is the most 'economic and efficient' for the project. To date, this process has been done individually for each project. At the end of the CION process, the developer signs a connection offer contract.

Surveys and pre-planning – (Usually) once the developer has the certainty of the connection location, a developer will have to complete a number of surveys and studies which make up an Environmental Statement (ES) for their project which is submitted at the consenting stage (surveys for the windfarm array area (cable routes) might start in advance of having certainty of a connection location),. The ES contains a report to inform the Environmental Impact Assessment (EIA) which comprises Benthic environmental surveys, Fish and shellfish surveys, Ornithological environmental surveys, Marine mammal environmental surveys, Onshore environmental surveys and Human impact studies. The ES also contains a report to inform the Habitats Regulations Assessment (HRA) and further assessments under other relevant regulations (water framework directive, or the equivalent UK implementations). Where there are impacts on other designated sites e.g. SSSI (Sites of Special Scientific Interest) and MCZ (Marine Conservation Zones) then information also needs to be provided to inform assessment of impacts on these. In addition, information will need to be provided on impacts to designated landscapes and where the impacts of development are likely to be significant, a Landscape & Visual Impact Assessment should be provided with the proposal to inform decision making. The Secretary of State for BEIS undertakes an EIA and HRA when considering the consent decision. Throughout this stage developers will have to consider relevant policy documents, such as national policy statements and marine plans as well as develop mitigation and monitoring plans. They will also have to engage with the appropriate regulators and nature conservation bodies and use those discussions to inform their application for consent.

Planning and consenting – Following successful completion of required environmental assessments, surveys, studies and policy considerations, a developer can start working towards obtaining required planning permissions and consents for their development. For applications in English waters above 50MW or in Welsh waters above 350MW, before submitting a formal application for consent, a developer will have to complete a 'design envelope' for their project (also called 'Rochdale envelope'). This includes all the technical detail and specifications of the project. A developer will also have to carry out consultation with statutory consultees and interested parties on their proposals. Once these are complete, they can submit their Development Consent Order (DCO) Application to the Planning Inspectorate (PINS). This is also called the 'DCO process'. The Planning Inspectorate submits recommendations to the Secretary of State for BEIS who makes the final decision to grant or refuse the DCO. The formal DCO process usually takes c.18 months. Projects in English waters may benefit from a deemed marine licence as part of the DCO process, however, a separate marine licence would be required for projects in Welsh waters. The DCO process does not apply in Welsh waters for projects below 350MW and for all projects in Scottish waters where instead developers apply for Section 36 of the Electricity Act 1989 and for a separate Marine Licence. Once the consent is granted, a developer can enter their lease and commence the post-consent discharge of license conditions which include provision of relevant documents, environmental monitoring and surveying.

Contracts for Difference (CfD) – Contracts for Difference are the Government's default support mechanism for offshore wind generation. They are allocated through a competitive bi-annual process called the 'CfD Allocation Round' also referred to as CfD auction. The policy framework governing the process and the allocation process itself are managed by BEIS, the

funding of the CfD and the actual contract are managed by the Low Carbon Contracts Company (LCCC) which is a private company owner by BEIS. As part of the CfD auction, developers submit sealed bids for a strike price in £/MWh (a price for electricity reflecting the cost of investing in a particular low carbon technology). The auction is run on a 'pay as cleared' basis, so that all successful bidders receive the same strike price. If they are successful in the auction, they will be paid a flat rate for the electricity they produce over a 15-year period – this will be the difference between the 'strike price' (which they bid on) and the 'reference price' (a measure of the average day-ahead market price for electricity in the GB market)[38]. There are a number of milestones associated with the CfD contract which a project has to meet before payments commence. This generally takes place once the project becomes operational and starts generating.

Final Investment Decision (FID) – Also referred to as 'Financial Close'. This stage takes place at the end of the pre-construction phase of the project and requires the developer to secure commitment from its lender(s) and shareholders to fund the construction of the project. To do so, a developer must have successfully completed all previous stages and secured relevant consents, contracts and agreements. This stage is critical to ensure that the development will proceed.

Engineering, Procurement, Construction and Commissioning – throughout this stage a developer will work with contracted third parties to construct the onshore and offshore elements of the project. Depending on the size of the project, distance from the shore, design complexity and technology used (e.g. HVAC vs HVDC), construction can take approximately between three and five years. This stage also includes the discharge of conditions in relation to mitigation and monitoring plans (developed in the planning stage) as well as the grid entry process which is required to start generating power. under the 'OFTO process'

OFTO process – under the OFTO regime, a developer cannot own and operate both the generation and the transmission asset. After technical completion, generators are allowed to operate the transmission asset without a transmission licence for 18 months, during which time Ofgem run a competitive tender to appoint a preferred bidder for the long-term ownership of the transmission (Offshore Transmission Owner (OFTO)), and for the parties to conclude the transfer. As part of this, Ofgem carries out an 'OFTO Cost Assessment' to determine the transfer value of the transmission asset. This is the amount that the OFTO will pay to the generator in return for ownership of the asset and a 25-year regulated revenue stream, which is made up of a management fee and any allowable adjustments. Prospective OFTOs bid the management fee when competing in the OFTO tender, with the lowest bidder being selected. The OFTO revenue is recovered through transmission charges (TNUoS – Transmission Network Use of System charges) which are levied on all users of the transmission system.

The developer pays two components of TNUoS – an offshore component and an onshore component. The Onshore component is the same as for any similar generator connecting in the region, while the offshore component is determined by the costs of the offshore circuit.

[38] A different reference price is used for dispatchable generation.

Annex 2 – High level comparison of Enduring Regime approaches

		(1) Incremental approaches		(2) Holistic network design and delivery			
	Status quo	**Incremental change**	**Incremental change + Strategic plan**	**Holistic network design (HND)**	**HND + Strategic plan**	**HND with early transmission delivery**	**(2b) Integrated seabed lease and financial support**
Model summary	Continue with the current regime – no changes	Introduction of some form of incentive to encourage coordination amongst developers. Otherwise assumes only minor changes to the existing processes and relies on built-in process flexibilities	Retains the developer-led approach of the current regime but introduces elements of strategic planning to maximise the potential for projects to coordinate and puts in place incentives to encourage coordination	Consolidates PW2030 approach without adding the element of a strategic plan ahead of further developing the holistic network design from PW2030. The holistic network design would need to be updated with each leasing round based on	Continuation of PW2030 approach with the addition of a strategic plan. Seabed leasing changes would focus development by region, accounting for onshore capacity, allowing ESO to develop a high-level network design ahead of or in parallel with the leasing round	Builds on approaches to the left, but moves detailed development of transmission ahead of the seabed leasing to reduce risk of stranded generation assets.	Bundles seabed lease, connection process and CfD auction into a single process which reduces uncertainty when conducting the holistic network design. This approach would require significant changes to both the seabed leasing process and the CfD auction. This could either involve developers taking the generation asset through consenting after the leasing round, or the leasing round could be for a pre-consented site.
Strategic Plan?	No	No	Yes	No	Yes	Yes	Yes
Holistic Network Design?	No	No	No	Yes	Yes	Yes	Yes
Early design and delivery of transmission?	No	No	No	No	No	Yes	Yes
Delivery models applicable	1	1	1	2-7	2-7	2, 4-7	tbc
Benefits		• Ease of implementation due to reliance on minor changes and utilising existing process flexibilities		• Potential to deliver high coordination benefits and maximise the efficiency of shared infrastructure • Could set long-term signals to the supply chain & support investment decisions • Overall cheaper delivery of offshore wind if savings from shared transmission can be passed on to consumers through lower CfD bids and strike prices • Increased certainty from more centralised delivery of transmission could reduce the cost of capital and increase confidence in timely delivery • early-stage competition could deliver consumer benefits by introducing more opportunities for innovation and exposing more of the process to competitive pressure • late-stage competition models could be more cost efficient by attracting cheaper finance once the riskiest stages of the project are complete. • Reducing cumulative impacts on environment and communities through a more coordinated approach could reduce overall consenting risks. In turn, reduced consenting risks should reduce developers' cost of finance leading to savings that could be passed through to consumers. • early transmission delivery could reduce the risks of stranded generation as there would be more certainty that the transmission would be delivered before the generation is ready to connect			• As on the left • The most 'streamlined option with the highest degree of centralisation • Potential to deliver the greatest coordination benefits in a shorter timeframe • Potential to shorten the end-to-end process and reduce uncertainty for developers.
Risks		• Unlikely to deliver desired levels of coordination as assumes continuing with developer-build of transmission which poses commercial barriers to coordination • As a result, unlikely to delivery significant reduction in environmental and societal impacts		• Taking some decisions away from, or reducing the options available to developers could increase costs of generation • More centralised approaches risk locking-in approaches or reliance on certain technologies which may not provide the most efficient way to deliver net-zero. • Early transmission delivery risks underutilised transmission assets as it would be designed with greater uncertainty of generation volume and location • Holistic network design and central delivery create a concentration of risk around the transmission planning & delivery stage. Any delays at that stage could adversely impact the overall speed of offshore wind deployment. • A higher degree of centralisation risks distorting competitive tension in the sector			• Moving consenting to after CfD would reduce the certainty of projects being able to progress. • Centralised consenting ahead of seabed leasing could reduce flexibility for developers to innovate. • Bigger gap between CfD award and FID could increase delivery risk as a result of potential for cost-base changes.

Annex 3 - High-level assessment of the range of options

Across the different models set out above, we need to consider a variety of interactions and trade-offs between competing criteria. Below we discuss some of the key considerations. We will use the responses to this consultation to inform our assessment of the options against the Review Assessment Criteria (see Annex 4).

Deliverability

We need to ensure that our proposals for the enduring regime are feasible and can be delivered in time to affect the projects in scope of the workstream (i.e. projects coming forward through future seabed leasing rounds) and early enough so as not to create delivery risks for these projects

There are four key aspects to deliverability:

- Understanding and overcoming any legal or political barriers to the policy/regulatory proposals
- Ensuring appropriate governance arrangements across the organisations that are responsible for the various parts of the end-to-end process (e.g., The Crown Estate/Crown Estate Scotland; National Grid ESO; Ofgem)
- The actual technical deliverability of proposals i.e., infrastructure itself
- Availability of private sector funding (debt and equity) at acceptable levels (i.e., Investment Grade Rating).

Coordination benefits

The current approach to determining the location of offshore wind generation and the ensuing competitive processes does not incentivise developer collaboration. To overcome this is likely to require a much more centralised approach, especially to the early stages of offshore wind development.

In the more centralised approaches, the ultimate level of coordination benefit delivered is likely to be partly a function of the strategic plan and how clear and ambitious it is. For example, a strategic plan that provides granular detail on the volume of wind generation expected in each area and the timings, will enable a more efficient approach to developing transmission with lower risks.

Similarly, a strategic plan that focusses development by region would maximise the potential for shared infrastructure compared to one that took a more disparate approach. However, other considerations would also need to be taken into account including, regional political appetite; environmental impacts; other seabed users; and market requirements.

End-consumer impacts

Approaches which help maximise coordination benefits (i.e., those involving strategic planning, holistic network design and central delivery) would benefit the end consumer through the

overall cheaper delivery of offshore wind as the cost savings from shared transmission could be translated into lower CfD bids and strike prices (if we maintain the current competitiveness for CfD bids separately from Transmission construction).

Some of the potential enduring regime approaches would replace the current processes with more strategic, centralised approaches aiming to increase coordination and speed of deployment. By taking some decisions away from, or reducing the options available to developers (e.g., reduced choice over seabed lease areas) this may tend to increase costs of generation. However, increased certainty would tend to reduce the cost of capital and increase confidence in timely delivery.

More centralised approaches risk locking-in reliance on certain technologies which may not deliver the most efficient way to deliver net-zero.

Approaches assuming early delivery of transmission infrastructure, or early lock-in of transmission design, carry a risk of stranded (underutilised) assets, which potentially means increased costs to end consumers. The scale of offshore wind deployment in the near future will tend to reduce this risk as it is increasingly likely that any capacity would be used by future generation.

Approaches which help maximise coordination benefits (i.e. those involving strategic planning, holistic network design and central delivery) would benefit the end consumer through the overall cheaper delivery of offshore wind as the cost savings from shared transmission could be translated into lower CfD bids and strike prices. Approaches that deliver the most efficient transmission design would benefit consumers. There is therefore a trade-off between early design to try to maximise coordination, and later design to maximise efficiency.

Delivery models that include early-stage competition could increase consumer benefits by introducing more opportunities for innovation and exposing more of the process to competitive pressure and allowing more potential for innovation. Delivery models that include late-stage competition are likely to deliver at the most efficient cost by attracting cheaper finance once the riskiest stages of the project are complete.

Delivery of offshore wind (deployment)

One of the key considerations for the enduring regime is to ensure that it enables the achievement of the government's renewable generation and net zero commitments. In doing so, it will be important to develop a pipeline of projects that can exceed the deployment required for net-zero, to allow for some projects to fall away and to ensure a degree of competitive tension.

Approaches involving holistic network design and central delivery create a concentration of risk around the transmission planning & delivery stage. Any delays at that stage could adversely impact the overall speed of offshore wind deployment. However, it may be possible to mitigate this risk by taking a thorough approach to assessing, minimising and mitigating environmental and local impacts through the strategic centralised approach. Under the current approach, consenting for transmission is one of the greatest risks that a project faces, and local

authorities are increasing taking account of cumulative impacts in their decision making. Reducing these cumulative impacts through a more coordinated approach could therefore reduce consenting risks overall, particularly if the holistic network design takes account of environmental and local factors early in the design process. Reduced consenting risks should reduce the cost of finance for developers which in turn should lead to savings that would ultimately pass through to consumers.

Central network design and delivery could also facilitate anticipatory onshore investment at lower risk, reducing connection risks for new generation.

Risk allocation

The enduring regime should take care to place risks on those who are best placed to manage them and allocate them in a clear and transparent way – a more detailed risk assessment will need to be conducted to ensure we strike the right balance. However, net-zero ambition challenges the traditional interpretation and it is likely that we will have to accept greater risks to the consumer which could entail higher costs.

Competitive landscape (Renewable generation and transmission)

We need to take care to minimise competitive distortions and ensure a level playing field for those involved in delivering net zero. The extent to which we foster competition between offshore wind and other technologies could be considered in the strategic plan.

So far, although OFTO-build is a possible option it has never been used and there has therefore been no direct competition on offshore transmission build. However, the costs are considered as part of the overall CfD bid, which exerts some competitive pressure. Some approaches that involve central design of transmission remove the competitive pressure on the early stage of the process.

Equally, some delivery models may increase competition, by including direct competition on the detailed design and construction stages of transmission.

Environmental and societal impacts

Approaches involving strategic planning and centralisation in network design and delivery could help ensure the most efficient use of onshore and offshore space, contributing to environmental and societal impact reduction.

Innovation & technology

A clear strategic plan could set long-term signals to the supply chain helping to support investment decisions.

Approaches assuming early delivery of transmission might lead to technological lock-in.

Early competition approaches could increase innovation.

Annex 4 – The Review Assessment Criteria

1. Deliverability of the Review policy and Net Zero			
	Name	Description	Notes
1a	Deliverability	Policy can be delivered in a timely and proportional fashion for the workstream	• Two aspects to this – delivery of policy/regulatory change, and deliverability of the policy option (for the transmission infrastructure itself and users connecting into it) • Not a binary answer – ability to deliver is dependent on several factors including organisations involved, scope and timeline • Qualitative assessment – is it even possible to make these changes (policy change, regulatory change, industry governance), and to do so sufficiently quickly? • Is the delivery model, overall regime, and timing feasible given other constraints, e.g., technology readiness, onshore network reinforcement, environmental legislation? • Qualitative assessment – can it be done in time to affect the projects it intends to? How complex is the change? • Is the development process sufficiently simple that developers/stakeholders can understand, navigate, and use it in practice?
1b	Decarbonisa-tion	Supports decarbonisation/ NZ agenda i.e., total/speed of emissions reduction	• Option must support the achievement of net zero greenhouse gas emissions • Carbon impact of transmission infrastructure, plus link to deployment impact, and may impact curtailment • Does it enable 40GW of offshore wind by 2030? • Does it help or hinder other potential offshore technologies e.g., hydrogen, CCUS
2. Economics and commercials			
#	Name	Description	Notes
2a	Deployment impact	It speeds up deployment of offshore wind compared to an uncoordinated solution	• Could deployment be sped up through a coordinated approach to grid connection? Could it also reduce or increase (risk of) delays through planning and consenting? • Integrated solution may delay some as they 'wait' for it, but speed up others if it gives a ready-made route to shore (e.g., prior to getting seabed lease) • Combining some process steps (or streamlining) may speed up whole development process • Deployment impacts may also include cost-effectiveness, safety (in terms of safety and integrity of system e.g., reliability), flexibility (does it lock in design/tech earlier or later than current regime?)
2b	Renewable generation competition impact	Maintain an effective competitive regime and level playing field for different actors in renewable generation	• OSW competition (e.g., increased or decreased by certain types of process integration) • Minimise competitive distortions (e.g., in CfD bid, in bearing costs of AI, timing and delays impact) • Maintain an effective competitive regime and level playing field for different actors • Note that potential for reform (e.g., of CfD, of market) can increase complexity and uncertainty, which may be detrimental to competition • Impact on competition is on a spectrum, not a binary outcome
2c	Transmission competition impacts	Increases, or does not decrease or distort, competition in transmission	• Delivery model for shared/coordinated transmission infrastructure may impact competition. For example, a model with less competition than current regime may be preferred if it enables other aims such as speed of deployment. Equally other models may increase competition, such as earlier-stage competition for offshore transmission infrastructure. • Potential knock-on impacts on onshore reinforcement and CATO regime • How the model makes sure parties involved in transmission have the skills and capabilities to deliver • Impact on competition is on a spectrum, not a binary outcome

2d	Risk allocation	Places risks on those best placed to manage them	• Is risk being placed with those best able to manage it? Is risk being allocated fairly? • Does the policy option materially increase/decrease project delivery risk? Eg by how it impacts liabilities, control etc. Including who bears the risk (and associated financial impact to transmission owner, generators and other transmission users) of delays in completion of transmission infrastructure. One way these risks manifest is through the FID for generation and transmission • 'Project' here can refer to offshore wind, offshore transmission or interconnectors (or other variants and technologies where appropriate) • Risks include but are not limited to delays, costs, decommissioning • Level of clarity and transparency for who bears risk
3. Environmental and Societal Impact			
#	Name	Description	Notes
3a	Environmental (non-carbon) impact	Significant impacts on the environment are avoided, minimised, or mitigated by coordinated transmission	• Includes offshore and onshore environmental impacts, for example AONB, SSSi. • Reduced volume of assets but remainder are larger in size and may involve more 'crossings' of other infrastructure assets • Marine constraints per TCE study – biodiversity, physical environment, historical environment, other subsea/infra, • When applying these criteria in practice, consideration must be given to the impact on Marine Protected Areas (MPAs) in order to minimise adverse impacts that might later risk or delay consent.". We note a number of requirements flowing from legislation (e.g., habitats regulations, Marine and Coastal Access Act) must be factored into any policy framework. • Regional environmental impacts (e.g., peatland in Scotland) • Cable impacts can include cable installation, sandwave clearance, external cable protection impacts
3b	Local Communities Impact	Impact and mitigation on local (including coastal) communities impacted by construction of 'onshore' assets and related activity	• Encompasses onshore and offshore communities, including sea users (such as fishing) and wider onshore communities hosting strategic grid infrastructure • Potential benefits including job creation, utilisation of local supply chains, and impact of compensatory measures • Key concerns typically relate to: the number and size of onshore connection points and onshore infrastructure; cumulative impacts associated with multiple connections, substations and other infrastructure; onshore transmission reinforcements driven by offshore infrastructure connections; and the lack of co-ordination between wind farm proposals. Co-ordinated/ consolidated/ integrated infrastructure is central to mitigating impacts. • Concerns about impacts relate to: visual impact; proximity to residential areas (socio-economic impacts) and built environment impacts (including heritage/ listed building impacts); impacts on environmentally protected and/or sensitive areas (ecological and visual impacts); lack of use of brownfield sites (use of which could be mitigation); noise, traffic and transport during construction in particular; additional local socio-economic and tourism impacts, particularly during construction.
4. Consumer and system impact			
#	Name	Description	Notes
4a	End-consumer net benefit	Has a positive impact on consumer savings	• Consumer savings (or additional costs), most notably through lower offshore T costs and hence lower CfD pricing (or market pricing e.g., cPPA), but also wider savings/costs. • Note that in principle impacts such as impact on onshore investment, curtailment, balancing costs, financing costs (i.e., WACC) could be factored into this analysis as part of a Cost-Benefit Analysis. In practice a proportionate approach must be taken in the time available. • Anticipatory Investment risk could be borne by the end-consumer - cost where any investment is not needed (either temporarily or permanently) • Note may also be non-monetary impact to all GB consumers of a more/less reliable network.

Annex 5 – Glossary

A

Anticipatory Investment (AI)
Investment that goes beyond the needs of immediate generation, reflecting the needs created by a likely future generation project or projects.

AONB
Area of Outstanding Natural Beauty

B

BEIS
Department for Business, Energy & Industrial Strategy. 'BEIS' and 'we' are used interchangeably in this document.

Bootstrap
In the context of this document, a 'bootstrap' is a subsea electricity cable linking two points in the onshore transmission system, such as two onshore substations. It would include an offshore substation to which multiple projects could connect instead of connecting directly onshore, in order to reduce the number of onshore landing points

C

CATO
Competitively Appointed Transmission Operator

CCUS
Carbon Capture Utilisation and Storage, CCUS, is an important emissions reduction technology that can be applied across the energy system.

Central Design Group
Formed by ESO and the TOs to support the production of the HND within the scope of the Pathway to 2030 workstream. Central design group formed by the ESO and the TOs to support the production of the HND within the scope of the Pathway to 2030 workstream.

CES
The Scotland Act 2016 ('the 2016 Act') established a process for devolution of the management of The Crown Estate's assets in Scotland, and the revenue generated from these assets to the Scottish Parliament. As part of this process, the 2016 Act allowed for the Treasury to make a scheme transferring all the Scottish functions of the Crown Estate Commissioners to the Scottish Ministers or a body nominated by them via a statutory instrument. Crown Estate Scotland was established by the Crown Estate Scotland (Interim

Management) Order 2017 to fulfil the Scottish functions of the Crown Estate Commissioners following their transfer through the Crown Estate Scotland Transfer Scheme 2017. The Scottish Crown Estate Act 2019 ("the 2019 Act") made provision to rename Crown Estate Scotland (Interim Management) as Crown Estate Scotland and makes provision about the management of the Scottish Crown Estate. **CfD**
Contracts for Difference

Climate Change Committee
The Climate Change Committee is an independent, statutory body established under the Climate Change Act 2008.

COIN
Connection and Infrastructure Options Note.

D

Developer
The Tender Regulations define a 'developer' as 'any person within section 6D(2)(a) of the Electricity Act 1989'. Section 6D(2)(a) of the Electricity Act defines such person as 'the person who made the connection request for the purposes of which the tender exercise has been, is being or is to be, held'. In practice, such person is also the entity responsible for the construction of the generation assets and, under Generator Build, the Transmission Assets. In this document, 'Developer' is also used to refer to developers of electricity interconnectors.

E

Electricity Act or the Act
The Electricity Act 1989 as amended from time to time.

ESO
National Grid Electricity System Operator. In this document also referred to as 'the ESO', 'National Grid ESO'.

F

FID
Final Investment Decision. See Annex 1 for more detail

H

Holistic Network Design (HND)

Holistic network design, which will identify the requirements for network capacity on the National Electricity Transmission System across GB onshore and in offshore waters to efficiently connect projects within the scope of the Pathway to 2030 workstream.

HRA
Habitats Regulations Assessment

I

(Market-to-market/Cross-border) Interconnection
Electricity interconnectors connect Great Britain's electricity system with other markets, allowing for the bidirectional trade of electricity.

ITO
The term ITO, Independent Transmission Operator, is used to address the competitively appointed company that would take ownership of the transmission at the relevant stage. It should be considered analogous to OFTO or CATO, but without prejudice to the mechanism.

M

Multi-Purpose Interconnector (MPI)
A combination of market-to-market electricity interconnection and offshore wind farms' connection to shore.

O

Ofgem
Office of Gas and Electricity Markets. Ofgem, "the Authority" and "we" are used interchangeably in this document.

OFTO
Offshore transmission owner.

OFTO-build
A model for the construction of Transmission Assets. Under this model, Ofgem runs a tender to appoint an OFTO with responsibility for constructing and operating the transmission assets.

OFTO Licence
The licence awarded under section 6(1)(b) of the Electricity Act following a tender exercise authorising an OFTO to participate in the transmission of electricity in respect of the relevant Transmission Assets. The licence sets out an OFTO's rights and obligations as the offshore transmission asset owner and operator.

P

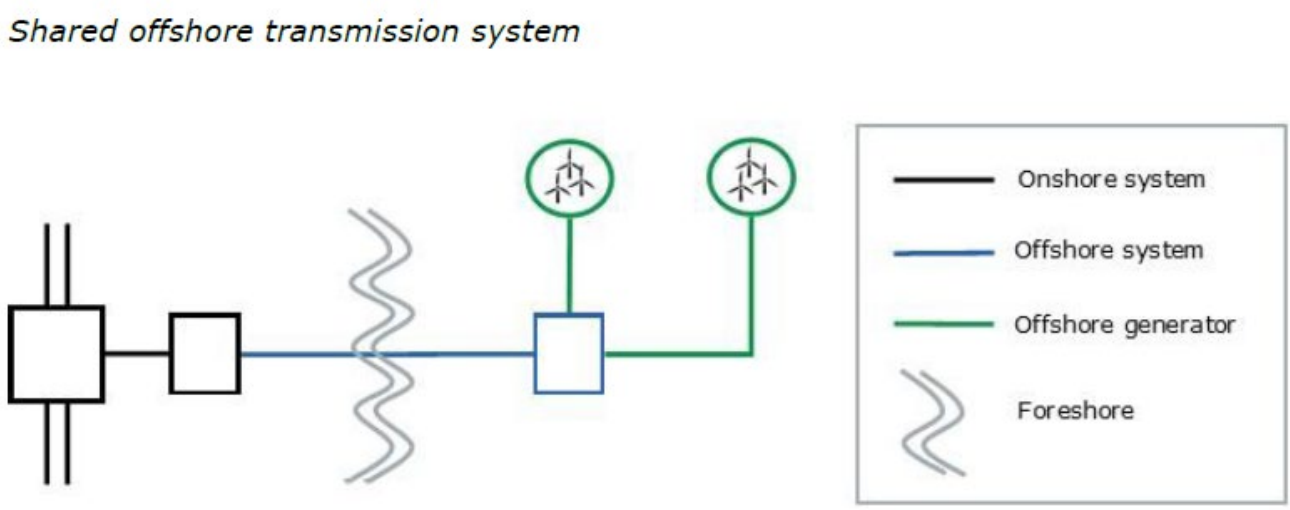
Power-to-x

The use of electricity to generate other energy carriers e.g. electrolysis to generate hydrogen.

S

SEA
Strategic Environmental Assessment

Shared Offshore Transmission System
This concept involves multiple generators using a single offshore transmission system. This concept emphasises a reduction in landing points and the number of substations compared to the business-as-usual radial links.



Source: Ofgem consultation on changes intended to bring about greater coordination in the development of offshore energy networks[39]

SO
The System Operator

[39] Ofgem (2021) https://www.ofgem.gov.uk/sites/default/files/2021-07/OTNR%20Ofgem%20Consultation_Jul%202021_Final%20%281%29.pdf

T

TCE
The Crown Estate. The Crown Estate is an independent commercial business, established under The Crown Estate Act 1961.

Tender Process
The competitive tender process run by Ofgem in accordance with the Tender Regulations in order to identify a successful bidder to whom a particular OFTO Licence is to be granted.

Tender Regulations
Electricity (Competitive Tenders for Offshore Transmission Licences) Regulations 2015.

TO or Transmission Owner
An owner of a high-voltage transmission network or asset.

Transmission Assets
Transmission assets are defined in Paragraph 1(3)(a) of Schedule 2A to the Electricity Act as 'the transmission system in respect of which the offshore transmission licence is (or is to be) granted or anything which forms part of that system'. The transmission system is expected to include subsea export cables, onshore export cables, onshore and offshore substation, and any other assets, consents, property arrangements or permits required by an incoming OFTO in order for it to fulfil its obligations as a transmission operator.

TNUoS
Transmission network use of system. TNUoS charging arrangements reflect the cost of building, operating and maintaining the transmission system. In this document also referred to as 'transmission charging'.

This consultation is available from: www.gov.uk/beis **[replace with direct URL if known]**

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