



North Sea  
**Wind Power Hub**  
Programme

**Regulatory & market design**

# Topical Agenda

Five key topics that require decision-making  
for hub-and-spoke project development

**Topical  
Agenda**



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# About this paper

## Why read this report

To facilitate large-scale roll-out of required offshore wind and a coordinated and integrated approach to energy system planning across the North Sea, the North Sea Wind Power Hub consortium developed a Topical Agenda. This Topical Agenda supports policy and regulatory developments and serves a structured discussion that identifies and explores key policies, regulatory and market issues that must be tackled. This paper addresses the five key topic areas where clarity is required to provide investment certainty to project developers and project stakeholders: 1. Main principles, 2. Scope, 3. Cost & Benefit, 4. Investment Framework and 5. Legal Framework. Finally, this paper presents the North Sea Wind Power Hub's ongoing work and efforts to support policy makers in creating an enabling framework for offshore wind development.

## Highlights

**The long lead time of large-scale infrastructure projects urges to facilitate prompt decision-making on policy, regulatory and market topics.**

**Early engagement and collaboration between developers and stakeholders is required to provide clarity, investment certainty and reduce risks.**

**The NSWPH is willing to support discussions and decision-making by sharing expertise and knowledge required to tackle key topics.**

## Structure of the Topical Agenda



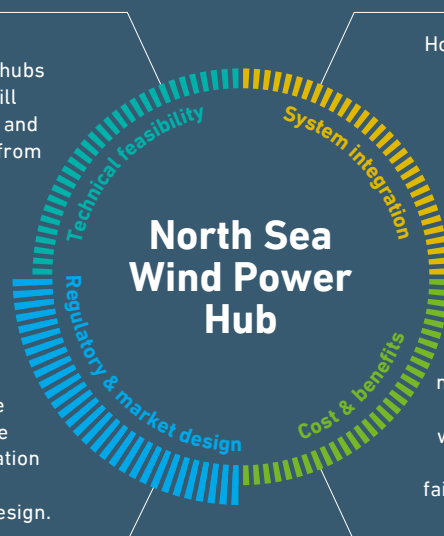
## The big picture

The North Sea is a powerhouse of wind energy. Harnessing this power requires us to cooperate across countries and borders to build an efficient network. To show that a solution can be achieved in a cost-effective and secure manner, the North Sea Wind Power Hub is working within four key areas.

This discussion paper explores key topics within regulatory & market design.

How to design and build the physical hubs and spokes that will collect, transform and distribute energy from the North Sea.

How to ensure a stable and reliable investment climate by adapting regulation and creating an efficient market design.



How to adapt the energy systems in Northern Europe to integrate a large volume of offshore wind from the North Sea.

How to ensure that the chosen solution maximises benefits for society and climate while minimising costs and distributing them fairly between countries and stakeholders.

# Executive summary

The Paris Climate Agreement is transforming the energy landscape of the North Sea and large-scale offshore wind deployment has a major role to play in meeting these emissions targets. To support the development of offshore wind in the North Sea region, the North Sea Wind Power Hub (NSWPH) consortium has also developed a vision of an international, cross-sector hub-and-spoke concept. The hub-and-spoke concept ensures cost-effective, modular deployment by combining offshore wind assets and interconnectors, and facilitating the integration of gas, electricity and heat sectors through Power-to-X (PtX) conversion.

Unfortunately, current regulatory frameworks and market design are not yet fully designed to support the large-scale roll-out of required offshore wind, nor to facilitate a coordinated and integrated approach to energy system planning across the North Sea. Further, given the long lead times of large-scale offshore infrastructure projects, there is a pressing need to address these topics early on in order to provide investment certainty to project developers and stakeholders.

With this context in mind, the NSWPH consortium developed this Topical Agenda to support policy and regulatory developments supporting and accelerating offshore wind deployment in the North Sea. The Topical Agenda serves as a structured discussion that identifies and explores key policies, regulatory and market issues that must be tackled in order to support the large-scale deployment of offshore wind. The Topical Agenda is structured into five key topic areas:

- 1. Main Principles** | Framework to kick-start development of the first hub and define guiding principles, including post-2030 targets, offshore wind farm (OWF) development zones, principles for market setup, governance models, assessment of costs and benefits, and cost sharing.
- 2. Scope** | Specified scope of the first project (e.g. location, size, technology), hubs and interconnectors, allocation of roles and responsibilities, as well as the sequencing of subprojects, including where, when and how.
- 3. Cost & Benefit** | An agreed framework and outcome for assessing (and sharing) costs and benefits between countries.
- 4. Investment Framework** | National and international discussions on the commercial and investment frameworks governing the project, including support schemes, financing, cost recovery and an energy market outlook.
- 5. Legal Framework** | Legal framework that enforces principles and decisions from previous topics through contractual agreements and provides certainty to project stakeholders.

While many policy and regulatory processes addressing these topics are underway in the North Sea countries or at the EU-level, many others remain unaddressed. The long lead time of large-scale infrastructure projects urges to facilitate prompt decision-making on policy, regulatory and market topics. Project developers need clarity and investment certainty well before any project development activities can commence. Hence, delay in decision-making could have a significant impact on investment decision timelines and in turn delay the development and construction of offshore wind. With this overall objective, the NSWPH consortium stands ready to support policy makers in the deployment of offshore wind in the North Sea. The NSWPH consortium is willing to share its expertise, providing a long-term, strategic view on large-scale infrastructure projects, as well as through its ongoing work exploring regulatory, commercial and technical topics to support offshore wind development.

# 1 Introduction

The European Commission (EC) has proposed a goal of 300 GW of offshore wind by 2050 across Europe to meet the Paris Climate Agreement and net-zero targets. However, with current energy plans we will not come close<sup>1</sup>. In the North Sea alone, 150 GW of large-scale offshore wind capacity are needed by 2040 and offshore wind capacity deployment rates need to more than double<sup>2</sup>. The challenge of achieving this accelerated pace of deployment is compounded by the importance of meeting our climate goals cost-effectively, while also maintaining security of energy supply.

Combined, these challenges require a holistic and international approach to energy system planning. The large-scale deployment of offshore wind needs coordination among all North Sea countries: a coordinated approach to long-term policy targets, a robust and consistent regulatory framework, and sector coupling (e.g. electricity, hydrogen, heat). This coordinated and renewed approach to energy system planning will be fundamental for the successful roll-out of offshore wind and grid infrastructure, and to capture benefits of scale and accelerated deployment, increased system flexibility and to minimise system costs.

The current regulatory frameworks and market design were not designed to support the large-scale roll-out and integration of offshore wind. They are also not designed to facilitate a coordinated and integrated approach to energy system planning. Further, given the long lead times of large-scale offshore infrastructure projects, there is a pressing need to address these topics early on to provide investment certainty to project developers and stakeholders.

Moreover, the EC recognised many of these challenges in the 2020 Offshore Renewable Energy Strategy and identified a list of actions that aim to support the development of offshore hybrid projects in the future. Among these actions, the EC committed to developing the following:

- A framework for EU Member States to formulate a joint long-term commitment for the deployment of offshore renewable energy through 2050;
- A long-term view on the market setup and how OWF developers can be compensated for possible reductions in income.
- A framework to enable transmission system operators (TSOs) to make anticipatory investments in offshore grids and for long-term offshore grid planning by the EU member states, national regulatory agencies (NRA) and TSOs; and, regulators and EU Member States; and
- Guidance on how to coordinate the sharing of costs and benefits for cross-border and hybrid projects (combining transmission and generation).

These actions and commitments made by the EC are consistent and aligned with the North Sea Wind Power Hub (NSWPH) consortium's objective of addressing relevant policy and regulatory topics that will enable the development of hubs in the future. Changes and or clarity for the regulatory framework are urgent because of the long lead times of large-scale offshore projects.

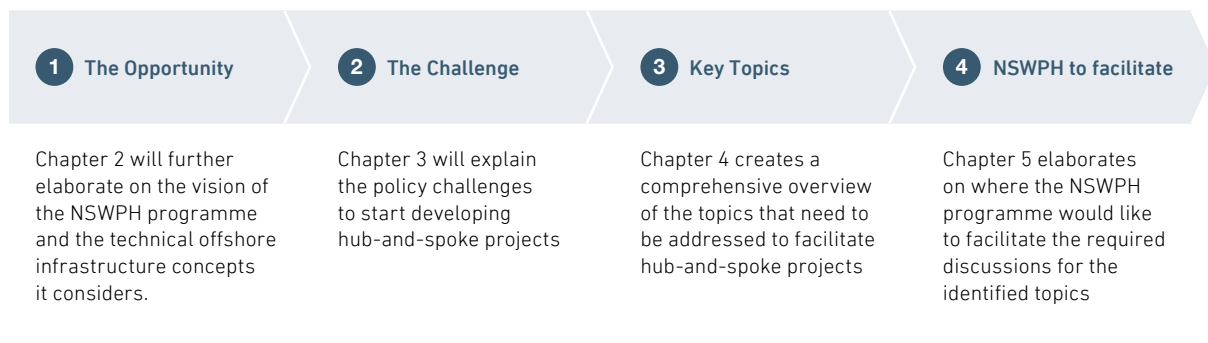
<sup>1</sup> Under current national energy plans, offshore wind capacity will only reach a maximum of approximately 90 GW by 2050. Source: European Commission. (2020). An EU Strategy to harness the potential of offshore renewable energy for a climate neutral future. [https://ec.europa.eu/energy/sites/ener/files/offshore\\_renewable\\_energy\\_strategy.pdf](https://ec.europa.eu/energy/sites/ener/files/offshore_renewable_energy_strategy.pdf)

<sup>2</sup> North Sea Wind Power Hub. (2019). Modular Hub-and-Spoke concept to facilitate large scale offshore wind. [https://northseawindpowerhub.eu/wp-content/uploads/2019/11/NSWPH-Drieluik-Herdruk\\_v01.pdf](https://northseawindpowerhub.eu/wp-content/uploads/2019/11/NSWPH-Drieluik-Herdruk_v01.pdf)

With this context in mind, the NSWPH consortium developed a Topical Agenda to support policy and regulatory developments supporting offshore wind deployment in the North Sea. The Topical Agenda serves as a structured discussion that identifies and explores key policy, regulatory and market issues that must be tackled in order to support the large-scale deployment of offshore wind. The objectives of this discussion paper are to:

1. Introduce the Topical Agenda as a structured approach to explore key policy, regulatory and market topics that must be tackled and addressed to support offshore wind development; and
2. Present the NSWPH's ongoing work and efforts to support policy makers in creating an enabling framework for offshore wind development.

**Figure 1: Structure of the Topical Agenda**



## 2 The Opportunity for Large-Scale Offshore Wind Development

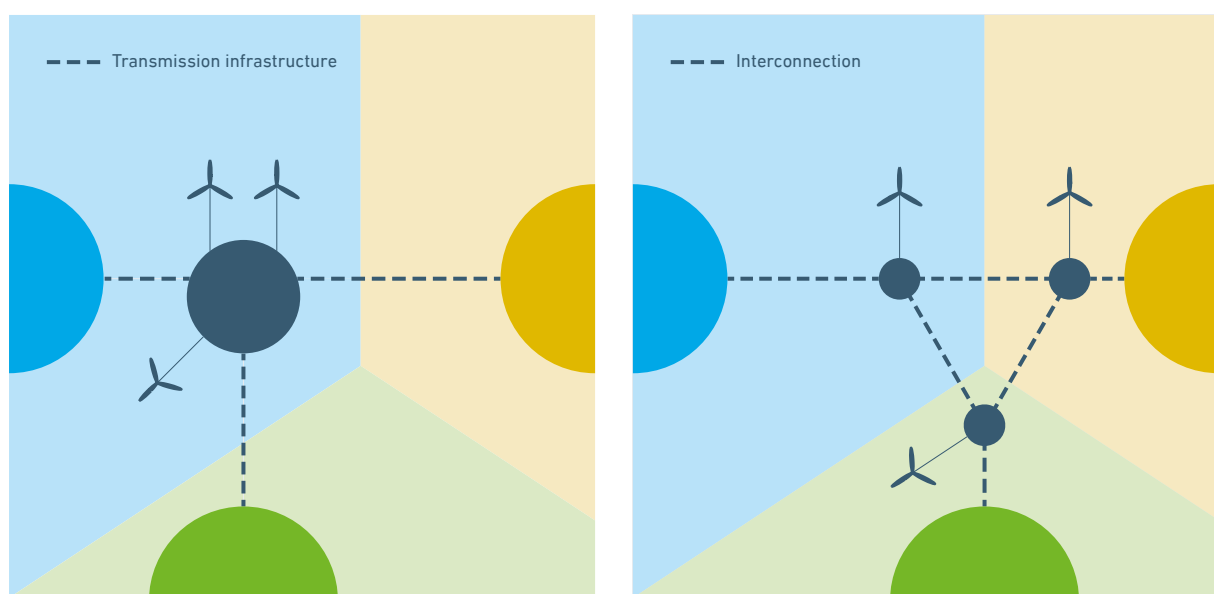
The vision of the NSWPH consortium is based on the development of an international, cross-sector hub-and-spoke concept to facilitate offshore wind deployment and energy system integration in the North Sea region. These hubs will include interconnectors to bordering North Sea countries and will enable sector coupling and re-use of existing gas infrastructure through Power-to-X (PtX) conversion (either on- or offshore). The consortium has investigated various hub-and-spoke concepts for different locations, sizes and configurations and has demonstrated their technical feasibility<sup>3</sup>.

The hub-and-spoke concept incorporates three features:

- 1. Hybrid** | Hybrid project infrastructure combines the grid connection for offshore wind and interconnection functionality;
- 2. Sector coupling** | Facilitating the integration of large amounts of offshore wind energy with sector-coupling by PtX conversion, renewable gas, storage and gas to power;
- 3. Multinational** | Strong cross-border nature by linking multiple individual national grids.

Within the NSWPH programme two hub concepts are explored, as illustrated by figure 2. The first setup is a "centralised" hub consisting of a single central hub system connected to multiple countries. The second setup is a "distributed" hub consisting of several interconnected hubs, each connected to their individual host countries.

**Figure 2: Centralised and Distributed Hub Systems**



Overview of a centralised hub system where hub is located in the EEZ of the blue country and is connected to the blue, yellow and green country.

Overview of a distributed hub system where a hub is located in the EEZ of the blue, yellow and green country, and is connected to the respective countries. The hubs are also connected to each other.

<sup>3</sup> North Sea Wind Power Hub. (2019). Modular Hub-and-Spoke: Specific solution options. [https://northseawindpowerhub.eu/wp-content/uploads/2019/07/Concept\\_Paper\\_3-Specific-solution-options.pdf](https://northseawindpowerhub.eu/wp-content/uploads/2019/07/Concept_Paper_3-Specific-solution-options.pdf)

The NSWPH is analysing these concepts to identify the optimal concept because each has its own advantages and disadvantages. The centralised hub concept is defined from an ideal integration perspective because it ensures maximum co-operation and synergy between countries, as well as maximum cost reduction through economies of scale. However, the centralised hub also requires a high level of international agreement and coordination. For example the governance model for infrastructure assets, cost sharing and the design of an offshore support scheme.

On the other hand, the distributed concept facilitates rapid hub development as it only requires alignment with internal national initiatives, reducing the need for extensive agreement and coordination between the participating countries. This less complex development comes at the expense of lower cost savings and benefits. Ultimately, the assessment of both hub concepts will require the development of a careful cost benefit analysis to weigh in advantages and disadvantages.

While different in setup, both concepts aim to realise the following energy system and societal benefits:

- **Cost Effective Deployment** | The modular hub-and-spoke concept ensures cost effective and modular deployment by combining offshore wind farm transmission assets and interconnectors and minimising the need for on-shore grid reinforcements.
- **Locational Flexibility** | The foundation type of the hub-and-spoke concept provides flexibility to adapt each project to location specific needs including project size, configuration and energy demand mix.
- **Optimised Infrastructure** | Interconnection capacity and sector coupling optimise the infrastructure to efficiently integrate the deployed offshore wind generation in the wider energy system.

**Highlight**

**Whereas the distributed hub systems facilitates rapid hub development, the centralised hub system ensures maximum cost reduction.**



## 3 The challenges for Hub-and-Spoke Concept Development

The hub-and-spoke concept delivers multiple benefits over a less-coordinated, national approach. However, the hub-and-spoke concept also carries a set of challenges that need to be addressed.

The three features of the hub-and-spoke concept (hybrid, cross-sector and multinational) require changes to current policies, regulatory frameworks and energy system planning.

1. **Hybrid:** Combining offshore wind farm transmission assets and interconnector functionality requires clarity on the EU and domestic market designs, capacity allocation and interconnector accessibility and their requirements regarding energy exchange;
2. **Sector coupling:** Integrating electricity, gas and heat sectors through PtX conversion infrastructure requires strategic alignment across electricity and gas sectors, and integrated long-term planning;
3. **Multinational:** The multinational nature of the hub-and-spoke concept requires coordination on regulatory and market frameworks by both the EU and the involved countries. This includes alignment on the assessment and allocation of hub costs and benefits, as well as coordination on the deployment of interconnectors and offshore wind farm transmission assets.

### The Need for a Structured Discussion to Address Challenges

Current regulatory frameworks and market design were not designed to facilitate the coordinated and integrated energy system planning required for large-scale roll-out and integration of offshore wind. Similarly, governance models for offshore wind are also not designed to enable optimised investment decisions. While there are some enabling policies and regulatory processes underway, more effort is still required. For example related to:

- A common cost and benefit analysis (and sharing) framework for hybrid, cross-sector projects;
- Market setup for hybrid projects;
- Regulatory framework for sector coupling at scale; and
- Planning and assessment of anticipatory investments.

Decisions and/or clarity on these topics are urgent because of the long lead times of large-scale offshore projects. The timeline from development to operation for projects of this scale is generally more than 10 years. Hence, in order to achieve the offshore wind targets, set by the EC for 2050, development cannot be delayed. Key decisions and regulatory changes are needed well in advance to provide clarity, investment certainty and to reduce risks to project developers. Delayed policy and regulatory decisions can, in turn, delay investment decisions timelines and jeopardise project development. As a result, there is a pressing need for a structured discussion to tackle all necessary policy and regulatory topics, as well as to facilitate decision-making at the national and EU level. To this end, the NSWPH has developed a Topical Agenda to serve as structured discussion to enable timely decision-making that can facilitate the first of many hubs.

### Highlight

**The Topical Agenda serves as structured discussion to enable timely decision-making required to provide clarity, investment certainty and reduce risks.**

## 4 The topical Agenda

The Topical Agenda identifies the five key regulatory topics that must be addressed to ultimately arrive at a full enabling framework that can provide sufficient investment certainty to project stakeholders.

### Key Regulatory Topics

These five topics must be tackled and addressed so decisions can be made on time to meet key milestones. The sequence of these five topics is significant, because it ensures key milestone dependencies are accounted for without jeopardising planning and development timelines.

1. **Main Principles** | Framework to kick-start development of the first hub and define guiding principles, including post-2030 targets, OWF development zones, principles for market setup, governance models, assessment of costs and benefits, and cost sharing.
2. **Scope** | Specified scope of the first project (e.g. location, size, technology), hubs and interconnectors, allocated roles and responsibilities, as well as the sequencing of subprojects, including where, when and how.
3. **Cost & Benefit** | An agreed framework and outcome for assessing (and sharing) costs and benefits between involved countries.
4. **Investment Framework** | National and international discussions on the commercial and investment frameworks governing the project, including support schemes, financing, cost recovery and an energy market outlook.
5. **Legal framework** | Legal framework that enforces principles and decisions from previous topics through contractual agreements and provides certainty to project stakeholders.

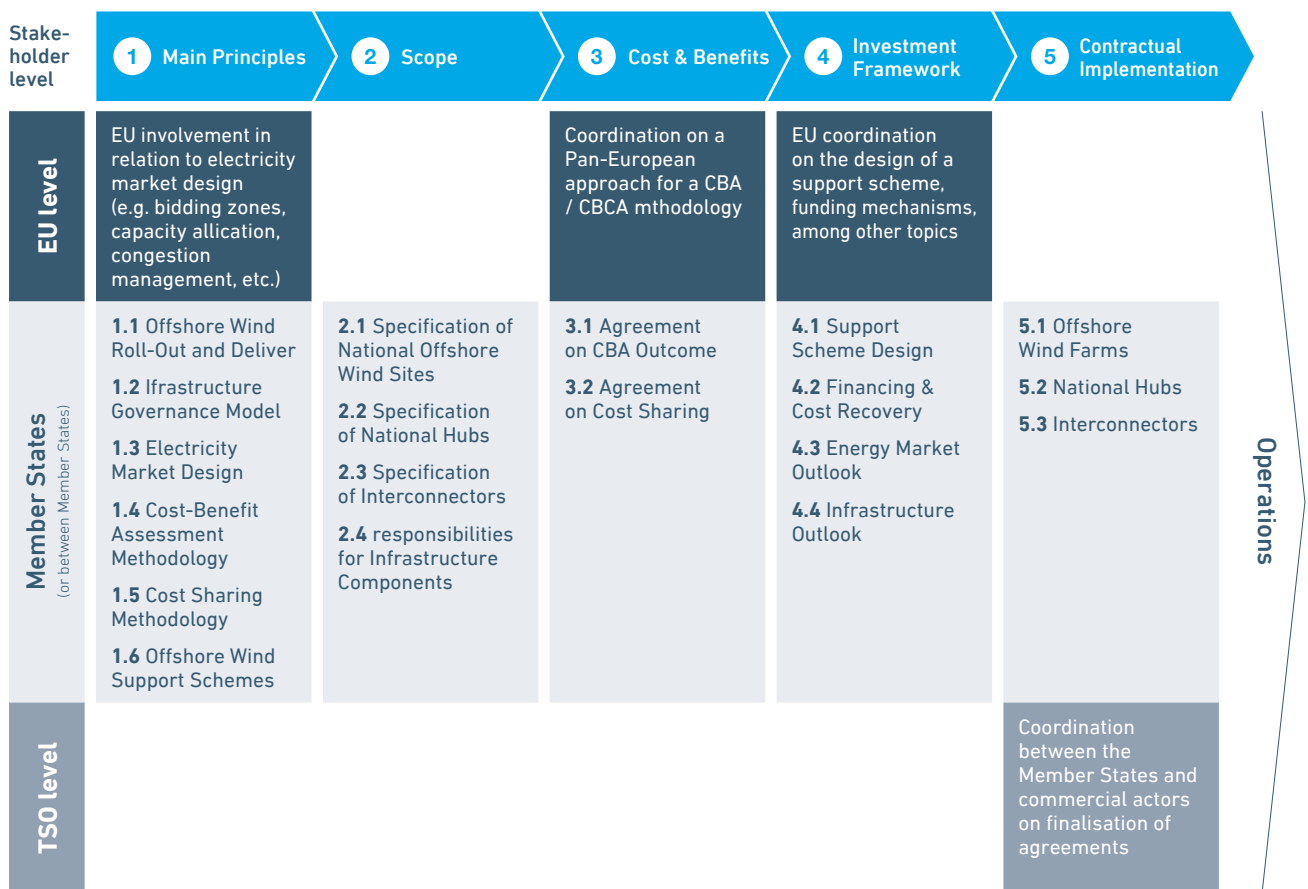
These five priority topics are in turn divided into multiple subtopics, each of which delves into more detail. These subtopics must also be investigated and addressed, and ultimately all involved countries must reach alignment or make decisions in relation to each.

Figure 3 presents the five priority topics along with their respective subtopics. As illustrated, the stakeholder-mapping of all subtopics is at the MemberState level. This indicates that decision-making for each subtopic will be made either individually or collectively by member states (e.g. the Netherlands, Denmark and/or Germany). Some topics, however, do require involvement and input at the EU-level, from OWF developers, NRAs or from TSOs.

**Highlight**  
**Five key regulatory topics and their subtopics must be addressed to enable hub-and-spoke development to facilitate an efficient roll-out of offshore wind.**

For example, while decision-making for all Main Principles' (topic 1) subtopics is done by member states, some key areas do require EU involvement. In this case, the need for EU involvement is in relation to the market setup, and provisions for capacity allocation and congestion management – all of which benefit from coordination and alignment at the EU-level. Similarly, EU-level involvement is also important in the coordination of consistent cost benefit analysis (CBA) and cross-border cost allocation (CBCA) methodologies (Topic 3) and for alignment on the structure of an offshore wind support scheme and funding mechanisms (Topic 4).

**Figure 3: Summary of Topical Agenda subtopics and stakeholder-levels**



Chronological overview of topics and subtopics that must be addressed per stakeholder before the operational phase of the hub-and-spoke project.

## Detailed Review of Subtopics

While many policy and regulatory processes addressing subtopics are already underway in the North Sea countries or at the EU-level, many other topics have not yet been addressed. The following sections describe the subtopics within each topic area, as well as summarise the current state of any policy or regulatory processes currently underway. These sections also identify gaps where discussions on the required topics have not yet started.

### Topic 1: Main Principles

Defining the main principles at an early stage seeks to develop alignment among all North Sea countries on the scope and guidelines of a first hub. As part of this process, six unique subtopics must be addressed:

- 1.1. Offshore wind roll-out and delivery** | This first subtopic requires North Sea countries to define post-2030 national targets for offshore wind and to identify target areas for future developments. While Denmark and Germany already have established post-2030 offshore wind targets, there are processes to define targets underway in the Netherlands. Denmark has also preliminarily defined post-2030 zones for hub development. Processes for post-2030 site selection are underway in the Netherlands and Germany.
- 1.2. Governance model** | North Sea countries must align, at least at a high-level, on the governance models over the various infrastructure components of the project; among those, offshore wind transmission assets, PtX conversion, hydrogen transmission and interconnectors. Discussions are ongoing in all North Sea countries related to infrastructure governance models. However, an active cross-border discussion is still lacking and needs to be initiated to provide clarity on roles and responsibilities for a first hub-and-spoke project.
- 1.3. Electricity market design** | Developing key market design principles early on is critical as they will serve as inputs for a future cost benefit assessment, the design of an offshore wind support scheme, and the characteristics of a first hub. The discussion on market setup includes clarity and decisions on bidding zones, interconnector accessibility and the design of a hydrogen market. Discussions are ongoing in all North Sea countries, including on the setup of a hydrogen market.
- 1.4. Cost benefit assessment and 1.5 Cost sharing** | North Sea countries must agree on the principles of a CBA and cost sharing methodology. These methodology principles will be critical in order to select a hub among different configuration options (during the scoping phase). Discussion related to these subtopics have not yet started, however Denmark and Germany have developed insights through the Kriegers Flak Combined Grid Solution<sup>4</sup> project.

**Highlight**  
Addressing Main Principles requires alignment of all involved North Sea countries required clarity on six subtopics.

<sup>4</sup> The Kriegers Flak - Combined Grid Solution project has connected the Danish region of Zealand with the German state of Mecklenburg-Western Pomerania via two offshore windfarms, German Baltic 2 and Danish Kriegers Flak.

**1.6. Support schemes** | The design principles of a future support scheme must be defined early on and must reflect principles for governance models for hybrid projects. While no decisions or definitive views have been made by any North Sea countries, relevant discussions are underway. For example, in Denmark discussions have been held on PtX support, while in the Netherlands combined offshore wind and hydrogen tenders are under investigation.

### Topic 2: Scope

Once the main guiding principles have been agreed on, the next topic involves establishing the scope and specifications of the first hub project, including where, when and how. These discussions cover four subtopics:

**2.1. Specification of national offshore wind sites** | In line with post-2030 national targets for offshore wind, North Sea countries must select and plan the roll-out of offshore wind sites. Denmark has already predefined offshore wind sites and is ahead of the Netherlands and Germany, where a review of post-2030 site selection is underway.

**2.2. Specification of national hubs** | With selection completed for offshore wind sites, the characteristics of each national hub can be defined; including size, capacity, requirements for power and hydrogen transmission, PtX conversion, etc. Denmark has a process underway for the specification of a potential national hub. In the Netherlands and Germany, no hub specifications have been considered as of yet.

**2.3. Specification of interconnectors** | North Sea countries will then define the sizing and timing of interconnector needs for each hub based on a cost benefit assessment to determine optimal configuration of interconnectors. None of the North Sea countries have specified any post-2030 interconnector plans yet.

**2.4. Responsibilities for infrastructure components** | The final subtopic requires responsibilities to be formalised over all infrastructure components based on the agreed governance model principles. Processes exploring infrastructure responsibilities are underway in all North Sea countries, however, Denmark is further ahead in defining responsibilities over energy island development, PtX production and hydrogen transmission.

### Topic 3: Costs & Benefits

Cost and benefit discussions serve the purpose of ensuring a common approach to the allocation of costs and benefits. This topic ensures final alignment among North Sea countries on the outcome of the cost benefit assessment of the first hub and cost sharing. These discussions cover two subtopics:

**3.1. Agreement on CBA outcome** | A cost benefit assessment of the first hub will be developed based on agreed key principles. All North Sea countries are required to agree on the results of the assessment. This is critical to assure the value sharing between the countries engaged in the project developments.

**3.2. Agreement on cost sharing** | All countries must also agree on the methodology and mechanisms for cost sharing.

**Highlight**  
Once the Main Principles are clarified, offshore wind sites, hub locations, interconnector development and governance principles need to be defined.

Since discussions to define the principles of a cost benefit assessment and cost sharing methodology (1.4 and 1.5) are still at an early stage in all North Sea countries, as well as on EU level. Much has still to be done to make progress in these subtopics.

#### **Topic 4: Investment framework**

The objective of defining the investment framework and commercial setup governing the first hub is to provide clarity on offshore wind subsidy schemes, financing and cost recovery of anticipatory investments, and to develop long-term outlooks of the energy market and infrastructure development. These discussions cover four subtopics:

- 4.1. Support scheme** | Agreement on the design of the support scheme including decisions related to the scope of a tender, the type of support offered (e.g. CfD, investment subsidy, redistribution of income), auction timing and the support allocation mechanism (e.g., auction or multiple criteria). None of the North Sea countries have defined post-2030 support schemes for offshore wind.
- 4.2. Financing and cost recovery** | There must be an agreement on the preferred financing options and cost recovery mechanisms for key infrastructure components, including transmission and PtX infrastructure, and interconnectors. While Denmark has initiated discussions on financing and cost recovery, the Netherlands and Germany are yet to initiate discussions.
- 4.3. Energy market outlook and 4.4. Infrastructure outlook** | For hub developers to make informed investment decisions, long-term outlooks of energy markets (power and PtX markets) and infrastructure developments (interconnectors deployment plans) must be developed. Denmark and Germany have processes underway to develop long-term energy and infrastructure outlooks (e.g. post-2030). The Netherlands is yet to initiate plans to define post-2030 energy and infrastructure outlooks.

#### **Topic 5: Legal framework**

Principles and decisions from previous topics must be formalised into legal contractual agreements providing clarity and investment certainty to hub developers and other stakeholders. With these agreements in place, there will be a clear path for deployment of the first hub project. These discussions cover three subtopics:

- 5.1. OWF** | Contractual agreements on requirements, responsibilities and rights including the definition of the complete investment framework.
- 5.2. National hubs** | Contractual agreements for the development of national hubs including a realisation agreement, connection agreement and financial agreement should be finalised.
- 5.3. Interconnectors** | A realisation agreement for the development of interconnectors should be finalised and cost recovery should be ready for implementation.

### **Interdependencies across Topics must be considered**

While the five Topical Agenda discussion topics have been structured sequentially in order to address key dependencies, multiple interdependencies remain across subtopics. These interdependencies are categorised into four themes:

- 1. Cost Benefit Analysis & Cross-Border Cost Allocation (CBA/CBCA) |** Initial guiding principles of CBA/CBCA will act as pre-requisite for deciding on the scope of a first hub. These guiding principles are fundamental in the assessment of costs and benefits, and serve as input for clearly defining the regulatory framework and contractual agreements.
- 2. Power-to-X |** Early alignment on the importance of sector coupling between electricity and gas grids will set the groundwork for the scoping of the first hub and potentially increase the complexity of the CBA. The regulatory and commercial framework will in-turn have to account for the added challenges arising from the integration of electricity and gas systems.
- 3. Market Design |** Agreement on the main market design principles for the project will influence discussions on project scope, CBA framework and investment framework. These market parameters influence the appropriate investment framework as well as help shape contractual and legal documents.
- 4. Responsibility Allocation |** The allocation of roles and responsibilities of infrastructure assets (e.g., electricity & hydrogen transmission, PtX conversion and storage and interconnection) impacts principles of the first project scope, tender design, and options for financing and cost recovery of the infrastructure.

#### **Highlight**

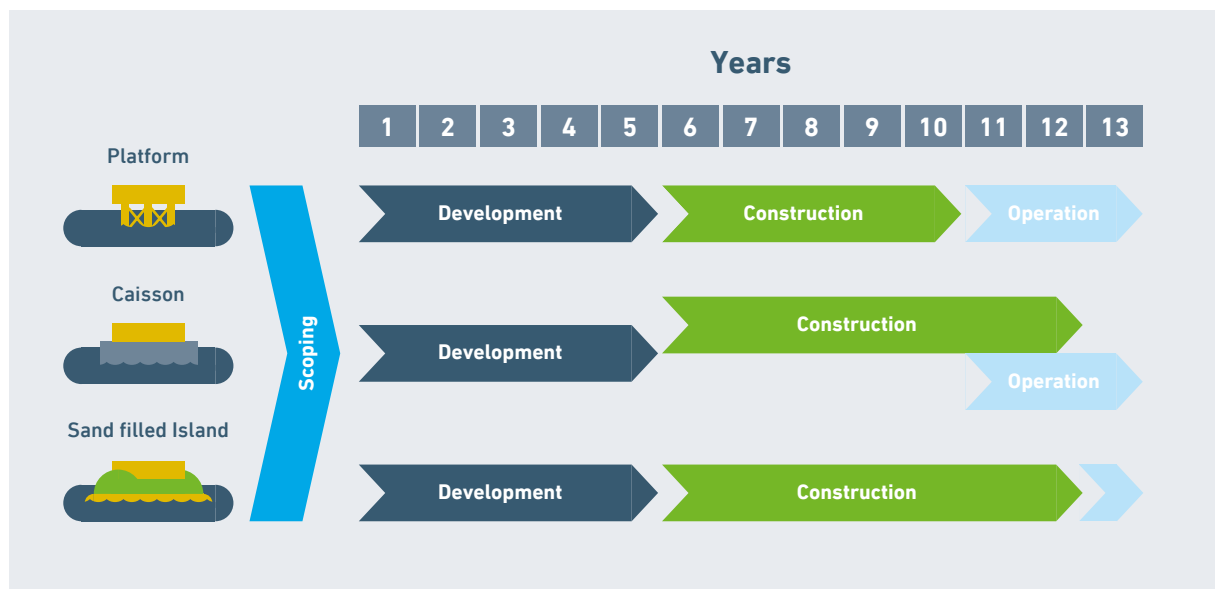
**The Topical Agenda provides a preliminary sequential order, but topic interdependencies should be considered.**

### Timely Policy Decisions are Critical for Project Success

Addressing the Topical Agenda subtopics early on is fundamental for creating an environment that promotes offshore wind development. Project developers need clarity and investment certainty well before projects are initiated. As illustrated by figure 4, the development and construction period of offshore wind projects can take upwards of 10 years, regardless of the type of hub foundation used. As a result, there is an urgent need to act early and to facilitate decision-making on policy, regulatory and market design subtopics.

These decisions must be made ahead of, or in parallel to, the scoping phase of projects. This means, all key decisions and agreements must be in place roughly a decade before first power. The required lead time may even be greater than a decade based on the type of hub foundation. For example, construction of a sand-filled island hub is expected to take a few years longer than for a platform. Hence, the lead time required for decision-making may be even longer than a decade, putting even more urgency on ensuring decision-making is done in time. Delays in policy, regulatory and market design decisions would have a significant impact on investment decision timelines and in turn delay the development and construction of hubs.

**Figure 4: Timeline for different hub configurations**



The development and construction timeline per hub foundation type. The hub foundation types that are depicted are the platform-based hub, caisson-based hub and sand filled island hub.



## 5 The NSWPH Consortium Stands Ready to Facilitate the Topical Discussions

The Topical Agenda developed by the NSWPH consortium and presented in this report identifies the policy and regulatory topics that need to be agreed upon to enable the development of hubs. Given the international nature of large-scale offshore infrastructure developments and their long timelines for development, there is an urgent need for close collaboration among developers, TSOs, policy makers and energy regulators. This requires collaboration and engagement to begin now.

The NSWPH consortium is willing to share its expertise, providing a long-term, strategic view on large-scale infrastructure planning, development and operation, as well expert techno-economic advice on transmission grid developments and offshore wind integration. The consortium is confident its work and expertise can support policy makers address these topics and ultimately enable the development of the first hub.

As part its work and effort to support policy makers, NSWPH consortium is continually developing evidence-based discussion papers tackling new and emerging regulatory, commercial and technical topics to support the development of offshore hybrid infrastructure. Several discussion papers are currently being scoped or under development and will be completed and published by 2021 Q1.

The topics of these discussion papers include:

- **Market setup** | As a follow-up to a previous discussion paper, this paper will capture new insights on the impact of market setups for hybrid projects on regulatory and legal frameworks and will incorporate quantitative insights from power market modelling.
- **CBA framework** | This discussion paper will explore CBA frameworks currently under consideration by stakeholders, aiming to provide a common understanding on how hybrid, cross-sector projects could be evaluated.
- **PtX Energy System Framework** | This discussion paper will explore the benefits of system integration through PtG when integrating large volumes of offshore wind into onshore grids.
- **PtX Regulatory Framework & Certification** | This discussion paper will analyse the traceability of green hydrogen with a focus on Certificates of Origin and the structure of the market and regulatory framework for PtG to ensure wider system efficiency.

**Highlight**  
**Early engagement and collaboration between developers and stakeholders is required. The NSWPH is willing to support this by sharing expertise and knowledge required to tackle key topics.**



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