



North Sea  
**Wind Power Hub**

# Industry Engagement

June 2019





# Contents

<b>Executive summary</b>	2
<b>1. The Grand Vision – how do we achieve the Paris Agreement’s goals?</b>	7
<b>2. The NSWPH and its vision</b>	9
<b>3. What is the hub?</b>	10
<b>4. Engaging with the industry</b>	12
<b>5. Identified actions and support needed for the project to proceed</b>	16

# Executive summary

“ We support the ambition of the NSWHP... and believe it could be an enabler to unlock a successful co-operation in the North Sea creating a long-term competitive advantage for the... region

Copenhagen Infrastructure Partners



This report identifies and highlights key regulatory and commercial issues which has been discussed with offshore wind stakeholders so that the industry can catalyse the deployment of far offshore wind in the North Sea at a scale commensurate with the ambitions of the Paris Agreement.

In order to facilitate this discussion, the North Sea Wind Power Hub (NSWPH) has engaged with commercial and regulatory experts from the leading offshore wind farm (“OWF”) developers (“the Developers”). This engagement has shown that the OWF developers support the establishment of a broader consultation, where clear frameworks, actions and roles can be identified in pursuit of a solution.

We, supported by the Developers, have identified four key success factors that will help to realise the potential of offshore wind in the North Sea. These factors are:

1. Generating a holistic view of regional planning of the seabed across jurisdictions;
2. Driving a coordinated rollout of offshore wind projects across the North Sea;
3. Efficient use of infrastructure that can accommodate the required level of offshore wind resource; and
4. Establishing a long term visibility of capacity deployment targets denoting strong commitment towards offshore wind developments.

## Offshore wind in the North Sea is an enabler for reaching the goals of the Paris Agreement

Offshore wind must play a pivotal role in driving decarbonisation of the European energy markets. It provides scalable, low carbon energy at a low social cost and with minimal environmental impact, while helping to meet wider security of supply objectives.

Meeting the Paris Agreement requires, amongst other things, a major overhaul of the energy system in the countries bordering the North Sea (the ‘North Sea Countries’ including Germany, UK, Netherlands, Denmark and Norway). Within this context, offshore wind provides a unique opportunity to significantly increase low carbon installed capacity at pace. Independent studies show that in order to meet the Paris Agreement an estimated 230GW of offshore wind is required by 2045 in the territorial waters of the North Sea Countries, of which almost 80% (180GW) will be deployed in the North Sea. To achieve this, a deployment rate of around 6-7 GW/year over the period 2030-2050 is required<sup>(1)</sup>.

<sup>(1)</sup> Ecofys, 2017. Translate COP21. <https://northseawindpowerhub.eu/wp-content/uploads/2017/10/Translate-COP21-Public-report-July2017-final.pdf>



## A new approach is needed to implement the required level of offshore wind

The current offshore wind growth rate in the North Sea is approximately 2GW per year and as such, a continuation of this deployment rate will fall substantially short of the requisite installation pace for the technology in meeting the Paris Agreement ambitions. New approaches are required to incentivise and bring forward large scale offshore wind capacity, in particular on sites which are far from shore (i.e. greater than 100km from shore).

The offshore wind sector has been successful in delivering significant cost reductions but as distance from shore increases, the risk profile inherently increases and many costs rise significantly. As such, there is a limit as to how much further developers can bring the costs of such developments down without changing the approach to deploying offshore wind.

Only by innovating can we deliver commercially attractive business models capable of delivering on the 230GW ambition.

### How can the Hub facilitate the deployment of 180GW offshore wind capacity?

The NSWPH sees an opportunity to facilitate a series of projects harvesting the enormous offshore wind potential in the North Sea, using an innovative hub and spoke concept supported by the industry which will:

1. Deliver scaled offshore wind deployment;
2. Drive further cost reduction;
3. Drive efficiencies in transmission utilisation (reducing costs);
4. Enable effective onshore grid integration across North Sea Countries; and
5. Facilitate coupling of energy markets

NSWPH is taking the first steps towards reaching the Paris Agreement by bringing together key regional stakeholders to develop a series of projects that facilitate a closing of the gap between current planned installation and the required installation of offshore wind.

The concept builds on a modular approach where additional wind power could be added step-by-step to each hub with limited extra costs. A first project will be carried out as part of a staged roll-out where several projects are anticipated to be initiated over time. The first concrete step is the development of a “Hub and Spoke” Grid Connection System facilitating 10-15 GW of offshore wind capacity, combining grid connection of wind power with interconnectors.

In parallel, NSWPH will explore opportunities for leveraging Power-to-Gas technology in conjunction with the Hub and Spoke. Power-to-Gas is essential in the future energy system, providing a critical link in the solution for grid congestion. Benefits from the use of hydrogen could be captured through reduced costs of curtailment, optimised balancing through the use of storage and the reduced need for additional onshore electricity-grid extensions.

### Offshore wind industry engagement

The NSWPH seeks to facilitate the development of a business model that provides a viable route to market for OWF developers, while balancing the benefits for all stakeholders and society in general. The business model of the NSWPH will strive to support the business case for OWF developers through minimised costs, access to interconnected energy market and enhanced long-term revenue stability via greater price arbitrage (between jurisdictions and products). In order to achieve this ambition, early input from OWF developers has been a key priority for the NSWPH as it is essential to creating a successful business model and advancing the first NSWPH project.

In early 2019, the NSWPH engaged with leading and influential OWF developers to get feedback and input on a successful business model for a first-of-a-kind project, combining grid connection of offshore wind power with interconnectors. The views of these developers are represented in this report.

Political support is vital in order to drive the further maturation of the NSWPH project and overcome regulatory barriers that must be solved in order to see the concept become a reality.



# Key messages from the industry

Whilst Europe is on a long term trajectory towards becoming a single energy market, co-ordinated jurisdictional planning of the energy system is not currently a reality. Taking a regional approach to planning new offshore wind assets across the North Sea would have considerable benefits, including to the North Sea Wind Power Hub concept. The NSWPH see three key advantages of a co-ordinated approach.

01

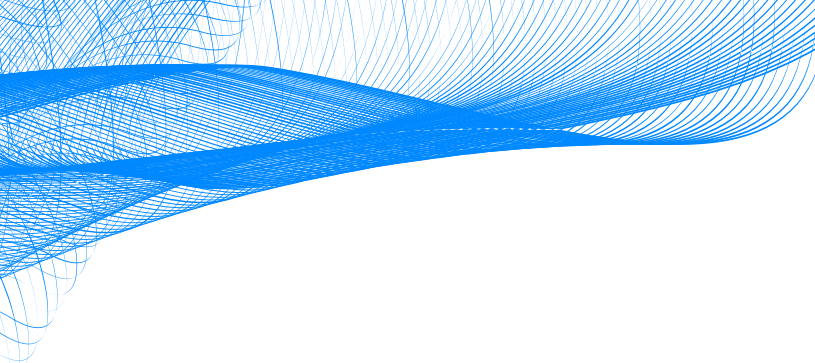
Efficient use of infrastructure for the effective integration of large scale offshore wind

02

Combined Spatial Planning to achieve the ambitions of the Paris Agreement

03

The OWF developers support to the further examination of techno-economic feasibility of the Hub and the conceptual design of the first project



## 01 Efficient use of infrastructure for the effective integration of large scale offshore wind

Our Developer engagement shows that the industry supports the idea that an efficient utilisation of international, cross-border transmission infrastructure is required to successfully integrate large-scale offshore wind energy into the energy system. The network of transmission cables, directly connecting the NSWPH with European energy markets, will provide interconnector functionality. This will support the integration of European energy markets, increase security of supply and yield socio-economic benefits from increased energy market coupling.

## 02 Combined Spatial Planning to achieve the ambitions of the Paris Agreement

Given the current and planned use of space in the North Sea, a co-utilization approach is necessary in the future to reach the required installed capacity of offshore wind. A recent study concluded that if all the currently utilised areas are excluded, only 14,000km<sup>2</sup> or 3% of the suitable space in the North Sea remains available for OWFs, which is only sufficient to host 47-84 GW, depending on the power density<sup>(2)</sup>. In addition, this space is highly fragmented limiting the potential to benefit from scale effects.

A concerted call to action and cooperation across all stakeholders is required to enable further cross-border coordination in spatial planning of the North Sea, which is pivotal in reaching the Paris Agreement ambitions. The approach must consider co-utilization with other sectors such as nature, shipping and fisheries and take a long-term, international and multi-stakeholder perspective. This is supported by the industry and in line with the message from the Political Declaration on energy cooperation between the North Seas Countries<sup>(3)</sup>.

## 03 The OWF developers support to the further examination of techno-economic feasibility of the Hub and the conceptual design of the first project

The discussions with OWF developers show that there is a common understanding of the challenges facing the industry and of the urgent need for increasing the installation pace to meet the Paris Agreement ambitions. The offshore wind industry recognizes that various technical, operational and commercial aspects have to be further matured in the next stage of the project. It is recommended by the industry that the further maturation of the NSWPH project is done in close collaboration between OWF developers, TSOs, policy makers and regulators.

“ We have a positive outlook on the hub and spoke concept of the NSWPH as it enhances further market coupling and the integration of European markets

Eneco ”

(2) Witteveen+Bos Raadgevende ingenieurs B.V. 2019, Cost Evaluation of North Sea Offshore Wind Post 2030. <https://northseawindpowerhub.eu/studies/>

(3) European Energy Union and North Seas Countries, Political Declaration on energy cooperation between the North Seas Countries, 2016. [http://europa.eu/rapid/press-release\\_IP-16-2029\\_en.htm](http://europa.eu/rapid/press-release_IP-16-2029_en.htm)



As a final remark, the industry would like to ask European policy makers to consider the importance of:

- o Taking a holistic view in regional planning of seabed across jurisdictions;
- o Planning for a coordinated rollout of offshore wind projects across the North Sea;
- o Delivering efficient use of infrastructure that can accommodate the required level of offshore wind resource; and
- o Establishing long term visibility of capacity deployment targets denoting strong commitment towards offshore wind developments.

The NSWPH invites the Dutch, Danish and German governments and the European Commission to set up a cross-governmental consultation to find solutions for the issues highlighted in this report in order to enable the offshore wind potential of the North Sea to contribute to achieve the ambitions of the Paris Agreement. We are also keen to open up the discussion for participation from other North Sea countries such as the United Kingdom and Norway.

# 1. The Grand Vision

## How do we achieve the Paris Agreement's goals?

“ Shell supports long-term cross border infrastructure planning for large-scale offshore wind development in the North Sea... [and] is ready to collaborate with governments and industry to ensure an enabling framework for offshore wind capacity growth to supply the renewable electricity demand that will be needed to deliver Europe's energy transition.

Shell ”

### Offshore wind in the North Sea is an enabler for reaching the ambitions of the Paris Agreement

Offshore wind must play a pivotal role in driving decarbonisation of the European energy markets. It provides scalable, low carbon energy at a low social cost, with minimal environmental impact, whilst helping to meet wider security of supply objectives.

At COP21 in December 2015 a global, legally binding climate deal was reached. The agreement sets out a global action plan detailing national and international ambitions to put the world on track to address climate change, limiting global warming to “well below two degrees” with an aim to limit the increase to 1.5 °C. The EU formally ratified the Paris Agreement, and it entered into force on 4 November 2016. With the political will and mandate to act, the EU is fully focused on the practical implementation of this agreement.

Limiting global warming to “well below two degrees” requires net zero greenhouse gas emissions well before 2050. The challenge for the energy system to achieve this is enormous, as today's renewable energy share in the EU is still below 20%. Decarbonising the power sector is generally considered to be the critical first step. This is because it is cost effective, has significant impact on CO2 reduction and it is considered a catalyst in driving the heat and transport decarbonisation necessary to fully decarbonise the sector well before 2050.

Key in the decarbonisation of the power sector are:

1. Substantially increased and efficient deployment of renewable electricity capacity;
2. Sufficient roll-out of interconnection capacity between countries;
3. Development of flexibility options to address imbalances between supply and demand; and
4. Effective market coupling, facilitated by greater interconnection enabling the free flow of energy across borders and boundaries.

Several long-term energy market scenarios<sup>(4)</sup> demonstrate that wind in general - and offshore wind in the North Sea in particular - will be a major contributor to renewable electricity generation for the North Sea countries. The long-term scenarios set out a range for deployment of 70 to 150 GW of offshore wind power in the North Sea by 2040. The most recent European Commission scenarios show a range of 150 to 400 GW of offshore wind in the EU by 2050, with a growth rate of 3-15 GW per year between 2031-2050. Scenario analysis undertaken by the NSWPH, based on the COP21 Paris Agreement commitment, projects a capacity in line with these scenarios with 180 GW of offshore wind capacity required by 2045 in the North Sea.

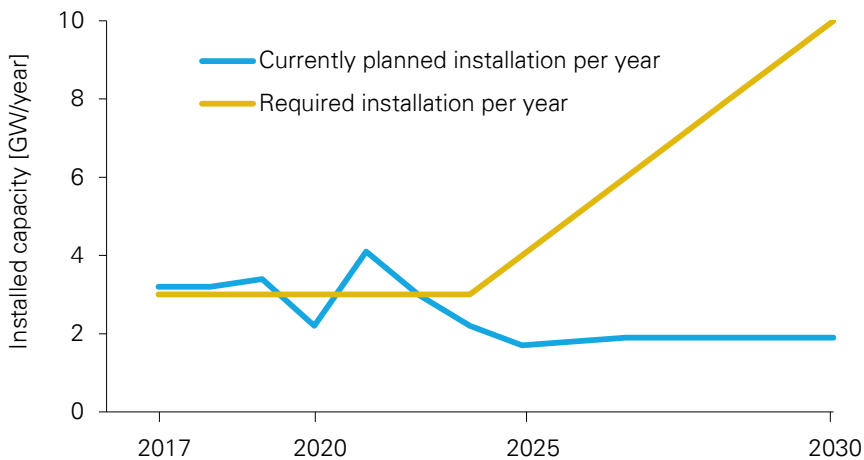
<sup>(4)</sup> For example, those produced by the European Commission, Fraunhofer, PRIMES, Greenpeace, WindEurope, ENTSO-E, IEA



Offshore wind energy has scalable potential to deliver cost-efficient decarbonisation, as evidenced by recent offshore wind projects with limited or no subsidies. However, despite this cost decline, deployment rates must accelerate significantly to meet the Paris Agreement ambitions. There is currently a large gap between planned installation of offshore wind and the required installation rate to reach the Paris Agreement requirements as illustrated in Chart 1.

**Chart 1:**

**Currently planned and required installed capacity per year to reach 230 GW of installed offshore wind capacity in Europe in 2045 based on Ecofys: Translate COP21 (2017)<sup>(5)</sup>**



**A new approach is needed to implement the required level of offshore wind**

To realise the required installation pace, large scale roll-out of far offshore wind is necessary (i.e. offshore wind that is greater than 100 km from shore). The current offshore wind growth rate in the North Sea is around 2GW/year, a continuation of this deployment rate is clearly insufficient to achieve the climate goals.

At the end of 2018 approximately 13 GW of offshore wind capacity was installed in the North Sea<sup>(6)</sup>; while a further pipeline towards 2023 of approximately 2 GW/year of new installations is projected<sup>(7)</sup>. A continuation of today's offshore wind deployment rate will not realise the ambitions implied by the Paris climate agreement. Thus, a step change in offshore wind deployment is required. Independent studies show that in order to meet the Paris Agreement, an estimated 230GW of offshore wind is required by 2045 in the territorial waters of the North Sea Countries, of which almost 80% (180GW) will be deployed in the North Sea. To achieve this, a deployment rate around 6-7 GW/year over the period 2030-2050 is required<sup>(8)</sup>.

**In order to accelerate deployment rates, a stable market framework and collaboration efforts from suppliers, developers and system operators is required.**

<sup>(5)</sup> Ecofys, 2017. Translate COP21. <https://northseawindpowerhub.eu/wp-content/uploads/2017/10/Translate-COP21-Public-report-July2017-final.pdf>  
<sup>(6)</sup> WindEurope, 2019. Offshore Wind in Europe - Key trends and statistics 2018 <https://windeurope.org/wp-content/uploads/files/about-wind/statistics/WindEurope-Annual-Offshore-Statistics-2018.pdf>  
<sup>(7)</sup> Ecofys, 2017. Translate COP21. <https://northseawindpowerhub.eu/wp-content/uploads/2017/10/Translate-COP21-Public-report-July2017-final.pdf>  
<sup>(8)</sup> Ecofys, 2017. Translate COP21. <https://northseawindpowerhub.eu/wp-content/uploads/2017/10/Translate-COP21-Public-report-July2017-final.pdf>



## 2. The NSWPH and its vision

### WHO IS NSWPH?

TenneT Netherlands, TenneT Germany, Energinet, Gasunie and Port of Rotterdam have joined forces to develop a large scale European electricity system for offshore wind in the North Sea

The North Sea Wind Power Hub (NSWPH) consortium partners consider the project to be an important potential path for developing co-ordinated spatial planning with a view towards accomplishing the green energy transition and achieving the Paris Agreement objectives.

#### North Sea Wind Power Hub Consortium



By developing the NSWPH project, the consortium endeavours to make the energy transition both feasible and affordable. Central to the vision is the construction of several hubs at suitable locations in the North Sea, with connections to bordering North Sea countries that combine connection and interconnection functionality. Our long term ambition is for each Hub to function as a base for transport of wind energy, interconnection to the connected countries, offshore wind developers, and a conduit for possible Power to Gas solutions.

### WHAT IS THE VISION OF NSWPH?

To capture the benefits of mass-scale offshore wind power in the North Sea in an innovative first-of-a-kind project, combining grid connection of wind power with interconnectors and providing green energy to millions of Europeans.

The vision of NSWPH relies on three pillars:



#### Meeting the Paris Agreement

The NSWPH seeks to facilitate meeting the Paris Agreement which requires installation of up to 180 GW offshore wind in the North Sea by 2045.

NSWPH is taking a first step towards reaching the Paris Agreement by bringing together key regional stakeholders to develop a project that facilitates a closing of the gap between current planned installation and required installation of offshore wind.



#### Commercial viability

The NSWPH seeks to facilitate the development of a business model that provides a viable route to market for OWFs and supports the delivery of up to 180 GW offshore wind in a post-subsidy world.

The business model will strive to support the business case for OWF developers through minimised LCOE, access to several markets and enhanced long-term revenue stability.



#### Regional cooperation

The NSWPH seeks to facilitate a strong regional cooperation and coordination to support power flows and low cost energy systems, catalysing new investment into offshore wind in the region.

The regional cooperation will support the integration of European energy markets, increase security of supply and yield socio-economic benefits from energy market coupling.

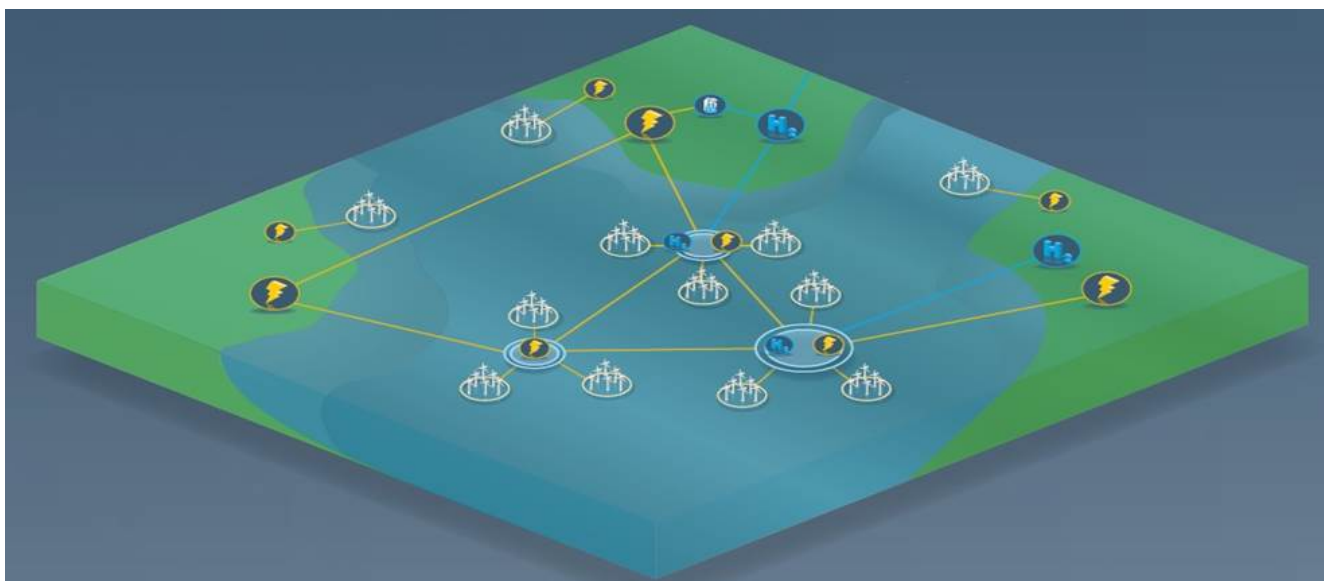


### 3. What is the hub?

“ The Hub-&Spoke concept offering interconnector functionality will increase the integration of European energy markets...[and] will provide societal benefits to consumers through lower energy prices

Innogy ”

#### A network of hubs that connect far offshore wind farms to North Sea Country Countries energy markets



**Developing 180 GW of offshore wind power in the North Sea, to be supplied to European markets, using a modular “hub and spoke” concept**

The North Sea Wind Power Hub (NSWPH) sees an opportunity to use an innovative Hub-and-Spoke concept to harvest the enormous offshore wind potential in the North Sea in pursuit of the Paris Agreement objectives.

Via a series of Hub-and-Spoke projects, the NSWPH sees an opportunity to transform the roll out of offshore wind by providing a stable and integrated market framework which OWF developers need to make 180GW of offshore wind in the North Sea a reality.

Each offshore wind hub would be capable of connecting up to 10-15 GW of wind power and would distribute the power to North Sea Countries through a network of cables (spokes) and/or pipelines (H2 production). The network of transmission cables will also function as interconnectors, directly connecting European energy markets and facilitating greater market coupling.

## The first concrete step is the development of a “Hub and Spoke” Grid Connection System facilitating 10-15 GW offshore wind capacity

The NSWPH consortium is currently investigating the specifications of the first project. In order to reap the benefits of economies of scale, the first project is expected to be an all-electric hub concept connecting approximately 10-15 GW of offshore wind capacity (in line with the TYNDP2018 submission – “project 335”).

The first project is expected to have interconnections to the Netherlands, Germany and Denmark. A Roland Berger study for the European Commission noted the potential for significant savings based on such a hub design, resulting in lifetime benefits of approximately 1.5 bn EUR CAPEX and 1 bn EUR OPEX<sup>(9)</sup>. This was predominantly achieved via better utilisation of the electrical infrastructure by combining connection and interconnection functionality, excluding additional benefits resulting from P2X solutions.

To ensure timely actions, the anticipated commissioning year of the first project is expected to be around 2032, leaving limited time to bring the first project from concept to construction.

## The Hub and Spoke concept accommodates growth and provides several benefits

The NSWPH consortium sees the potential for a modular Hub-and-Spoke concept to facilitate the integration of large volumes of offshore wind energy into the wider regional energy system. This is in stark contrast to the current radial and incremental roll-out approach.

The Hub and Spoke concept builds on a modular build-out approach meaning that development can start today without having to rely on cutting edge innovation to reach sufficient maturity and reliability in the fields of DC grid protection strategies.

The concept is based on a combination of offshore transmission hubs, where power is collected and brought to shore via high capacity (DC) export cables, and builds on the experience of German connections with HVDC export technology. The export cables are connected to onshore grids in a smart and coordinated manner to locations with minimal impact on existing grid capacity. By making smart connections between hubs, export cables also provide interconnection capacity, reducing the need for regular (point-to-point) interconnection. In addition, P2X<sup>(10)</sup> can be used to facilitate onshore integration of offshore wind through, for example, hydrogen conversion and storage of renewable energy at times of low electricity demand.

The modular Hub-and-Spoke concept brings forward a number of key benefits:

- **Delivering efficient offshore LCOE:** The Hub-and-Spoke concept yields a comparatively low Levelised Cost of Electricity (LCOE) throughout most of the North Sea region, enabling far from shore developments to provide near shore LCOE levels. In addition, building far from shore captures the benefits of higher average wind speeds, while delivering benefits of scale on costs compared to a no-hub solution. A recent study concludes that the benefits of a Hub-and-Spoke concept as part of the full offshore wind roll-out can potentially bring a LCOE reduction of 5-6% as compared to deploying only radial connections<sup>(11)</sup>.
- **Higher utilization and lower costs through combined transmission and interconnection:** Combining offshore wind transmission and interconnection functionality increases utilization of assets and reduces both absolute and per unit costs, compared to a separate interconnection line and radial wind farm connection. With transmission connections now comprising up to one third of offshore wind development capex, driving efficiency will continue to yield results on the offshore wind LCOE.
- **Optimized roll-out of offshore wind through co-ordinated spatial planning:** co-ordinated spatial planning offshore enables allocation of sufficient continuous area, and areas of sufficient capacity, to leverage the full potential of the Hub-and-Spoke concept. Co-ordination concerning onshore grid integration ensures offshore wind is connected where congestion, and the need for grid reinforcements, are minimized. It increases the security of delivering on the Paris Agreement as the risk of delays and stranded assets are reduced. In addition, it ensures a steady offshore wind deployment throughout the North Sea region, securing market stability to further reduce cost and realise the required up scaling of the entire supply and introduce the necessary innovations.
- **Integration of gas and electricity grids:** the Hub-and-Spoke can be a way to integrate gas and electricity infrastructure through P2X conversion and H2 storage. P2X conversion can utilize excess amounts of electricity to produce e.g. hydrogen which can be stored and used to produce power when needed. This provides stability to the energy system and helps to maintain the security of supply. Another benefit is that existing gas transmission infrastructure can be re-used and can be an alternative for new post 2030 electricity transmission corridors. It provides robustness to energy markets with high indeed of variable renewable energy sources by mitigating scarcity situations (peak prices) as well as energy oversupply situations (low to negative prices). P2X conversion can also provide a means of decarbonisation to end use sectors such as industry and transport.
- **Modularity and scale:** the Hub-and-Spoke concept allows for a step-by-step approach, to adjust scale, lead time and functionality of individual projects based on the needs of a changing environment. For example, a first modular hub project in the early 2030s is likely to be largely all-electric providing hybrid offshore wind connection and interconnection functionality. Subsequent hubs will increasingly include P2X functionality, based on increased maturity and scale of the required conversion technologies. Significant hub sizes (of more than several GWs) enable additional cost reduction through economies of scale.
- **Potential onshore environment offshore:** if for a specific location a sand island is found to be the most favourable hub foundation, additional functionalities can be considered because the hub can create an “onshore” environment far out at sea. Potential benefits may include the ability to function as a permanent base for personnel to undertake construction and maintenance of surrounding wind farms, house possible synergistic technologies such as P2X or provide a docking hub for other industries such as fisheries.

<sup>(9)</sup> Roland Berger for the European Commission, 2019. Cost efficient offshore development through hybrid projects.

<sup>(10)</sup> P2X includes power-to-gas (mainly H2 as well as methane) and other options (such as fuels, feedstock, food, oxygen, residual heat, etc.)

<sup>(11)</sup> Witteveen+Bos Raadgevende ingenieurs B.V. 2019, Cost Evaluation of North Sea Offshore Wind Post 2030. <https://northseawindpowerhub.eu/studies/>



## 4. Engaging with the industry

“ We would like to continue the dialogue about the possible design options for the NSWPH. The timing of implementation and co-operation across markets are key success factors in our view.

Vattenfall ”

### Process of the engagement

The NSWPH seeks to facilitate the development of a business model that provides a viable route to market for OWF developers, while balancing the benefits for all stakeholders and society in general. The business model of the NSWPH will strive to support the business case for OWF developers through minimised costs, access to several markets and enhanced long-term revenue stability. The consortium recognizes that in order to achieve this ambition there are several key components that require discussion amongst the OWF developers, TSOs and regulators.

In the latest report from WindEurope<sup>(12)</sup> a reduction in offshore wind investment costs of 45% per MW is identified in the period 2013 to 2018 – cost reductions that have been shared with society. The industry knowledge from offshore wind developers is key in order to ensure a viable business model and concept of the first project. Therefore, early input from OWF developers has been a key priority for the NSWPH as it is essential to create a successful business model and advance the first NSWPH project.

**In early 2019, the NSWPH together with KPMG identified the leading and most influential OWF developers to start a dialogue on a successful business model for the NSWPH. During the spring of 2019, NSWPH and KPMG engaged with the OWF developers in a series of workshops where regulatory and commercial experts from both the developers and TSOs participated to discuss key regulatory, commercial and business components of a successful first project.**

In a report from August 2018<sup>(13)</sup>, Roland Berger, on behalf of the NSWPH and the European Commission, analysed and assessed mitigating actions for a number of potential commercial and regulatory barriers for the NSWPH as a hybrid project<sup>(14)</sup>. Based on the Roland Berger report, the following commercial aspects have been chosen as a focal point in the NSWPH consortium's initial engagement with the industry:

- **Market arrangements:** How should the revenue model for the OWF developers and cable operators be structured? What market arrangements should be defined to specify commercial flows from the hub to various countries? Consequently, what will be the capacity allocation regime for the cables from the hub to shore?
- **Geographical and timing alignment:** How could a post 2030 project be aligned to the three countries' national preferences for location, regulation and routing?

The above mentioned topics, and others, have been discussed between the NSWPH consortium and the OWF developers. The engagement between the NSWPH consortium and the industry was based on a bilateral exchange of knowledge and experiences.

The engagement between all parties has shown a high degree of mutual understanding and a common interest in maturing the NSWPH project due to the innovative hub and spoke concept and the potential of the NSWPH to play an enabling role in meeting the requirements as set out in the Paris Agreement. The fruitful discussions between the consortium and experts from the OWF developers have resulted in key input to the development of a viable business model of the NSWPH.

<sup>(12)</sup> WindEurope, 2019. Offshore Wind in Europe – Key trend and statistics 2018.

<sup>(13)</sup> Roland Berger, 2018. North Sea Offshore Energy Clusters.

<sup>(14)</sup> A hybrid project refers to project that combine offshore generation and transmission in a cross-border setting

# Key messages from the industry

Our engagement with the leading and most influential OWF developers has resulted in three key messages from the industry – all supported by the NSWPH consortium.

01

Efficient use of infrastructure for the effective integration of large scale offshore wind

02

Combined Spatial Planning to achieve the ambitions of the Paris Agreement

03

The OWF developers support to the further examination of techno-economic feasibility of the Hub and the conceptual design of the first project



## 01 Efficient use of infrastructure for the effective integration of large scale offshore wind

Our discussions show that the industry supports the idea that an efficient utilisation of international cross-border transmission infrastructure is required to successfully integrate large-scale offshore wind energy into the energy system. The network of transmission cables, directly connecting the NSWPH with European energy markets, will provide interconnector functionality. This will support the integration of European energy markets, increase security of supply and yield socio-economic benefits from increased energy market coupling. Several developers noted that without efficient use of infrastructure, the future capture prices of offshore wind as large volumes of offshore wind were deployed would inhibit investment certainty without alternative routes to market.

## 02 Combined Spatial Planning to achieve the ambitions of the Paris Agreement

Our engagement shows that the industry agrees that political support and coordination across borders is vital to ensure that the available seabed in the North Sea is designated to enable the full 180GW of offshore wind by 2050.

Given the current and planned use of space in the North Sea, a co-utilization approach is necessary in the future to reach the required installed capacity of offshore wind. A recent study concluded that if all the currently utilised areas are excluded, only 14,000km<sup>2</sup> or 3% of the suitable space in the North Sea remains available for OWFs which is only sufficient to host 47-84 GW, depending on the power density<sup>(15)</sup>. In addition, this space is highly fragmented limiting the potential to benefit from scale effects.

A concerted action and cooperation across all stakeholders is required to enable further cross-border coordination in spatial planning of the North Sea, which is pivotal in reaching the Paris Agreement. The approach must consider co-utilization with other sectors such as nature, shipping and fisheries and take a long-term, international and multi-stakeholder perspective. This is supported by the industry and in line with the message from the Political Declaration on energy cooperation between the North Seas Countries<sup>(16)</sup>.

## 03 The OWF developers support to the further examination of techno-economic feasibility of the Hub and the conceptual design of the first project

The interviews and workshops show that there is common understanding of the challenges facing the industry and that there is an urgent need for increasing the installation pace to meet the Paris Agreement. The industry recognizes that various technical, operational and commercial aspects have to be further matured in the next stage of the NSWPH project. It is recommended by the industry that the further maturation of the NSWPH project is done in close collaboration between OWF developers, TSOs and regulators to ensure regulatory barriers can be overcome as quickly as possible enabling critical action.

“ We welcome the initiative of the North Sea Wind Power Hub and support further dialogue on the technical solutions and commercial and regulatory conditions for an integrated offshore grid.

Equinor ”

<sup>(15)</sup> Witteveen+Bos Raadgevende ingenieurs B.V. 2019, Cost Evaluation of North Sea Offshore Wind Post 2030. <https://northseawindpowerhub.eu/studies/>

<sup>(16)</sup> European Energy Union and North Seas Countries, Political Declaration on energy cooperation between the North Seas Countries, 2016. [http://europa.eu/rapid/press-release\\_IP-16-2029\\_en.htm](http://europa.eu/rapid/press-release_IP-16-2029_en.htm)

### Additional key principles for the NSWPH

During the discussions with industry, a number of principles regarding a viable business model of the NSWPH were commonly supported. These principles included:

- Developers from different jurisdictions should join the hub under harmonised regulatory and/or subsidy parameters
- Hydrogen solutions should be further considered as a means to enhance the business case for developers and TSOs
- Alignment of the timing is key in ensuring that the sizing of the cables is commensurate to the capacity which is connecting
- Roles and responsibilities have to be defined early and clearly, for example who is operating the grid infrastructure, who is responsible for balancing the power, etc.

Reaching a common understanding on these principles is a key milestone for the consortium in the maturation of the NSWPH project and the development of a viable business model.

### Areas for further discussion:

The consortium recognises that a number of additional areas have to be further discussed and analysed before reaching a consensus regarding a viable business model. During our dialogue with the industry, the following areas were discussed and need to be further investigated:

- **Governance structure:** During our industry engagement, various options for the governance structure were discussed. An optimal governance structure should be analysed further, covering, amongst other things, the hub operator, grid operator and the allocation of ownership.
- **Revenue models:** An optimal revenue model for transmission cables and how the hub/generators capture revenues should be further investigated in the next project phase.
- **Sharing of socio-economic benefits:** An optimal model for how the socio-economic benefits are shared with the connected markets should be further investigated in the next project phase.





# 5. Identified actions and support needed for the project to proceed



We see interesting possibilities in the NSWPH project...and believe further examination... should include studies on the role of hydrogen as a potential means to prevent curtailment.

Engie



## In order to reach the ambitions of the Paris Agreement there is a need for 180 GW of offshore wind in the North Sea.

Learnings from the industry engagement and the analysis conducted by the NSWPH consortium have shown that co-ordinated spatial planning across territorial zones is needed to fully utilise the limited space in the North Sea.

Furthermore, the current and future power grid development plans need to be approached with the same holistic thinking to ensure the best sizing of interconnectors and onshore power grids to accommodate sufficient distribution of offshore wind energy.

In order to solve the challenges of this co-ordinated approach to spatial planning and roll out, the NSWPH consortium invites the Dutch, German and Danish governments and the European Commission to have a cross-governmental consultation during the fall of 2019. During the consultation suggested topics of discussion include:

1. How to co-operate across borders in the North Sea region in regards to large offshore wind projects?
2. How to handle other potential regulatory barriers or challenges in the current market model?
3. What is the next step in regards to the offshore wind development in the North Sea?

During the consultation, the roles and responsibilities in ensuring the development of the offshore wind farms in the North Sea should be discussed and agreed upon.

Lastly, the consortium is keen to open discussions with other North Sea countries, such as the United Kingdom and Norway, to seek their commitment to a co-ordinated spatial planning approach in the future development of offshore wind in the North Sea. Involving more countries will increase the complexity of the project. However, a united approach to the co-ordinated spatial planning of the North Sea is crucial to fully utilise the limited space.

