

## Efficient access to offshore wind resources

*Lessons from Germany, UK, the Netherlands and Denmark for efficient connection of offshore wind to the onshore grids*

*Study commissioned by Ørsted*

*Workshop on Offshore Grid - How to ensure a cost efficient offshore grid development in Europe?*

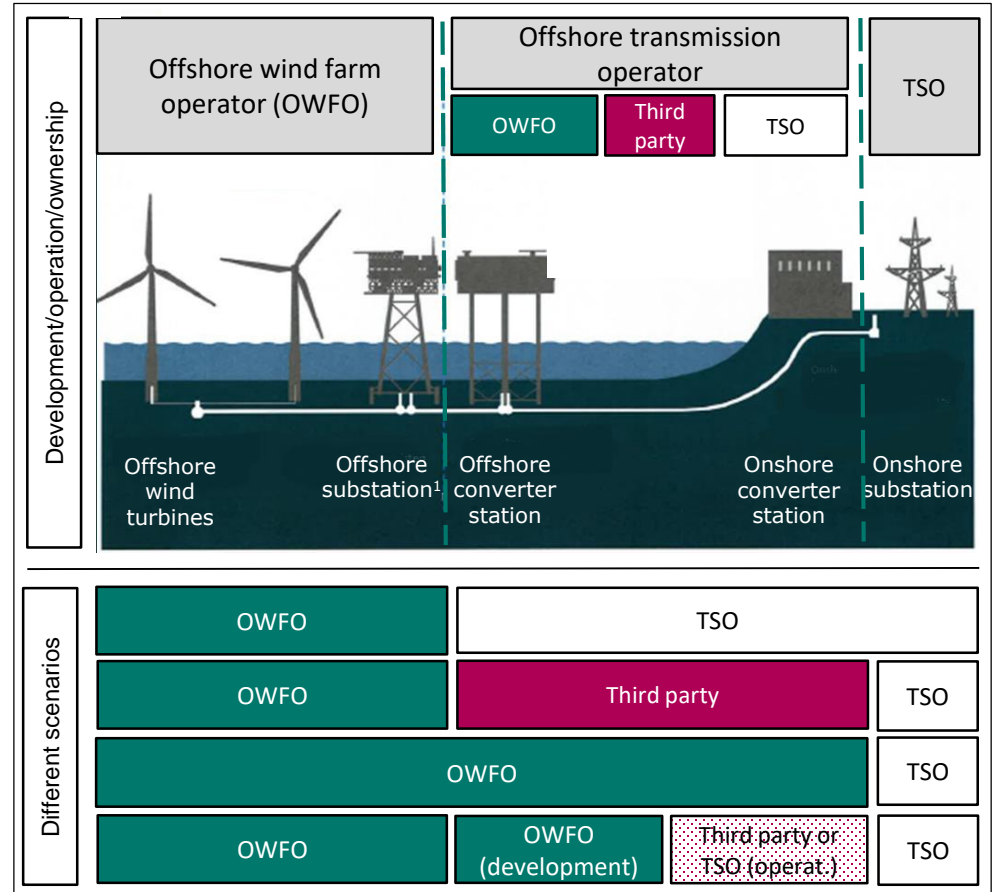
Hamburg, September 2018

## Motivation

### Who is responsible for connecting the offshore wind farm to the onshore substation?

- Theoretically, the following allocations of responsibilities concerning the offshore connection are possible:
  - The (local) *transmission system operator (TSO)* has a monopoly and owns, develops as well as operates the offshore transmission asset; TSOs are regulated by a national regulatory authority (NRA) or are public companies
  - A *third party*<sup>2</sup> owns, develops and operates the offshore transmission asset
  - The *offshore wind farm operator (OWFO)* is not just responsible for the offshore wind farm, but also owns, develops and operates the offshore transmission asset
  - A fourth possibility is a *mixed solution* (as in the UK), where the OWFO is responsible for the development of the transmission asset and a third party operates and finally owns the asset after the completion. In general, the TSO might also be in charge of operating the offshore transmission asset

### Overview of potential responsibilities of the offshore transmission asset



**Assumption:** The offshore transmission operator is not entitled to trade electricity. He is only responsible for the transmission.

<sup>1</sup> In the UK the offshore substation is part of the OTA.

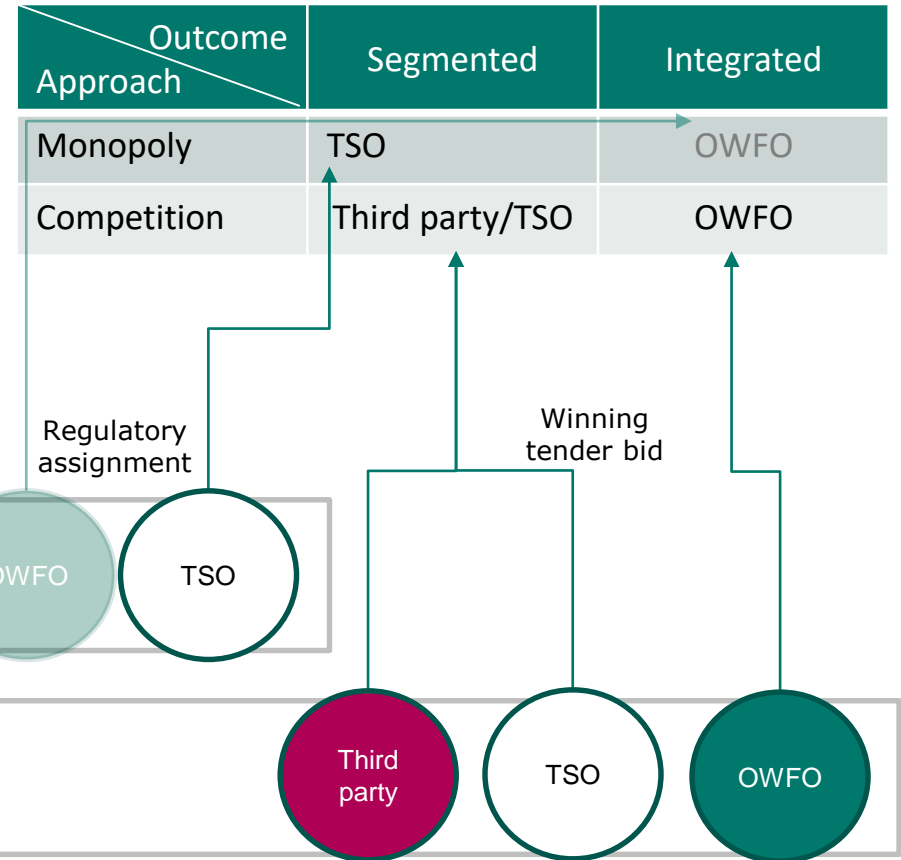
<sup>2</sup> A third party can be any company that is not the OWFO or the (local) TSO.

## Motivation

### Different approaches/outcomes regarding the allocation and responsibilities for the offshore connection – definitions

- Segmented vs. Integrated - Ex-post outcome
  - *Segmented*: Development, operation and ownership of offshore wind farm and offshore transmission asset *by two distinct parties*
  - *Integrated*: Development, operation and ownership of offshore wind farm and offshore transmission asset *by the same party*
  
- Monopolistic vs. Competitive - Ex-ante approach
  - *Monopoly*: One party is legally assigned to develop, operate and own the offshore transmission asset. No competitive tender.  
→ In most cases this will be TSO and not the OWFO.
  
  - *Competition*: Competitive tender in order to determine who will be in charge to develop, operate and own the offshore transmission asset.

Responsibilities for development and operation (incl. ownership) of the transmission asset to shore (ex-post allocation decision)



## Evaluation of the different approaches (generic discussion)

Legend (in relative terms, ordinal scale):

- Most advantageous
- Medium advantageous
- Least advantageous

**Dimensions of the market design (competitive vs. monopolistic and integrated vs. segmented) affect the strategic behavior of the market participants and impact the costs of offshore wind energy transmission**

- Offshore wind development planning
- Cost of development and operation of offshore transmission asset
  - Least-cost selection effects of a competitive tender (vs. monopoly)
  - Cost effects through synergies (economies of scale and scope, flexibility)
- Coordination costs
  - Cost of misaligned time schedules (connection delays)
  - Cost of idleness (e.g. through different lifetimes of transmission and generation assets)
- Other transaction costs
  - Cost of a complex tender bidding process
  - Cost of the regulatory system (to determine network charges)
- Innovation incentives
- Transparency about the cost of electricity generation
- Attracting additional finance into the business

Assessment criteria	Monopoly	Competition			
	TSO	Segmented		Integrated	
		TSO	Third Party	OWFO	
Offshore wind development planning	●	<i>planning and environmental impact</i>			
Cost of development and operation of OTA	●	●	●	●	
	●	<i>cost efficiency</i>			
	●	●	●	●	
Coordination costs	●	<i>cost synergies</i>			
	●	●	●	●	
	●	<i>risk of connection delay</i>			
	●	●	●	●	
	●	<i>risk of unused transmission capacity</i>			
	●	●	●	●	
Other transaction costs	●	<i>lifetime optimization</i>			
	●	●	●	●	
	●	<i>risk of insolvency</i>			
	●	●	●	●	
Innovation incentives	●	<i>costs of tendering</i>			
	●	●	●	●	
Transparency w.r.t. cost of electricity generation	●	<i>costs of the regulatory system</i>			
	●	●	●	●	
Attracting additional finance or new market players	●	<i>innovation incentives</i>			
	●	●	●	●	
	●	<i>cost transparency</i>			
	●	●	●	●	
	●	<i>market openness (for new entrants)</i>			
	●	●	●	●	
	●	<i>attractiveness for private funding</i>			
	●	●	●	●	

## International practice

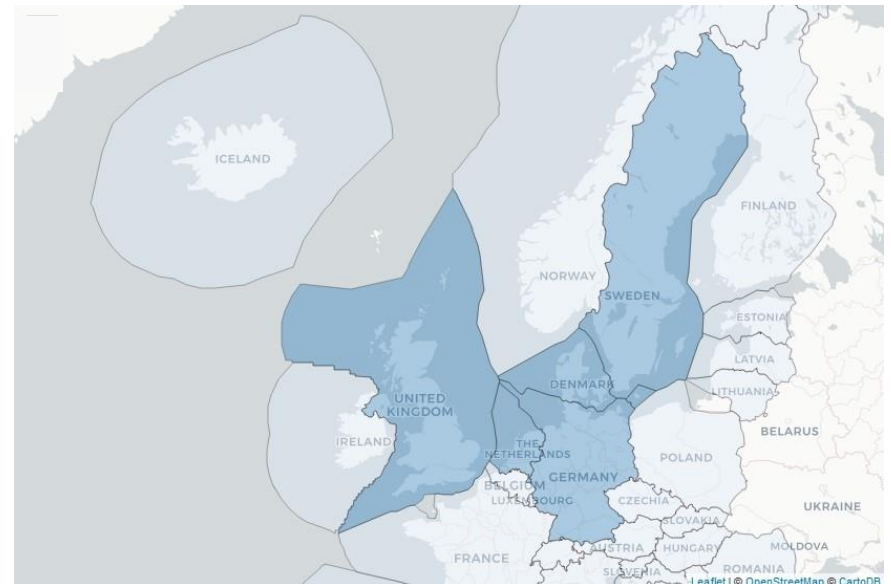
### Comparison of different international regulatory approaches

- Countries choose different approaches for organizing offshore transmission. We compare regulatory approaches in different countries and, more importantly, how their design differs.
- The following countries are in the focus of attention in this section:
  - *United Kingdom (UK)*
  - *Germany (DE)*
  - *The Netherlands (NL)*
  - *Denmark (DK)*
  - *Sweden (SE)*

### Assignment of countries to the regime matrix

Outcome Approach	Segmented	Integrated
Monopoly	DE, NL, DK	---
Competition	UK	UK, DK

### Map of investigated countries



## International practice

**United Kingdom** – Germany – The Netherlands – Denmark

- Current market approach
  - The Office of Gas and Electricity Markets (Ofgem) established a regulatory regime for offshore transmission in collaboration with the Department of Energy and Climate Change (DECC). Since 2009 there are two options:
    - The OWFO decides to build his own transmission infrastructure and transfers it to the Offshore Transmission Owner (OFTO) after completion for the operation OR
    - The OFTO develops, builds, operates and maintains the offshore transmission asset
      - So far, all project developers have chosen the OWFO-build option
- ➡ UK has a mixed design
  - Construction: Integrated or segmented competitive approach
  - Operation: Segmented competitive approach

COUNTRY PROFILE		
Assignment of countries to the regime matrix		
Outcome Approach	Segmented	Integrated
Monopoly		
Competition	UK	UK
<b>Approach/ Outcome</b>	Construction: Integrated or segmented competitive; Operation: Segmented competitive	
<b>Responsible party</b>	Construction: OWFO; Operation: Third party (OFTO)	
<b>Regulatory authority</b>	Ofgem, DECC	
<b>Cost of development and operation of offshore transmission asset</b>	Cost pressure for construction and operation through two separate tender processes. Construction: Bidder wins based on the least costs; Operation: Bidder wins based on the revenue request. Cost synergy: Economies of scale and scope Cost recovery: Construction - Cost covered by the price the OFTO pays; Operation - Revenue stream for OFTO	
<b>Coordination costs</b>	High incentives to complete wind farm and transmission simultaneously; high incentives to increase availability of the transmission. Partial optimization of lifetime of transmission and generation to 20 years. Some projects have a lifetime of transmission up to 40 years.	

## International practice

United Kingdom – Germany – The Netherlands – Denmark

### □ Cost recovery

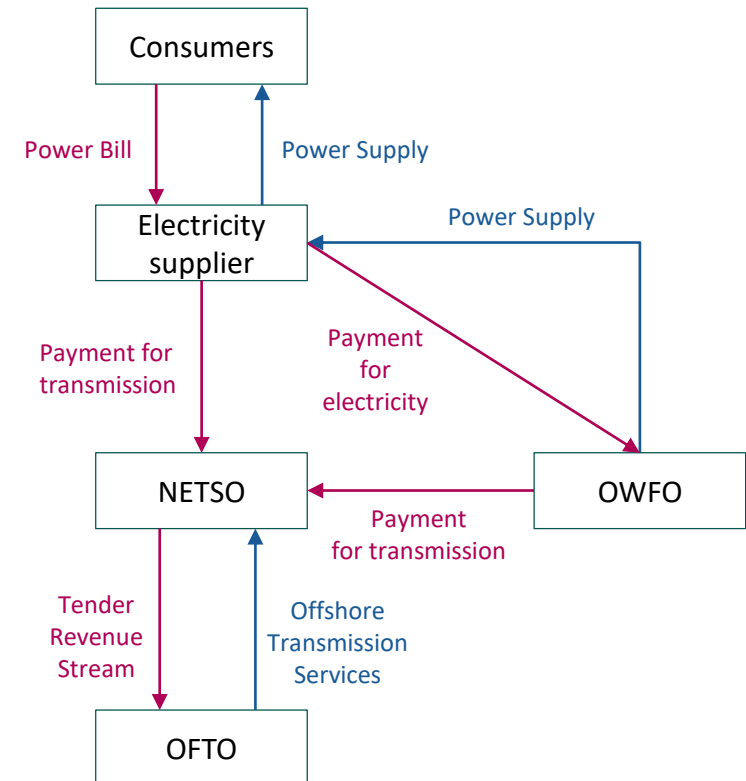
#### ■ Construction

- CAPEX for the transmission asset (invested by the OWFO) are covered by the price the OFTO pays to the OWFO determined through the tender process

#### ■ Operation

- A 20-year revenue stream unrelated to the OWF performance is provided to the OFTO in return for operating, maintaining and decommissioning the transmission asset
- The payment is made by the National Electricity System Operator (NETSO) and is funded by transmission charges that the OWFO and the consumers pay

- ➡ The approach enables cost pressure through competitive tender processes for the construction and operation of the transmission asset
- ➡ Economies of scope for the construction and potential economies of scale for the operation of the transmission asset can be captured
- ➡ The approach prevents that additional costs are allocated to the consumer since the revenue stream is fixed for 20 years



Source: CEPA, BDL (2014): Evaluation of OFTO Tender Round 1 Benefits - The Office of Gas and Electricity Markets, p. 3.

## International practice

United Kingdom – **Germany** – The Netherlands – Denmark

- Current market approach
  - Two private TSOs (TenneT and 50Hertz) have a natural monopoly for the transmission asset (onshore and offshore)
  - The (local) TSOs are legally obliged to build and operate all offshore transmission assets
  - ➡ Germany has a segmented monopolistic approach
- Cost recovery
  - A revenue cap determines the level of grid charges for the TSOs
  - Grid expansion investment costs are recouped by additional charges on top of the revenue cap
  - ➡ No cost pressure due to the lack of a competitive tender process. Although the TSOs might benefit from economies of scale, the approach offers no incentives for cost reductions.

COUNTRY PROFILE		
Assignment of countries to the regime matrix		
Outcome Approach	Segmented	Integrated
Monopoly	DE	
Competition		
<b>Approach/ Outcome</b>	Segmented monopolistic	
<b>Responsible party</b>	Local TSOs are TenneT (North Sea) and 50Hertz (Baltic Sea)	
<b>Regulatory authority</b>	BNetzA	
<b>Cost of development and operation of offshore transmission asset</b>	No cost pressure due to missing tender process Cost synergy: Economies of scale Cost recovery: TSOs recoup investment costs on top of their grid charges	
<b>Coordination costs</b>	Costs of time mismanagement: Compensations paid by the TSO to the OWFO No optimization of lifetime of transmission and generation	



## International practice

United Kingdom – Germany – **The Netherlands** – Denmark

- Current market approach
  - By law the TSO is responsible for the planning, construction and operation of the offshore transmission asset
  - The TSO (TenneT TSO NL) is a state-owned enterprise
  - The TSO is regulated by the Authority for Consumers and Markets (ACM)
  
- Cost recovery
  - Subsidy for the TSO to cover the construction costs of offshore transmission assets (Electricity Act 1998)
  - ➡ No cost pressure due to the lack of a competitive tender. Although the TSOs might benefit from economies of scale, the approach does not offer cost reduction incentives because costs are covered through grid charges.

COUNTRY PROFILE		
Assignment of countries to the regime matrix		
Outcome Approach	Segmented	Integrated
Monopoly	NL	
Competition		
<b>Approach/ Outcome</b>	Segmented monopolistic	
<b>Responsible party</b>	TSO (TenneT TSO NL)	
<b>Regulatory authority</b>	ACM	
<b>Cost of development and operation of offshore transmission asset</b>	No cost pressure due to missing tender process Cost synergy: Economies of scale Cost recovery: TSOs recoup investment costs on top of their grid charges	
<b>Coordination costs</b>	No incentive to reduce costs of time mismanagement: Compensations paid by the TSO to the OWFO Optimization of lifetime of transmission and generation to 20 years.	

## International practice

United Kingdom – Germany – The Netherlands – **Denmark**

- Current market approaches
  - The Danish TSO, Energinet.dk, is owned by the Ministry of Energy, Utilities and Climate and regulated by the Danish Energy Regulatory Authority
  - *A government tender for the wind farm*
    - Official connection point from OWF to the TSO is offshore
    - TSO is responsible for development, construction and operation of transmission asset
  - *Open door procedure*
    - The official connection point from the OWF to the TSO is onshore
    - OWFO is responsible for the development, construction and operation of the transmission asset
    - “First come – first serve” allocation mechanism
    - Until 2017 no project has been established under this procedure

COUNTRY PROFILE		
Assignment of countries to the regime matrix		
Outcome Approach	Segmented	Integrated
Monopoly	DK	
Competition		DK
<b>Approach/ Outcome</b>	Tender for wind farm: Segmented monopolistic; Open door: Integrated but no competitive tender	
<b>Responsible party</b>	Tender for wind farm: TSO (Energinet.dk); Open door: OWFO	
<b>Regulatory authority</b>	Danish Energy Regulation Authority	
<b>Cost of development and operation of offshore transmission asset</b>	No cost pressure due to missing tender process Cost synergy: Economies of scale Cost recovery: TSO recoups costs through tariffs (grid charges)	
<b>Coordination costs</b>	Costs of time mismanagement: Compensations paid by the TSO to the OWFO	

## International practice

United Kingdom – Germany – The Netherlands – **Denmark**

- Cost recovery
  - The TSO is a state-owned non-profit enterprise
  - ➡ All costs are covered by tariffs (grid charges)
  
- Current discussion about a regulatory change to the integrated competitive approach
  - A new OWF with approx. 800 MW is planned to be connected between 2024 and 2027 to the grid
  - The transmission asset connecting the wind farm to shore is expected to be part of the tender

COUNTRY PROFILE		
Assignment of countries to the regime matrix		
Outcome Approach	Segmented	Integrated
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Competition		DK
<b>Approach/ Outcome</b>	Tender for wind farm: Segmented monopolistic; Open door: Integrated but no competitive tender	
<b>Responsible party</b>	Tender for wind farm: TSO (Energienet.dk); Open door: OWFO	
<b>Regulatory authority</b>	Danish Energy Regulation Authority	
<b>Cost of development and operation of offshore transmission asset</b>	No cost pressure due to missing tender process Cost synergy: Economies of scale Cost recovery: TSO recoups costs through tariffs (grid charges)	
<b>Coordination costs</b>	Costs of time mismanagement: Compensations paid by the TSO to the OWFO	

## Conclusion

### **The advantages of a competitive tender approach and the trade-off between an integrated and a segmented offshore transmission asset operation**

- Intensifying competition in combination with sophisticated planning
  - Well defined decision (on a case-by-case basis) whether or not a hub connection is economically preferable and deduce implications for the competitive tender whether development and operations can be (in principal) carried out by the OWFO or operations require an independent third party (third party or TSO)
- Intensify competition (where appropriate)
  - (Ex-ante) Full flexibility of who will be in charge in terms of ownership, development and/or operation of the OTA (OWFO, TSO, third party)
  - Least cost selection through competitive tender will solve (ex-post) the allocation problem (segmented vs. integrated outcome)
- Competition will lead to highest incentives regarding
  - Decreasing development and coordination costs, higher innovation activities as well as higher cost transparency.
  - On the other hand, tender and regulatory complexity might increase.

## Contact



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Thank you for your attention!