Germany

- Industry structure
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- Existing offshore wind generation and transmission capacity
- Planned or proposed offshore wind generation and transmission capacity
- Existing OWT projects
- Upcoming and planned OWT projects

Industry overview and structure (1/2)

Policymakers

Federal Ministry of Economic Affairs and Energy (BMWi) is responsible for policy and legislation related to economy, energy, technology and foreign trade.

Federal Ministry of Transport and Digital Infrastructure (BMVi) is responsible for federal waterways and shipping administration as well as issues relating to law of sea

Planning and regulation

Federal Network Agency (Bundesnetzagentur or BNetzA) is responsible for regulation of energy sector in general and for conducting competitive process for offshore wind auctions as per WindSeeG2017.

Federal Maritime and Hydrographic Agency (BSH) is responsible for the development and preliminary investigation of areas for the construction and operation of wind energy at sea in an overall planning process based on Wind Energy at Sea Act (WindSeeG 2017).

Transmission network developer and system operator

- Grid access responsibility is TSO-led. Since 2006, German TSOs are required to plan, invest and operate offshore transmission network in Germany. Of the four TSO's, Tennet and 50 Hertz provide offshore wind transmission systems.
- Until 2013, grid connection was legally guaranteed. Thereafter, TSOs were required to deliver Offshore Network Development Plan (O-NEP) to BNetzA (up to 2017), allowing non-discriminatory allocation procedure for sharing of transmission assets across wind farms.
- O-NEP is replaced by Offshore Area Development Plan (FEP, first published in 2019), produced by BSH based on WindSeeG 2017.

Industry overview and structure (2/2)

Industry associations

OFFSStiftung HORE-WINDENERGIE – German Offshore Wind Energy Foundation – Founded in 2005 under the moderation of Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)

Bundesverband Windenergie e.V. (BWE) – German Wind Energy Federation- member of Bundesverband Erneuerbare Energie [German Renewable Energy Federation (BEE)] with more than 20,000 members

Bundesverband der Windparkbetreiber Offshore e.V. – Association of German Offshore Wind Farm Operators – represents all companies that plan, construct and operate offshore wind farms in Germany

VDMA Power Systems – division of German Engineering Federation (VDMA) – represents manufacturers of turbines, fuel cells and engine systems

WAB – German wind energy network in Northwest region – represents businesses active in all value-creation stages of the onshore and offshore wind energy sector

Recent policy and regulatory developments

Draft Climate Action Law and Climate Action Program 2030

- A draft Climate Action Law and Climate Action Programme 2030 was released in Q3 2019, stipulating 55% emissions cut goal for 2030 and outlining sectoral targets; increasing the share of renewables in total consumption to 65% by 2030; phasing out of coal-fired generation by 2038 (through a separate law); revising expansion target for offshore wind from 15 GW to 20 GW by 2030; removing support cap for solar PV currently at 52 GW capacity. Germany also plans to gradually reduce the country's trademark renewables surcharge and other policy related components of power price such as grid fees to lower electricity prices.

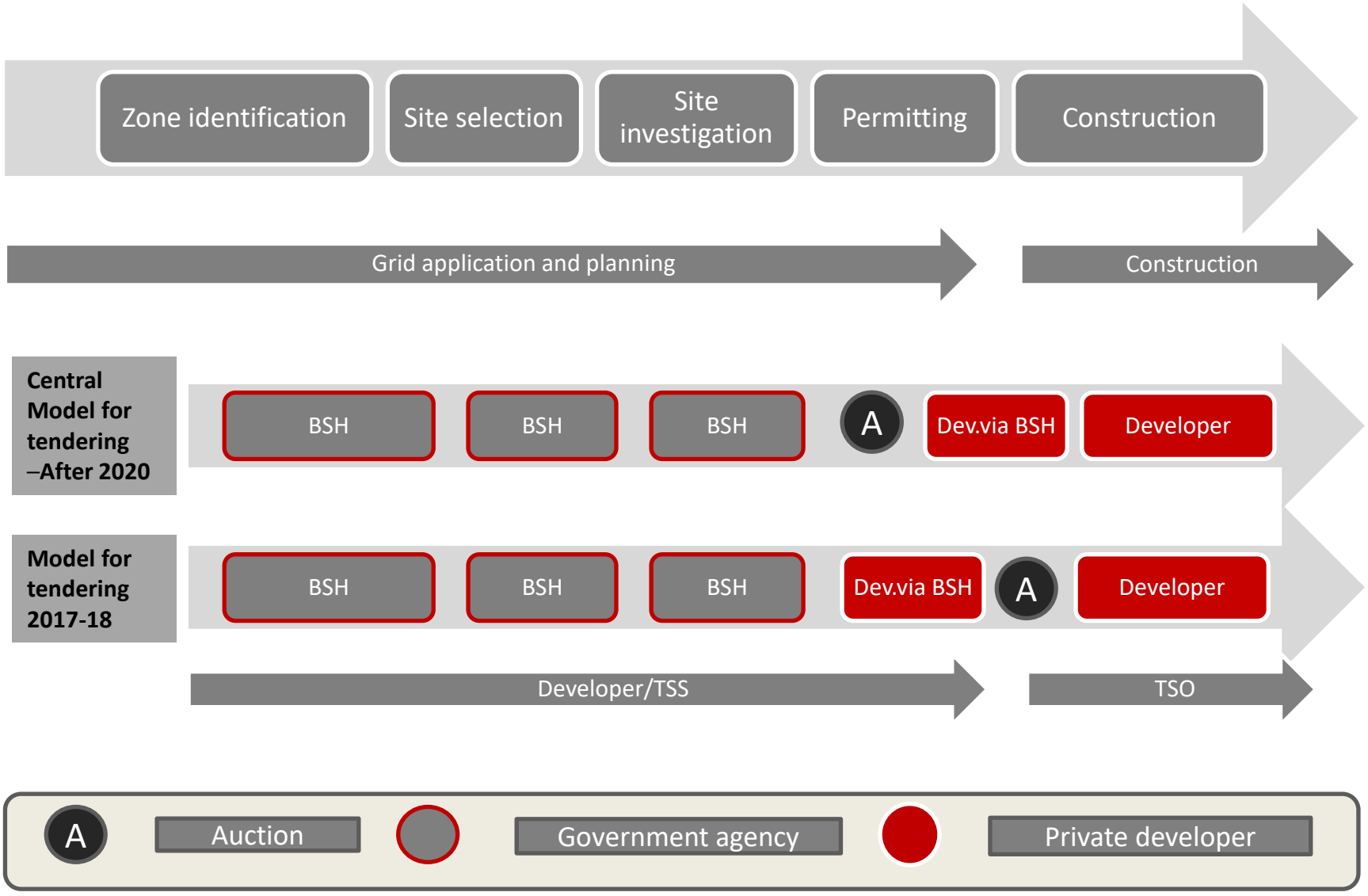
Renewable Energy Sources Act (EEG) 2017

- The EEG 2017, which marked the new stage of Energiewende, adopted the auction system for new renewable energy projects. It set the target of generating 35% of supply from RES by 2020, 40-45% by 2025 and 55-60% by 2035 and 80% by 2050. The interim targets were limited from previous levels due to slow progress in grid expansion.
- Starting from 2017, funding rates for RES are determined through competitive auction procedure in which the plant operators submit bids for funding. Each year 5% of newly installed renewable capacity will be opened up to installations from other EU member states. For instance, Germany and Denmark for the first time held cross-border auctions in Europe open to bidders with installations in either country in second half of 2016.
- The target for installed capacity for offshore wind is to reach 6.5 GW by 2020 and 15 GW by 2030. It may however be noted that the 2020 targets were surpassed in 2019 with the country achieving 7.5 GW of installed offshore wind capacity and there are plans to expand 2030 targets to 20 GW as mentioned above.

Offshore Wind Act (Wind-auf-See-Gesetz or WindSeeG) 2017

- Germany also introduced the Offshore Wind Act in 2017. Under this, a central model (where projects will be tendered only in areas with pre-examined land development plans) will be followed for projects tendered after 2020 to ensure sychronised expansion of wind energy capacity and offshore connection lines. With this, the BSH became responsible for the development and preliminary investigation of areas for construction and operation of wind energy projects.
- The central model outlines a tiered planning and tendering process. In the first step, the areas of wind energy are defined spatially and temporally in the Offshore Area Development Plan or Flächenentwicklungsplan (FEP). BSH then pre-examines the defined areas. Thereafter, the areas will be auctioned in a competitive process by the BNetzA whereby the results of the preliminary investigation will be available to the bidders. The successful bidder who is awarded the contract can build the project after going through the approval process. Such developers are entitled to the market premium and may use the connection capacity of the power line.
- BSH published the first FEP in June 2019 which provides specifications for offshore wind turbines and grid connections for commissioning year 2026 to at least 2030. Its scope relates to the German exclusive economic zone in the North and Baltic seas.
- Germany plans to hold annual offshore wind auctions of 700-900 MW (not more than 860 MW on an average) under the central model. The offshore developers will be granted a 25-year operation rights period. At the end of this period, the site may be re-auctioned or assigned for a different purpose.

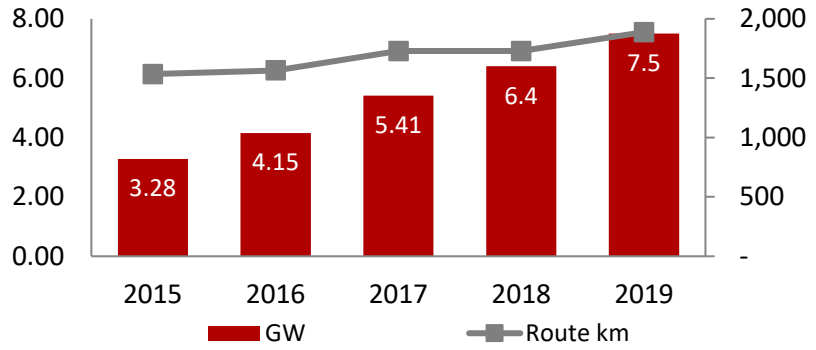
Permitting stages, responsibilities and timing of auction



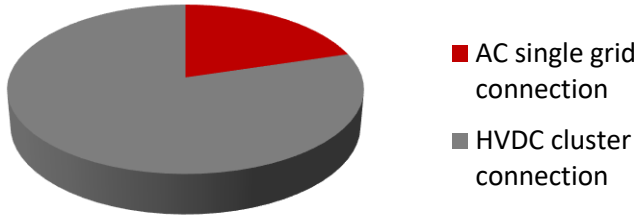
Existing offshore wind and transmission capacity

- As of 2019, about 1,469 turbines with a total capacity of 7,516 MW are connected to the grid with a transmission line length of XXXX km.
- Majority of the offshore wind transmission projects have been developed by Tennet, accounting for close to XX% of offshore wind capacity.

Offshore wind capacity and transmission network, 2015-19

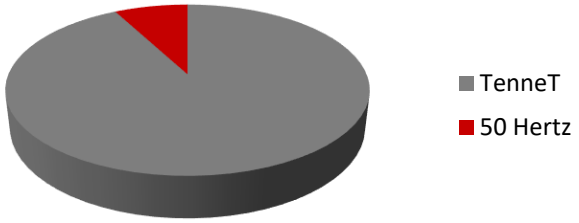


Offshore wind transmission network by connection (%)



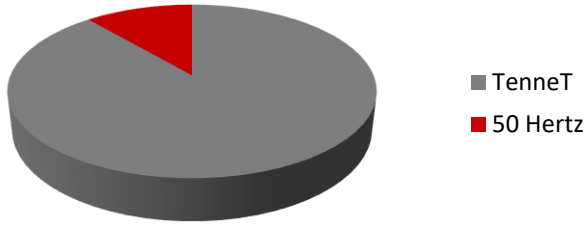
Total transmission network =XXXX km

Offshore wind capacity by TSO (%)



Total capacity =XXXX MW

Offshore wind transmission network by TSO (%)

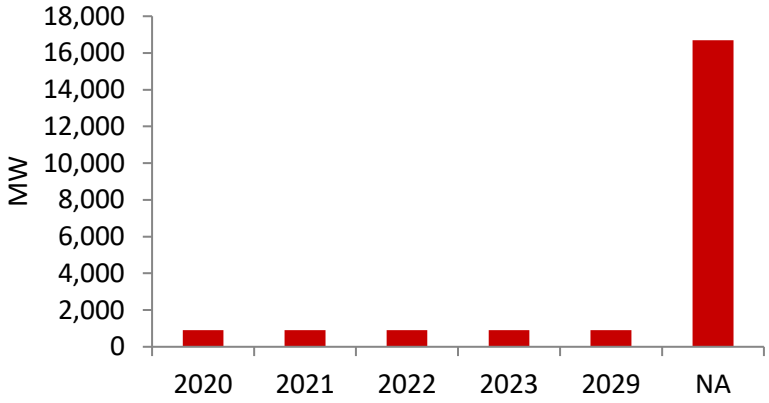


Total transmission network =XXXX km

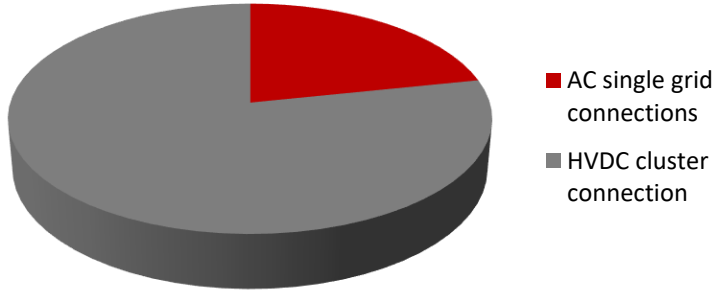
Source: Federal Ministry for Economic Affairs and Energy; Global Transmission Research

Projected offshore wind and transmission capacity

Projected offshore wind transmission capacity (MW)



Number of planned offshore transmission projects by technology/type (%)



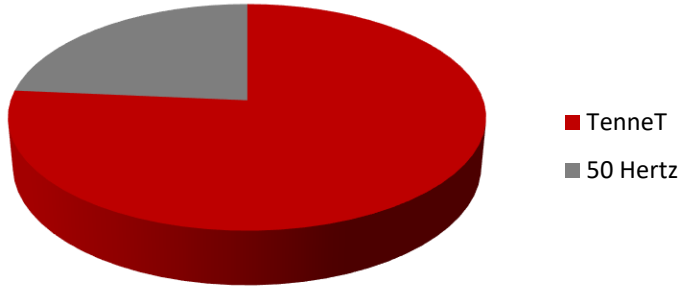
Total number of projects =XX

Growth in offshore wind transmission industry

- According to Bundesverband Windenergie e.V, an increase in the expansion target for offshore wind energy to at least 20 GW by 2030 – is expected to be implemented.
- According to Federal Ministry for Economic Affairs and Energy the country has planned to develop close to 23 projects in the coming years, with many projects in various stages of tendering.
- According to industry representatives, long-term expansion planning of the offshore wind capacity is expected to rise to over 50GW by 2050.

Source: Federal Ministry for Economic Affairs and Energy Global Transmission Research

Number of planned offshore transmission projects by TSO (%)



Total number of projects =XX

Existing offshore wind transmission projects (1/2)

Table 1: Existing offshore wind transmission projects (MW)

Project	Developer	Capacity(MW)	Length (km)	Technology	Investment (EUR billion)	Contractor
DolWin1	TenneT Holding B.V	800	165	XXX	XXX	XXX
XXX	XXX	XXX	XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX	XXX	XXX	XXX
Riffgat	TenneT Holding B.V	XXX	80	XXX	XXX	XXX
XXX	XXX	XXX	XXX	XXX	XXX	XXX
Ostwind 2	50Hertz	750	XXX	AC	XXX	XXX

Source: Global Transmission Research

Existing offshore wind transmission projects (2/2)

Table 1: Existing offshore wind transmission projects (MW)

Project	Developer	Capacity(MW)	Length (km)	Technology	Investment (EUR billion)	Contractor
BorWin1	TenneT Holding B.V	400	200	XXX	XXX	XXX
XXX	XXX	XXX	XXX	XXX	XXX	XXX
HelWin1	TenneT Holding B.V	576	130	HVDC	XXX	XXX
XXX	XXX	XXX	XXX	XXX	XXX	XXX
Ostwind 1	50Hertz	XXX	93	XXX	XXX	XXX
XXX	XXX	XXX	XXX	XXX	XXX	XXX

Source: Global Transmission Research

Upcoming offshore wind transmission projects (1/2)

Table 2: Upcoming /under construction offshore wind transmission projects

Project	Developer	Capacity (MW)	Length (km)	Technology	Investment (EUR billion)	Contractor
Cluster BorWin4–Emden-Ost Offshore Wind Farm Interconnection Project	TenneT Holding B.V	XXX	XXX	HVDC	XXX	XXX
XXX	XXX	XXX	XXX	XXX	XXX	XXX
Cluster SylWin2(NOR–5–2)–Büttel Offshore Wind Farm Interconnection Project	TenneT Holding B.V	XXX	205	XXXXX	1.40	XXXXX
XXX	XXX	XXX	XXX	XXX	XXX	XXX
Ostwind 2 - OWF Cluster 2 Baltic Sea Arkonasee (OST-2-1)	50Hertz	XXX	100	XXX	XXX	Danish cable manufacturer NKT and Dutch installation company Boskalis

Source: Global Transmission Research

Upcoming offshore wind transmission projects (2/2)

Table 2: Upcoming /under construction offshore wind transmission projects

Project	Developer	Capacity (MW)	Length (km)	Technology	Investment (EUR billion)	Contractor
XXX	XXX	XXX	XXX	XXX	XXX	XXX
Cluster DolWin5 (NOR–1–1)–Halbemond	TenneT Holding B.V	XXX	XXX	HVDC	XXX	Consortium of Aibel and Keppel FELS Limited with ABB as subcontractor
XXX	XXX	XXX	XXX	XXX	XXX	XXX
NOR–9–2–Ibbenbüren / Mettingen / Westerkappeln Transmission Line	Amprion GmbH	1,000	XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX	XXX	XXX	XXX

Source: Global Transmission Research