## Driving the energy transition with offshore wind





**TenneT and our offshore business at glance** 

**General conditions for our work** 

**Offshore grid connections – how it works** 

The power house North Sea - Our contribution to the energy transition









#### **TenneT offshore at glance (2021)**







In operation:

- Three AC grid connections with total 286 MW
- Nine DC grid connections with total 6,846 MW



# General conditions for our work

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#### **Connecting offshore wind farms** Regulatory framework conditions

#### Germany

Section 17d EnWG (German Energy Industry Act) from December 2006:

- Transmission system operators in whose control area the grid connection of offshore facilities shall take place (...), must install the lines in accordance with the respective offshore grid development plan and from beginning of 2019 in accordance to the grid development plan and the area development plan specifications."
- Legal mandate for grid development and safe operation on land and at sea.
- Since grid interconnection points are now moving further south and are therefore located in other control areas, other TSOs are now also taking on the task of building and operating grid connections.

#### **The Netherlands**

 Energy Agreement in 2013 with the first Roadmap for offshore wind 2014 - 2023: legal mandate and designation as offshore TSO in Electricity Act in 2016



### Offshore grid connections – how it works

Tennet

### Advantages of HVDC Technology

- HVDC can be used to transport large amounts of power over long distances particularly important offshore.
- Less environmental impact due to higher transmission capacity of the cables
- Stable long-distance grid operations even without reactive power compensation



#### **HVDC Connections in the North Sea – standard** Schematic illustration of a 900 MW offshore grid connection





#### **Innovative concepts for future projects** Schematic illustration of a 66 kV grid connection





BorWin gamma platform (DC)



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-V





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## Cable laying on sea and on land







ptember 2022 TenneT goes Offshore

#### **Technology challenges**

- TenneT was the first company in the world to build HVDC grid connections for offshore wind power
- Limited experience worldwide with the operation of HVDC grid connections for offshore wind farms
- Complex technology must be able to withstand the harsh conditions of the North Sea for 30 years





#### **Safety-related challenges**

Offshore working environment and harsh conditions poses numerous risks:

- All TenneT offshore staff has completed a wide range of training, including that of a special first responder
- TenneT contracted the development of safety gear, which meets the requirements to work offshore and with high voltage power
- Emergency responses take a long time because of the long distance from the coast





#### **Nature Protection**

- Much of the work offshore and in the Wadden Sea has to be done under tight time constraints because of environmental restrictions
- In the Wadden Sea, construction may only proceed outside the breeding and nesting period of domestic animals (which is from mid July)





The power house North Sea - Our contribution to the energy transition



### **The Esbjerg-Declaration** Ignition spark for offshore grids?

- With the Esbjerg Declaration, Denmark, Belgium, the Netherlands and Germany have set themselves an ambitious goal - to turn the North Sea into Europe's green power plant.
- The four states want to jointly expand 65 GW of offshore wind energy in the North Sea by 2030 and 150 GW by 2050.
- In addition, **20 GW of hydrogen** is to be jointly developed onshore and offshore by 2030.
- The declaration formulates concrete measures that the four member states intend to undertake in order to achieve their common goal, including in particular the joint development of "energy hubs" in the North Sea and the performance of the necessary analyses. The first results should ideally be presented by December 2022.
- The declaration talks about intensify research efforts, and explore new ways of building out renewable energy, including innovative partnerships with industry.

The Esbjerg Offshore Wind Declaration | WindEurope



#### **TenneT's offshore portfolio**

#### 10.8 GW in 2027 (D)



alpha ventus Riffgat Nordergründe

- 62 MW - AC - 113 MW - AC - 111 MW - AC



DolWin1 DolWin2 DolWin3 DolWin5 DolWin6 - 800 MW - DC - 916 MW - DC - 900 MW - DC - 900 MW - DC - 900 MW - DC

projects until 2031 (D): BalWin 3+4 each 2000 MW 2029 / 2029 LanWin1+2+4+5 each 2000 MW 2030 / 2030 / 2031 / 2031



SylWin1 HelWin1 HelWin2



- 864 MW - DC

- 576 MW - DC

- 690 MW - DC

 BorWin1
 - 400 MW - DC

 BorWin2
 - 800 MW - DC

 BorWin3
 - 900 MW - DC

 BorWin5
 - 900 MW - DC

 BorWin6
 - 980 MW - DC

#### 22.8 GW until 2031

#### 4.9 GW in 2026 (NL)



Borssele Alpha Borssele Beta Hollandse Kust (zuid) Alpha Hollandse Kust (zuid) Beta Hollandse Kust (noord) Hollandse Kust (west Alpha) Hollandse Kust (west Beta) - 700 MW - AC - 700 MW - AC

projects until 2031 (NL): IJmuiden Ver Alpha / Beta / Gamma each 2000 MW 2028 / 2029 / 2030 Ten noorden v.d.Waddeneilanden 700 MW (AC) 2031 Nederwiek 1+2+3 each 2000 MW 2030 / 2030 / ~ 2031

Doordewind 1+2 each 2000 MW ~ 2031 / ~ 2031 Hollandse Kust (west) Gamma 700 MW (AC) n.t.b.



Этеппет

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#### Acceleration of offshore wind energy What do we need?





#### A programmatic approach: the 2GW Program

A needed revolution for standardisation:

- TenneT combined the best experience from its Dutch and German expertise and carried out various studies together with the market.
- Through this, the 2GW Program, the new standard for offshore grid connection systems, was started and continuously developed.





### 2GW Program: 14 projects realised until 2031

Realisation of at least 14 (!) offshore grid connection systems with a transmission capacity of 2 GW in Germany and the Netherlands until 2031

- Standardisation as a basis
- Development and preparation (technology, operation, maintenance)

With the target:

- Fewer platforms & cables and therefore lower costs and less interference with nature
- Continuous development of innovative technologies





#### Framework agreements for 2GW systems



#### 23/06/22 Corporate News

Large-scale offshore tender sets TenneT on course to deliver 2030 offshore expansion targets



- > Achieving offshore targets requires new tender approach- novel framework agreement offers growth opportunities for technology companies and transmission system operators alike
- > Set goals: investment security, employment, and developing the required resources and supply chains
- > TenneT to connect 40 gigawatts of offshore expansion in the German and Dutch North Sea

In the Esbjerg Declaration in May at the North Sea Energy Summit, Germany, the Netherlands, Denmark, and Belgium agreed to jointly install at least 65 gigawatts of offshore wind energy by 2030. Transmission system operator (TSO) TenneT will account for almost two-thirds of this with 40 gigawatts - 20 gigawatts each in the German and Dutch North Seas. Achieving these offshore targets requires a new tender approach to ensure that the supply chain is able to anticipate on necessary investments.

#### Stimulate market with framework agreement

TenneT COO Tim Meyerjürgens said: "In order to meet the challenges posed by this major expansion target and achieve its goals, we are breaking new ground in cooperation with our industry partners, sending a strong signal to the market with a large-scale tender. The goal is to set out a new kind of framework agreement that allows for scaling through efficiently expanding these new offshore systems - both for technology companies and for other transmission system operators. This will stimulate the market to build up the resources and comprehensive supply chains we need in a targeted and - crucially - in faster way. In these turbulent times this provides the industry with the investment security they need."

TenneT plans to enter into a cooperation agreement with key market partners for a period of up to eight years. The agreement covers offshore platforms and onshore stations, as well as the converters for the twoway conversion between alternating and direct currents. The latter is based on the innovative 2-gigawatt high-voltage direct current technology for a forecast 15 to 20 offshore grid connection systems. Total order volume is estimated to be up to 30 billion euros.

The impetus of the large-scale tender sends a strong signal to the market. It underlines the long-term purpose of building up all the required resources such as industry sites, staff, and materials. Whereas up to now individual projects have always been tendered consecutively, the entirety of this large-scale tender will



#### Framework agreements for 2GW systems



TenneT announces large scale HVDC cable tender for offshore grid connections in the North Sea  Direct current cables for at least ten connection systems for wind energy transmission from sea to land in Germany and the Netherlands - TenneT's 2 Gigawatt program increases and bundles electricity transmission capacities and reduces environmental impact - Investment security, accelerated expansion and development of required resources and supply chains

Reading time 3 Minutes Last updated 9/20/2022

Corporate

"With our second large-scale EU tender this summer, we as a cross-border transmission system operator are once again giving the offshore market an important boost in terms of investment

socurity amployment and the plannable development of resources and supply chains" said

25 September 2022 22.09.2022 TenneT goes Offshore



### Innovative concept with hubs Confirmation in the NEP 2035 (2021) January 2022

- Onshore hub in Heide together with 50Hertz has been confirmed
- Onshore hub in area of Rastede (alternative grid connection point) with DC 34 (Amprion) and up to 3 offshore grid connections systems (TenneT) shall be planned
- Innovative: advanced concept for less space consumption and accelerated construction
- Cross-sector: by integrating different energy sectors and energy carriers
- First step towards an DC grid onshore and offshore





#### **Neccessary for our common success** Onshore grid expansion

- Around 2,000 km of new lines planned: 15 large onshore projects and hundreds of smaller projects
- Wind energy to be transported from the north of Germany to the south
- SuedLink:

with 800 km and 2 x 2 GW, the largest direct current line in Germany (in cooperation with TransnetBW)

 SuedOstLink:
 2 GW direct current line (in cooperation with 50Hertz)





TenneT is a leading European grid operator. We are committed to providing a secure and reliable supply of electricity 24 hours a day, 365 days a year, while helping to drive the energy transition in our pursuit of a brighter energy future – more sustainable, reliable and affordable than ever before. In our role as the first cross-border Transmission System Operator (TSO) we design, build, maintain and operate 24,500 kilometres of high-voltage electricity grid in the Netherlands and large parts of Germany, and facilitate the European energy market through our 16 interconnectors to neighbouring countries. We are one of the largest investors in national and international onshore and offshore electricity grids, with a turnover of EUR 6.4 billion and a total asset value of EUR 32 billion. Every day our 6,600 employees take ownership, show courage and make and maintain connections to ensure that the supply and demand of electricity is balanced for over 42 million people.

Lighting the way ahead together



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