More renewables faster

The wind power booster concept

A climate-neutral Germany by 2045 - to achieve this goal, the expansion of renewable energy must proceed even faster and more comprehensively than up to now. Offshore wind energy will play a decisive role in this. In particular, the wind power potential in the North Sea must be rapidly exploited, also with a view to national and international grid connections. For this to succeed, there needs to be a long-term and step wise meshing of direct current grids offshore and onshore. This meshed grid connections increase security of supply, make load flows more flexible, lower redispatch and investment costs, create international trading capacities, and reduce space demand at sea and onshore

A meshed grid at sea and on land

TenneT proposes to speed up three offshore grid connection systems with a combined capacity of 6 GW by three years, to implement them already by 2032, and to interconnect them for the first time at sea - in the LanWin hub - and onshore with additional DC connections. The modular expansion of the LanWin Hub will also allow additional offshore systems to be integrated more quickly in the period 2032 to 2035. Grids at sea must be planned and built in coordination with grids on land. Only through an integrated approach the large amounts of wind energy can be transported to the areas where they are ultimately needed: Thus, the concept envisions strong grid interconnection points onshore in Schleswig-Holstein and Lower Saxony - in Heide, the Bremen area, and northern Lower Saxony - to supply industry and planned electrolysis capacities there.

Planning the grid of the future today

To ensure that the transmission grid can meet the challenges of the coming years, planning must be done today with an eye to the future - this is the only way to give private consumers and industry the planning security they need to invest. The swift implementation of so-called "no-regret measures" thus serves to accelerate the energy transition overall.

These "no-regret measures" could be, for example, grid interconnection points that can already be planned today as hub or multi-terminal locations, or the onshore direct current connections to be connected, which could already be planned with metallic return conductors. For timely implementation of the wind power booster concept by 2032, confirmation of the accelerated sequence of the aforementioned grid interconnection points in the current Grid Development Plan/Netzentwicklungsplan NEP 2035 (2021) by the Federal Network Agency is required.

Advantages at a glance

- Acceleration of the energy transition through faster integration of more offshore wind
- Concrete potential for the expansion of international interconnections
- Sector coupling: Integrated planning right from the start
- Lower investment costs through modular design of DC hubs and multi-terminal systems
- Planning certainty and cost-efficient decarbonization for industry
- Potentially fewer grid connections in the long term through meshed grids
- Reduced land demand, less environmental impact
- Acceleration of market introduction of DC circuit breakers (525 kV)
- Increased security of supply

Conclusion

A meshed direct current grid (HVDC overlay grid) on land and at sea ensures security of supply and reduces the economic costs of integrating renewable energies to implement climate targets. Therefore, all new and future DC links that have not yet gone through the federal sectoral planning process should be planned and implemented in a modular expandable manner ("multi-terminal readiness") in the interests of future viability, so that intermeshing with later projects becomes possible. In the case of onshore DC lines, more space should be reserved for future transmission needs so that modular expansion at sensible locations is not restricted.

The concept in detail

Accelerated expansion of offshore wind energy

Areas N-11 to N-13, as defined in the regional plan for offshore wind energy, have an offshore potential of about 10 GW, which current plans call for development after 2030. The connection to the onshore transmission grid has so far been planned using point-to-point systems with a transmission capacity of 2 GW each. As a forward-looking alternative grid connection, TenneT proposes the realization of the Hub & Spokes concept in the form of a "LanWin Hub" for the efficient integration of 6 GW of offshore wind energy by 2032. The LanWin Hub will enable a three-year acceleration in achieving the ambitious offshore wind expansion path mapped in Scenario C 2035 of the NEP 2035 (2021).

Intelligent interconnection

Grid interconnection points - sector coupling projects - load centers

In order to integrate offshore generated electricity into the onshore grid in an economically beneficial and forward-looking manner, three suitable onshore grid interconnection points are required for the LanWin Hub to ensure that the offshore electricity can be consumed on site at the time of completion of the wind farms or transported to the consumption centers.

The LanWin Hub envisions accelerated grid connection to the following grid connection points:

- Heide/West already in 2030 (instead of 2032 according to 2nd draft of NEP 2035 (2021).

- Northern Bremen region in 2031 (as an exchange of a grid connection from zone 4 according to 2nd draft of NEP2035 (2021))

- Wilhelmshaven 2 in 2032

The first grid connection point Heide/West in Schleswig-Holstein is already optimally integrated into the existing transmission grid through the second section of TenneT's "Westküstenleitung" grid expansion project, which already went into operation in 2019. By 2030, Corridor B (DC25) is to be realized in Heide/West, which can partially bring offshore wind energy to the industry in North Rhine-Westphalia. Furthermore, for further integration of wind energy from Schleswig-Holstein, the two projects DC31 (Heide/West - Klein Rogahn) and P227 Lübeck/West - Krümmel must be confirmed as urgent and implemented as a priority. In addition, a 700 MW electrolysis plant is to be installed in Heide from 2025. Corresponding plans are based on the "Westküste 100" project, one of 20 laboratories of the German government's energy transition, in which the Heide refinery and the

offshore wind farm developer Ørsted Deutschland are involved, among others. In perspective, according to the state of Schleswig-Holstein, up to 2 GW of electrolysis capacity is planned in the Heide and Brunsbüttel region. Thus, the early connection of offshore wind power at the Heide site makes a direct contribution on the way to systematic sector coupling and strengthens the Schleswig-Holstein industry.

As a further grid interconnection point from 2031, a connection of offshore wind power in the region north of the metropolis of Bremen is an obvious choice. The load in this region will more than double by up to 1 GW in the coming years. The main reason is the decarbonization of the existing industry there, especially steel production. For this, the allocation of offshore systems in the grid development plan would have to be adjusted.

As a third grid connection point, a connection in the northern part of Lower Saxony is a possibility from 2032. A possible grid connection point is the planned Wilhelmshaven 2 substation, where a system-serving and direct integration of hydrogen production from offshore wind power is being pursued as part of a strategic partnership between Uniper, Ørsted and TenneT to decarbonize the industrial sector.

Alternatively, the Rastede search area would also be suitable: Connection to the onshore AC transmission grid is ensured via the Conneforde - Rastede - Elsfleth/West - Samtgemeinde Sottrum grid expansion project to be completed by 2030 / 2031 (BBPlG No. 56). At a later point in time, the offshore wind power landing in the Rastede region can be transported via a DC hub in the future DC corridor (DC34) in the direction of the load centers in the Rhine-Main area.

Future readiness through step-by-step connection of the LanWin hub

The configuration of the LanWin Hub will consist of three modules, each with 2 GW of installed offshore capacity. These modules will be interconnected according to the "hub-and-spoke" principle. This means that a direct connection (2 GW, 525 kV) will be routed from each hub module to suitable grid interconnection points onshore. In addition, each module is designed to provide connections to other platforms, hubs or onshore grid interconnection points. By interconnecting the onshore and offshore DC systems, a higher level of redundancy can be ensured, increasing security of supply for customers while reducing the costs that would be incurred if one system were to fail.

The modules are planned with DC circuit breakers to enable modular expansion to the DC grid in the future. This allows a linkage to be increased beyond 4 GW, unlike today's projects. By using DC circuit breakers, the multi-terminal system can also be divided into several protection zones, analogous to today's n-1 three-phase grid, in order to selectively separate the faulted part of the DC system from the overall system when faults occur. This increases the availability of the DC links and enhances the security of supply for residential consumers and industry.

European offshore interconnection in the North Sea

The modular design of the LanWin hub is a first step towards European offshore networking in the North Sea. A first opportunity for European networking is offered by the Danish "Energy Island" in the North Sea. The commissioning of the first 3-GW stage of "Energy Island" in Denmark is currently planned for 2032 - and thus synchronized with the envisaged full commissioning of the LanWin hub in 2032. In perspective, Dutch offshore wind projects are also to be connected to the LanWin hub. In perspective, the LanWin Hub opens up a cost-efficient possibility to integrate future offshore wind farms and hydropower plants in Norway or the UK into the German energy mix via hydrid interconnectors.

In line with the area and network development plan

The offshore areas N-11 to N-13 earmarked for the LanWin Hub are part of the specifications of the upcoming update of the German “Flächenenentwicklungsplan” (FEP). An implementation of the LanWin Hub would therefore not contradict the current determinations of the FEP2020 and would only have to be considered and confirmed as an alternative connection concept in the upcoming update of the FEP.

Furthermore, a sensitivity of scenario C 2035 considering a "North Sea Wind Power Hub (NSWPH)" with a connected capacity from offshore wind of 3x 2 GW (plus 6 GW offshore wind from neighboring countries) has already been investigated in the NEP 2035 (2021). The grid interconnection point Heide/West was already proposed by the transmission system operators in the 2nd draft of NEP2035 (2021) for the connection of offshore wind energy. The grid interconnection point in the Bremen area is made possible by the project route letter of measure P119 adjusted on the part of TenneT during the consultation on NEP2035 (2021). The offshore grid connection system NOR-9-2 (BalWin3) will be connected by TenneT to the grid connection point Wilhelmshaven 2 by 2030 and a direct coupling with the B corridor to build a multi-terminal system is proposed by TenneT. The alternative grid interconnection point search area Rastede is also already part of NEP2035 (2021). Thus, for the timely implementation of a LanWin hub by 2032, only a confirmation of the accelerated sequence of the above grid interconnection points in the current NEP 2035 (2021) and the associated onshore projects (DC31 and DC34) by the Federal Network Agency is required.