



Technology Brief

Addition of Transmission of Electricity in the Technology Catalogue

The chapter on the transport of electricity has undergone a comprehensive overhaul. Before it consisted of a chapter on, and data sheets for, distribution of electricity regionally and locally, with only few perspectives regarding transmission of electricity nationally and internationally. The updated chapter now provides an integrated perspective on both transmission and distribution technologies, with added data sheets regarding transmission of electricity. However, it is important to note that the existing data sheets on electricity distribution remain unchanged.

The main reasoning for this update was the lack of techno-economic data and descriptions of technical necessary components for the transmission of electricity. However, the update was further motivated by several factors:

1. *Rising prices:* A number of global events and political plans for electricity demand and supply has driven unprecedented cost increases for electricity transport components.
2. *Shifts in infrastructure best practices:* Innovations and new approaches in offshore infrastructure design necessitate updated and added descriptions of components.
3. *Simultaneous update of offshore wind:* As offshore wind farms move further from the coast; a larger share of the total cost stems from the transmission to coast. The technology catalogue chapter on offshore wind was updated due to cost increases and technical development, which means it was an appropriate time to add and update our chapter on electricity transport.

It is important to note the battery limits of the data sheets and the associated techno-economic data. The costs shown in the data sheets generally do not include project development or permitting, which can vary by location. Please refer to the footnotes and chapter descriptions for further details.

What's New

The following updates can, among others, be found in the chapter and data sheets.

- Updated figures and text for improved clarity.
- Expanded coverage of HVDC (High-Voltage Direct Current) and HVAC (High-Voltage Alternating Current) systems and their technical components.
- Descriptions of multiterminal configurations for advanced systems.
- Datasheets for DC substations include HVDC converters and therefore the data has been consolidated under "DC substations".

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Key drivers for the recent price surge:

A variety of global developments have significantly raised the costs associated with electricity transport systems which means data sheets for the future cost development are highly uncertain:

- *Pandemic and Post-Pandemic surge:* During and following the COVID-19 pandemic, demand for transmission assets created a mismatch between supply and demand, straining supply chains that remain challenged.
- *Energy transition pressure:* The shift from fossil-fueled energy systems to green energy systems has accelerated the need for investment in transmission networks, further increasing demand.
- *Rising raw material costs:* Global inflation and supply constraints have sharply raised the prices of key materials used in transmission assets.
- *Geopolitical instability:* The war in Ukraine disrupted supply chains. This had widespread macroeconomic effects, exacerbating price pressures.

Perspectives for Denmark

Denmark has set several targets and goals for renewable energy generation, including plans for offshore wind in the North Sea and the quadrupling of land-based renewable electricity generation. Denmark also anticipates increased renewable energy consumption, mainly due to the electrification of sectors like heating, transport and industry. Both generation and consumption affect plans for transmission and distribution grid reinforcements and expansions.

Updated Chapter on Offshore Wind

Together with this addition of electricity transmission in the Technology Catalogue, the offshore wind chapter was updated (January 2025). Previously, grid connection costs were estimated inherently in the chapter within the Technology Catalogue for Generation of Electricity and District Heating, but the chapter has now been updated to directly correlate with the section on electricity transmission.

In the earlier version of the Technology Catalogue for Generation of Electricity and District Heating (updated March 2022), the projected cost of grid connections (including substations and export cables) was set at **0.24/0.26 M€/MW** (2025/2050) for an AC-connected wind farm, with a distance to shore of 27 km in 2025 and rising to 50 km in 2050.

In the most recent update, the projected grid connection costs for an offshore AC-connected wind farm (including substations and export cables) have increased to **0.84/0.70 M€/MW** (2025/2050), both with a distance to shore of 60 km.

This surge in cost for grid infrastructure significantly impacts the total cost of offshore wind farms. It is important to note that these projections rely on the continuation of the current situation of elevated demand without further disruptions or discontinuities.