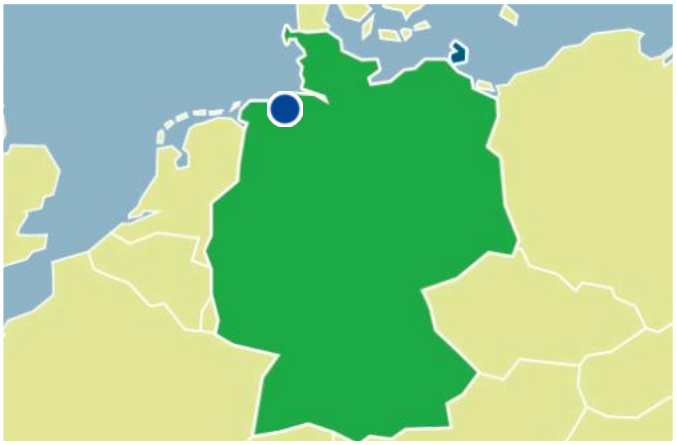
GE
Grid Solutions

DolWin3

HVDC Voltage Source Converters for Efficient Connection of Renewable Energy

GE's HVDC VSC Solution connects 900 MW of offshore windpower to the German high voltage grid

Imagination at work



83 km Undersea HVDC Line to the Coast

The German "Energiewende"

The German energy transition, Energiewende, is an extensive programme with roots back to the 1970s to increase renewable energy production and commercialisation. The initiative is supported by the Renewable Energy Act (EEG), with a particular focus on offshore wind farms. The ambition is to generate 80% of energy consumption from renewable sources by 2050.

Customer Challenge

Wind farms in the German North Sea are constructed far from the shore. The ideal solution for efficiently transporting energy over these long distances is to use High Voltage Direct Current (HVDC).

With the development of more compact HVDC Voltage Source Converter (VSC) solutions, there is greater potential to connect the large number of offshore wind farms planned over the next decade.

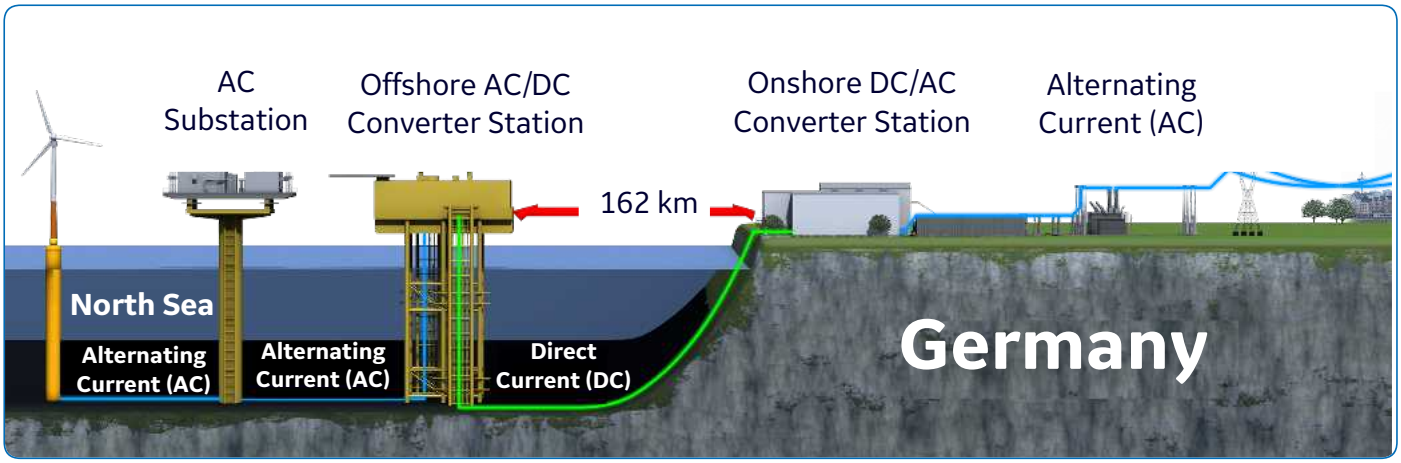
TenneT Offshore GmbH is responsible for extending the grid to the German North Sea and in February 2013, awarded GE the DolWin3 HVDC connection, marking the next step in Germany's energy turnaround.

Project Overview

Country:	Germany
Project:	DolWin3 (part of the DolWin Cluster in the German North Sea)
Customer:	TenneT
Scope:	Turnkey delivery of a complete offshore-to-onshore HVDC interconnection including offshore platform Dolwin Gamma and 380 kVAC onshore substation (HVDC controls and valves, transformers, GIS and AIS switchgear, etc.) and ±320 kVDC XLPE sea and land cables
Rating:	±320 kVDC, 900 MW
Commercial Operation:	Expected 2019

HVDC Key Benefits

- Efficient grid connection of renewable wind power
- Compact substation footprint both on- and offshore
- Cutting-edge technology



Dolwin 3 project overview

The Solution

As the main contractor for TenneT, GE delivered the engineering, supply and construction of both the onshore and off-shore converter stations as well as the connecting cable system.

The DolWin3 project uses HVDC Voltage Source Converters (VSC). This solution can deliver up to 900 MW of wind-produced electricity at +/-320 kV, and has already transmitted over 800 MW subject to windpark availability. The electricity is delivered through an 83 km sea cable to the coast, plus 79 km of underground cable to the converter station in Dorpen/West in Lower Saxony.

Together with the offshore platform manufacturer, Nordic Yards, GE has erected a turnkey converter platform in the DolWin cluster, which will convert the Alternating Current (AC) produced by the wind turbines into Direct Current (DC).

This energy is then transmitted as DC through more than 160 km of submarine and onshore cable to a second converter station on the mainland, where it is converted back into AC and fed into the onshore grid. GE collaborated with cable supplier Prysmian Powerlink to deliver the HVDC cables, connecting both stations.

GE has also been awarded a five-year service contract covering the complete offshore converter platform, as well as the onshore converter system. This includes inspection, preventive and corrective maintenance, refurbishment and repair, spare parts management and a technology support line.

The central yellow structure is the DolWin3 Converter Platform

Offshore Transmission: How does it work?

Once the generated wind electricity has been transported via submarine cables to the AC substation (where voltage is combined and transformed), the power is directed to the offshore converter platform. Both substations (one belonging to the offshore wind farm and the other to the offshore converter platform) are built on separate platforms and installed in the sea.

At the AC/DC converter, the electicity is converted from AC to DC by a large series of valves.

HVDC VSC technology is relatively new but offers some advantages over traditional HVDC schemes; it is more compact, does not require converter transformers and does not need a large AC switchyard to accommodate harmonic filters as the converter inherently produces a waveform with little harmonic content.

After being converted to DC, the electricity is transported via submarine cable to the coast and then connects to land cables where it is fed into an onshore DC/AC converter station. At this point the energy is converted back into AC and is fed into the German power grid.

Dolwin Project

DolWin3 is the eighth grid connection project to be implemented by TenneT using direct current technology, accumulating to approximately 6.8 GW of offshore wind energy being delivered to the grid. The DolWin3 project will be the third grid connection in the DolWin wind farm cluster in the southwestern region of the North Sea and will supply enough power for a city of over one million people.

"One of the main challenges for the future of energy grids is to transport electricity from offshore wind turbines to the onshore grid with minimal losses. With DolWin3, we strengthen our position as a key partner in the German energy transition."

Alf Henryk Wulf, CEO of GE Germany

AC/DC Offshore Converter Station

Valve Hall on the Offshore Station

GIS Installed on the AC Substation

Control Room on the Offshore Station

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