Limited offshore HVDC experience inspires new guidelines

09/23/2014
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A joint industry group has developed a recommended practice (RP) for qualification of new HVDC systems and components used to connect offshore wind farms that would prove the technologies are suitable for their intended use.

The group anticipates an industry preference for HVDC over AC technology for long-distance underwater power transmission as offshore wind farms are sited more remotely in the future. The RP was designed to address the fact that operational experience with offshore HVDC technologies is limited and few standards and guidelines are available for the market.

Norway-based DNV GL developed the methodology together with the Swedish Transmission Research Institute (STRI) and ten other organizations. The RP was based on DNV GL’s methodology for technology qualification used for managing risk in the oil and gas industry.

Partners in the project included ABB (NYSE:ABB), Alstom Grid, DONG Energy, Elia, Europacable, Scottish Power, Statkraft, Statnett, Statoil, Svenska Kraftnät/Vattenfall.

The RP outlines six steps for the technology qualification process along with two case examples, including:

- A hypothetical point-to-point HVDC link with one offshore converter station, connecting an offshore wind farm to the AC onshore grid, and
- A hypothetical multi-terminal HVDC system connecting two offshore wind farms and one offshore oil and gas platform to the AC onshore grid.

Project group participant ABB has made voltage-source converter and extruded cable technologies, together comprising the HVDC Light system, available commercially since its installation for a wind farm on the Swedish island of Gotland in 1999.

Ten years later, ABB installed the HVDC technology for an offshore wind farm for the first time at BorWin1. The 400 MW project has about 80 miles of cable installed in the North Sea and another 47 miles underground to interconnect with the grid in northern Germany.

“HVDC was used at BorWin1 because there is a practical limitation on how far you can transport electricity in the cable using regular power frequency,” Roger Rosenqvist, ABB vice president of business development, power systems division for North America, told TransmissionHub on Sept. 23. “As Germany developed their wind farms farther and farther away from the shore, HVDC was really the only practical technical solution to bring that power on shore and connect it to the existing power grid in Germany.”

Since that time, construction has begun on several other wind farms in the North Sea, and ABB has installed its HVDC Light system on the DolWin1 and DolWin2 wind farms to connect to the German power grid.
The 800 MW DolWin1 project is in the commissioning phase now, and the 900 MW DolWin2 project should be completed next year, according to Rosenqvist.

Advancements in HVDC technology will match the stepped growth in project capacity size that the wind power industry is experiencing, explained Rosenqvist, adding that ABB announced on Aug. 21 the commercial availability of HVDC Light cables that more than double the capacity rating in a single circuit to about 2,600 MW from 1,000 MW.

The ability to connect higher capacity projects farther from land using HVDC technology could help advance U.S. offshore wind farm proposals that seek to avoid viewshed concerns while also keeping project costs down.

“When you are close to shore it is generally more economical to connect with an AC cable because you don’t need to build an offshore converter station on the offshore platform,” said Rosenqvist. “Once you get beyond a certain length, however, it is just not technically feasible to do it with an AC connection.”

The Cape Wind offshore project, for example, is sited close enough to land that it could connect to the onshore grid via AC cable, but the project has been notoriously delayed by stakeholder concerns about wind turbine visibility.

Additional improvements to the HDVC converter components also will focus on minimizing the footprint of converter systems on the offshore platforms, according to Rosenqvist.

“Even though the capacity rating of the facility goes up, the footprint of the facility is not increasing proportionally,” said Rosenqvist. “These compact systems become more economical because the cost of building a platform is directly related to the footprint requirement.”

Rosenqvist does not see offshore wind farm capacity growth slowing down any time soon, and his vision for HVDC is unlimited.

“Perhaps, we are going to see higher and higher capacity circuits being built,” he said. “We could build a power hub in the ocean to collect all the power from offshore projects and transmit it via a DC system onshore. It becomes like an interstate or super-highway for the power to get onshore.”