Development and Commissioning of the First VSC-HVDC Demonstration Project in China

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CEPRI OF SGCC

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China’s first VSC-HVDC Transmission for wind farm integration

CEPRI (subsidiary of SGCC) delivered the complete transmission system, including design, manufacturing, testing and commissioning.

Effectively improve the wind farm’s low voltage ride through capability.
<table>
<thead>
<tr>
<th><strong>Project Description</strong></th>
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<tr>
<th><strong>Operation time</strong></th>
<th>2011.7</th>
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<tbody>
<tr>
<td><strong>Rated Capacity</strong></td>
<td>18MW/20MVA</td>
</tr>
<tr>
<td><strong>Rated AC Voltage</strong></td>
<td>35kV</td>
</tr>
<tr>
<td><strong>Rated DC Voltage</strong></td>
<td>±30kV, 6X50 Submodules</td>
</tr>
<tr>
<td><strong>DC Cable</strong></td>
<td>8.4km XLPE</td>
</tr>
<tr>
<td><strong>Converter</strong></td>
<td>Modular Multilevel Converter</td>
</tr>
</tbody>
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![Diagram of wind farm and power system](image_url)
Modular Multilevel Converter Valve

- Based on modular and standard design
- Parameters: 1800V, 1200A (Peak value)

- Full shielding system with strong anti-interference
- Easy for maintenance
- Full digital drive and protection
Valve Base Controller (Flexcon System)

- The central control unit of Modular Multilevel Converter Valve.

- Higher processing performance of capacitor voltage balance control and current balance control.
- Execution period of microsecond, less than 100μs.
- Overall redundancy of the system and reliable self-test technology.
Control and protection system

- Hierarchical design to achieve the highest reliability.
- Independent control and protection equipment, all devices duplicated.
Dynamic simulation test

- Equivalent simulation of Modular Multilevel Converter.
- Effective means for verification of PCP and VBC (Flexcon System).
- Modular design and flexible for expansion.
Type tests

Type test circuit for submodules

Type test for VSC valves
Commissioning and test on site

Active Power 18MW
Reactive Power 3MVar

- Voltage of AC side
- Voltage of Valve side
- Current of Upper Valve
- Current of Upper Valve DC line Voltage

The commission test showing good performance of the project.
Transient fault test configuration

Fault point was two kilometers from Shurou converter station
Transient fault test results

- Successfully passed the three phase short circuit test, two phase short circuit test and single phase grounding test.
- The rise of fault current was restrained rapidly, and the VSC-HVDC system resumed normal operation quickly after clearance of the fault.

**Test results of the three phase ground fault**

- Increasing of fault current is inhibited by the rapid control
- Low voltage caused by fault
- Restored after disappearance of fault

Shurou Station  Nanhui Station

Three phase voltage Three phase current
Enhance reliability and power quality of Dalian power grid, protecting the city electricity security.

- DC capacity 500MW/ ±300kV
- AC Terminal Voltage 220kV
- Transmission distance: 43km

±300kV Valve hall design

layout of ±300kV Converter station
Project Planning in Zhoushan, China

- Improve the capability of wind power integration and the power supply reliability for the islands of Zhoushan network.
- Effectively enhance the electricity quality of the island.

<table>
<thead>
<tr>
<th>Station</th>
<th>Send/Receive Terminal</th>
<th>Rated Active Power/MW</th>
<th>AC Terminal Voltage/kV</th>
<th>DC Terminal Voltage/kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daishan Island</td>
<td>Send Terminal</td>
<td>70</td>
<td>110</td>
<td>±120</td>
</tr>
<tr>
<td>Qushan Island</td>
<td>Send Terminal</td>
<td>70</td>
<td>110</td>
<td>±120</td>
</tr>
<tr>
<td>Sijiao Island</td>
<td>Receive Terminal</td>
<td>140</td>
<td>110</td>
<td>±120</td>
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Thanks for your attention

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