ABB Advanced Power Electronics

STATCOM for Wind Farm to meet Grid Code requirements

Substation with STATCOM in container

PCS 6000 STATCOM: +/- 12.5 MVAr unit
Introduction and Main Technical Features

The continuous increase of installed wind power seen during recent years has forced the transmission system operators (TSO) to tighten their grid connection rules – also known as grid codes – in order to limit the effects of wind power parks on network quality and stability. These new rules demand that power plants of any kind support the electricity network throughout their operation. Key issues are steady state and dynamic reactive power capability, continuously acting voltage control and fault ride through behavior. Some commonly used turbine designs have limitations in terms of achieving grid code compliance in several countries. For wind parks built with such turbines, additional equipment like a STATCOM is needed.

Problem description

Wind farm owners in many countries must now be “grid compliant” before being permitted to connect to the grid. The exact requirements differ from country to country and require that many wind farms install additional equipment, since their turbines are not grid code compliant.

Solution

ABB’s STATCOM technology adds the missing functionality to wind parks in order to become grid code compliant. The fast dynamic voltage control and the behavior during balanced or unbalanced grid faults (fault ride through) allow meeting the stringent grid code requirements. Based on the medium-voltage converter platform widely used for industrial applications, ABB has successfully supplied STATCOMs to the wind power industry in order to integrate wind parks into grids with demanding connection requirements.

Key functionalities

- Continuous and dynamic voltage control
- Reactive power over voltage range
- Dynamic performance
- Step response <<1s
- “Ride through support” for grid failures
- Robust MV IGCT design

Customer Benefits

- Grid code compliance
- Very fast industrial control system AC800 PEC
- Reactive current at reduced voltage (no Q−U² characteristics as Capacitors)
- High reliability and low losses due to MV IGCT
- Low operation costs (no mechanical breakers)
- No switched passive elements (no oscillations)

Reliability runs in the family

The MV STATCOM design is part of ABB’s family of PCS 6000 products which are used for a wide range of applications. It uses the same power technology as the ACS 6000 range of MV Drives. The standardization of these power electronic modules delivers substantial advantages in terms of cost and quality. With many PCS 6000 sold worldwide this converter has a proven track record and high reliability.

MV converter

ACS and PCS 6000 converter units are based on three-level IGCT phase modules. The IGCT (Integrated Gate Commutated Thyristor) is the state-of-the-art semiconductor element for this power range. The converter units are connected by a medium voltage DC link (intermediate circuit). The converter modules are water cooled with a virtually maintenance free closed loop water system equipped with redundant circulating pumps.

Case study

ABB delivered and commissioned a +/-12.5 MVAr PCS 6000 STATCOM for a Wind Farm in Ireland to meet the grid code requirements. The STATCOM was placed inside a weatherproof container, allowing a fast and cost efficient installation. The wind farm now meets the grid code requirements.

Case study project data

<table>
<thead>
<tr>
<th>Plant:</th>
<th>Wind Farm, Ireland</th>
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<tbody>
<tr>
<td>Application:</td>
<td>STATCOM</td>
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<tr>
<td>Type:</td>
<td>PCS 6000 STATCOM single</td>
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<tr>
<td>Installation:</td>
<td>Outdoor</td>
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<tr>
<td>Nominal output power:</td>
<td>+/- 12.5 MVAr</td>
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<tr>
<td>Nominal frequency:</td>
<td>50 Hz</td>
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<td>Nominal voltage:</td>
<td>21 kV</td>
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