# **ABB Advanced Power Electronics**

# **STATCOM** for Wind Farm to meet Grid Code requirements



Substation with STATCOMs inside

# 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

As described above, the growing amount of installed wind power led to a change of the grid code requirements. In order to meet these requirements, an add-on equipment like the STATCOM is required.



Wind farm + STATCOM = Grid code compliant

Figure 1: Principle overview

## STATCOM

The STATCOM (STATic COMpensator) technology adds the missing functionality to wind parks in order to become grid code compliant. The STATCOM as a pure static device with no switched passive elements provides outstanding performance for both steady state and dynamic operation. Especially, the fast dynamic voltage control and the behavior during balanced as well as 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.

Features

- 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
- Small footprint
- No switched passive components
  → no steps = no oscillating problems
  → no mechanical switching = low maintenance



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### 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

Two PCS 6000 STATCOMs were delivered to a Wind Farm in Scotland to meet the grid code requirements.



Figure 2: Project overview

The setup with two 33kV strings required two separate STATCOM units in order to operate the wind farm partially. The compact MV STATCOMs were placed inside the substation building allowing a cost efficient installation in a well protected environment.

# Case study project data

Plant: Wind Farm, Scot	land 🚽
Application: STATC	COM 🚆
Type: PCS 6000 STATCOM single ind	door 🛛
Installation: Inc	door 🗄
Nominal output power: 2x 12.5 M	IVAr 🖁
Nominal frequency: 50	)Hz 🖁
Nominal voltage: 33	3 kV 🗑