

Power quality solutions

Application leaflet ABB's innovative power electronics solutions for the wind industry



Wind energy production is rapidly gaining in popularity nowadays with thousands of turbines in operation around the world. These include not only large scale wind farms, but also small projects. The global increase of installed wind power has forced the transmission system operators to tighten their grid connection rules – also known as grid codes – in order to maintain network quality and stability. As a consequence, some commonly used turbine designs have difficulties in achieving grid code compliance in several parts of the world. To address the global challenge for improved grid quality, ABB offers supplementary compensation equipment, such as STATCOM and ESS.

Background

According to GWEC, Global Wind Energy Council, over the past ten years, global wind power capacity has continued

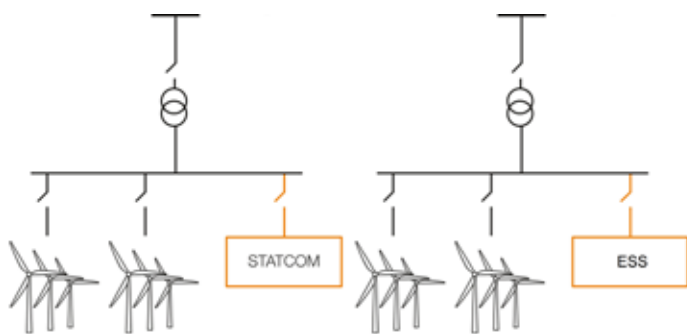
to grow at an average rate of over 30%. This phenomenal increase of installed wind power has led to a change of the grid code requirements. These new rules demand that power plants of any kind support the electricity network throughout their operation. In addition, as a significant number of wind farm projects is set up at sparsely inhabited, remote locations, where the electricity grid is relatively weak, the need for an add-on equipment, such as ABB's STATCOM, becomes all the more fundamental. Furthermore, due to linear and gust changes of wind speed, grid power quality is dramatically affected. Thanks to the new energy storage devices, it is possible to store energy from the electricity grid and return it when required; however, such equipment is heavily reliant on a converter to interface with the grid. ABB's ESS (Energy Storage System) is specifically designed to allow a range of energy storage devices to be coupled to the grid, offering advanced features and configuration options.

Solution required

One of the solutions offered by ABB is STATCOM (STATIC COMPensator), a unique line-up of state-of-the-art technology, which adds the missing functionality to wind parks, thus ensuring grid code compliance. As a pure static device with no switched passive elements, the system provides outstanding performance for both steady state and dynamic operation. Especially, the fast dynamic voltage control and the behaviour during balanced as well as unbalanced grid faults (fault ride through) allow meeting the stringent grid code requirements. ABB's STATCOM portfolio comprises PCS100 (Power Converter System), which is suited for low-power (<10MVA) applications, as well as PCS 6000, designed for medium-power (<30MVA) operations. ABB has successfully supplied both STATCOM solutions to the wind power industry in order to integrate wind parks into grids with demanding connection rules.

As a full scope supplier, ABB also offers PCS100 Energy Storage System (ESS), which is a converter platform that enables energy storage devices, such as batteries, flywheel systems and new generation super capacitors to be connected to the grid, thereby strengthening and enhancing the performance, quality and reliability of the system. PCS100 ESS looks to the power system like a traditional synchronous machine. This is achieved through fast acting Digital Signal Processors (DPS's) incorporated into the product design, which allow both real and reactive power to be controlled at near instantaneous speeds. In case the grid supply is lost, ESS can detect this, disconnect itself from the grid and shut down.

The Energy Storage's ability to store energy is highly scalable. At present, rated power and capacity are typically in the 20MW range for tens of minutes, but the technology permits up to 50 MW for periods of 60 minutes and more.



Principle overview

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www.abb.com/powerelectronics (grid interconnection)

ABB's technology

ABB's Power Converter Systems provide a new dimension in developing smart grids, allowing for a significant increase in renewable energy generation. Both PCS100 and PCS 6000 are characterized by great efficiency (from 97 to 98,5 percent) and high reliability. Modular construction utilizing leading-edge technology makes the design of both STATCOM and ESS highly configurable and versatile, thereby enabling both indoor and outdoor placement. The solution is particularly competitive in terms of installation time and space requirements. Furthermore, the high efficiency and low maintenance (MTTR<30min) lead to low operational costs. Owing to maximum flexibility, the solutions may be applied to a wide range of applications. These include wind farms, utilities with weak grids or fluctuating reactive loads as well as industrial applications. Both STATCOM and ESS provide a new dimension in developing smart grids allowing for a significant increase in renewable energy generation whilst maximizing CO2 free energy generation. They constitute cost-effective, environmentally attractive and high quality services for existing networks.

Benefits

- Improved plant efficiency
- Grid code compliance
- Enhanced network quality and wind farm reliability
- Fast response in case of instability
- Voltage control – reactive power compensation
- System power factor control
- Flicker mitigation, unsymmetrical load balancing
- LVRT capability
- Active harmonics cancellation



1 x 12.5 MVA PCS 6000 STATCOM for Midas wind farm, Ireland

Note:

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