Wind Energy Conversion System Voltage Ride Through Capability Enhancement Through STACOM Installation to Improve Transient Stability

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Motivation

The Renewable Energy Independent Power Producer Procurement Program (REIPPPP) has facilitated an increase in the penetration of Renewable Energy generation, which can have an impact on the transient stability of the grid. In particular, a LVRT event can initiate transient instability, which may eventually lead to a blackout.

Problem Statement

During a low voltage event at the point of common coupling, independent power producers prefer to disconnect wind energy conversion systems from the grid to prevent tower vibrations and transistor failure in the case of wind energy conversion systems (WECSs) with Permanent Magnet Synchronous Generators (PMSGs). These sudden disconnections cause an active power imbalance in the grid, which can result in transient instability. The problem becomes severe when the disconnected WECSs have a high penetration.

Methodology

It will be shown in this paper that the transient stability of the grid can be improved by installing a STATCOM at the point of common coupling. The STATCOM improves the low voltage ride through capability of the wind energy system which ensures that wind turbines remain connected to the grid during a low voltage event and produce reactive power to assist in voltage regulation at the point of common coupling. This will be shown in the form of simulations in Power Factory. A network which consists of a 150MW PMSG-based wind farm and a synchronous generator connected to the grid was used to do the studies. The case where the wind farm remains connected to the grid was compared to the case where the wind farm was disconnected from the grid during a low voltage event at the point of common coupling.

Results

It was found that the case where the PMSG based WECS had a LVRT capability led to a better transient stability response compared to the case without a low voltage ride though capability. This is because the wind system provided active and reactive power to support the grid. The active power requirement from the synchronous machine was reduced and thus reducing the power required to accelerate it, which in turn reduced the amplitude and settling time of the rotor angular oscillations. The reactive power generated by the wind system assists in voltage regulation at the point of common coupling (PCC).

Conclusions

It was concluded that continued operation of WECSs during a LVRT event improves the transient stability of the grid, and also improves the voltage regulation at the PCC.