Renewable Management System: to manage grid codes and contribute to grid stability

Introduction

Grid codes stipulate that Renewable Power Plants should contribute to power system control . The purpose of the Power Plant Controller is to ensure grid compliance at the Point of Common Coupling The PPC provides fast real-time control of the active and reactive power by dynamically piloting various pieces of equipment within the Power Plant.

In a Wind farm context, the controlled equipment include:

- Wind Turbine Generators (WTG) and compensation equipments
- Flexible Alternating Current Transmission System (FACTS): capacitor banks, shunt reactors, dynamic compensation system technologies.

The PPC receives instructions from the Grid regarding the regulation control mode and set points/limits if any. According to these instructions the PPC calculates the set points and pilots each piece of equipment to accurately adjust Active and Reactive power.

Selected compensation systems can be based on the following:

- Hybrid reactive power compensation system :
  - Dynamic compensation by leading or lagging reactive power,
  - Capacitor banks for leading reactive power,
  - Shunt reactors for lagging reactive power.
- Large storage facilities. The PPC will provide scalability and flexibility to support various interfaces.

The PPC is connected to the data collection SCADA system but as a separate brick to achieve processing and control speeds required by the fast control loop's response times.

Grid codes requirements

Common Grid Codes usually request and define:

- Operating ranges: parameters that defines voltage/frequency deviation and associated time constraints.
- Ride Through ranges: parameters that defines voltage/frequency extreme deviation and associated time constraints.
- Control modes and set points calculated by mathematical functions.

Operating ranges

The Grid Code authority uses profile to specify operating ranges requirements. RPP are capable of operating in these voltage/frequency time deviation constraints. Depending on the selected control mode, the PPC can act during these abnormal network operating deviations and contribute to power control.

Ride-Through capacities

The Grid Code authority uses profile and/or table to specify Ride-Through range requirements. RPP are capable of operating in these extreme voltage/frequency time constraint deviations and, if requested, contribute to grid stability. Plant's equipment have the ability to withstand these deviations.

Power control requirements

The PPC will pilot the WTG and FACTS to regulate active and reactive powers

Active power regulation :

- Frequency control: active power output is a function of frequency excursions
- Power control
- Power Limitation

Reactive power regulation :

- Voltage control: adjust reactive power to control the voltage at the Point of Common Coupling
- Reactive power control
- Power factor control: provide or absorb reactive power

The PPC provides fast real-time control of the active power/frequency and reactive power/voltage at the PCC. Core control algorithms for the power plant are placed inside the PPC which can sustain various control loops. The PPC manages in real-time the plant control of WTGs and compensation equipment. At any time, the PPC knows the status and the possible capacity contribution of each individual equipment. Contribution capacities of equipment depend on the technology used.

By taking into account Grid Requirements the PPC implements control algorithms and then an "allocator" function will dispatch orders to equipment.

HMI & Interface

The system is able to log historian data, to have synoptic, alarming, logs, web access, settings interface. The system be able to record/retrieve analog values to generate reports on Power Quality

Conclusion

Implementation of a reliable PPC can contribute to grid stability. Schneider Electric offers a flexible and scalable solution to manage the Renewable Generation through its PPC, its hybrid compensation solution and its Scada.