Generation control: an integrated secondary controller for generators in industry grids

Generation control coordinates the generators in industry grids as a secondary controller. Generation control is a fully integrated part of the Siemens substation automation system. Using generation control, grid operators can manage the following industry grid operation modes:

- **Connected mode**
- **Island mode**

The main goals of generation control are to keep frequency and voltage in the islanded grid in a desired range, to control the interchange with the external grid in connected mode, and to provide sufficient spinning reserve by load sharing in both modes.

This solution is a generic application that can be adapted to individual customer needs through configuration and parameterization. It is based on the SICAM RTU platform and uses SICAM SCC or Spectrum Power 5 for the Human-Machine Interface (HMI) and substation automation for process connection.

**Main functions**

**Connected mode**
- Maintains desired power interchange with utility by balancing load changes with the generators.
- Keeps power import between desired interchange limits.
- Keeps interchange power factor above contracted limit.
- Shares produced power between generators.
- Calculates and monitors the actual reserve (spinning and interchange reserves).
Island mode
• Keeps frequency in desired range using load frequency control (LFC).
• Maintains voltage in desired range with automatic voltage control (AVC).
• Controls the operation mode of the primary controllers (AVR and Governor).
• Shares active and reactive power between generators in the industry grid.
• Calculates and monitors the spinning reserve.
• Recognizes multiple islands and operates generation control for each island in parallel.

Range of operation
Generation control is designed for industry grids with up to 16 controllable generators. The grid can be operated in up to 8 parallel areas in either connected or island modes. The actual active areas are automatically recognized by the topology function. This makes it simpler for the industry grid operator.

The generators are usually driven by steam or gas turbines, or by diesel engines. Additional use of renewable power sources can be supported by adding the optional SICAM microgrid control.

System requirements
• Generation control can be implemented on SICAM AK 3 / CP-2019 or A8000 / CP-8050 (with limitations).
• For every participating generator set a subcontroller based on a SICAM RTU is necessary to interface the primary controllers (governor, AVR).

Supported options
• Operation and monitoring of generation control is done with prepared images on the connected HMI.
• Redundant SICAM controllers are also supported.

Benefits
• Fully integrated into the substation automation system.
• Only one HMI is therefore used both for monitoring and control, and for supervising all power management functions.
• Supports the operator with dynamic display of generator characteristic including actual working point.
• Can be adapted to specific needs through configuration and parameterization without additional programming.
• Automatically recognizes multiple islands and controls them in parallel.
• Includes calculation of spinning reserve (SRC) which also supports the load shedding function.
• Based on the IEC 61850 standard to ensure communication between all included automation devices. This significantly reduces parallel wiring, increases system availability and provides a future-proof solution.
• Goes beyond simple load sharing by including closed-loop control for both frequency and voltage in island mode.