ABB PSPG-E7

OPTIMAX PowerFit
Virtual Power Plants: Optimization of multiple generation units
New trends for optimization of multiple generation units:

- The number of power production units significantly increases with the use of renewable energy
- The power production needs to be re-planned frequently during a day, in order to account for fluctuations
- The required optimization cycle times reduces from daily planning cycles down to seconds, e.g. for pooling of secondary frequency control
- The role of human operators changes from being part of the loop to supervision
Trading results in e.g. daily schedules of 15 minutes steps for

- MW and MVAR load set point
- Allocated ranges for load dispatcher +/-
- Frequency control load range +/-

Virtual Power Plant (VPP) distributes all of the above load requirements to multiple generation units in an optimized way e.g. minimizing generation costs.
OPTIMAX® PowerFit solution
Traditional system layout
OPTIMAX® PowerFit solution
New system layout
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Internal optimization power plant Jänschwalde
Pooling of six 500 MW units

Advantage of multi-unit optimization

- Exploit communication network between management system and unit control system
- Real-time optimization of set points and secondary frequency control
- Fast and optimal reaction to fulfill production task, incl. gradients and timing of load ramps

Goals

- Minimize fuel consumption and CO₂-emissions
- Increase flexibility
Reference combined heat and electricity production

Flexible use of different production units
- Gas turbines
- Boilers
- Steam turbines
- Different fuels

Online-optimization considering market needs
- Planned production
- Minute reserve
- Secondary frequency control
Reference SRL pooling of renewable biogas plants
System overview

- Process database
- Real-time optimization
- IEC 60870-5-104 scanner
- Operation and management

VPN Gateway 1
VPN Gateway 2

Internet

Up to 500 production units, typically 500 kW per unit

Service Client

Operations Client

ABB Engineering Station

Leitwarte Firma XX

Control room
Control and monitoring

Engineering client-import / export for operational management

4 Grid operators

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Reference SRL pooling of renewable plants
Redundant implementation

Results of auctions, availabilities, schedules → Import (PGIM) → Process DB → Control (Real-time Opt.) → Operation (S+ Office Client) → Export (PGIM) → Process DB → Control (Real-time Opt.) → Reports, e.g. Unit commitment

IEC 60870-5-104 Scanner

SC Request Grid Operator 1 → SC Request Grid Operator 2 → SC Request Grid Operator 3 → SC Request Grid Operator 4 → SC Request Grid Op. 5 (Test) → IEC 60870-5-104 Scanner → Unit 1 → Unit 2 → ... → Unit 500

Operation (S+ Office Client) Results of auctions, availabilities, schedules

IEC 60870-5-104 Scanner

SC Request Grid Operator 1 → SC Request Grid Operator 2 → SC Request Grid Operator 3 → SC Request Grid Operator 4 → SC Request Grid Op. 5 (Test) → IEC 60870-5-104 Scanner → Unit 1 → Unit 2 → ... → Unit 500

Operation (S+ Office Client) Results of auctions, availabilities, schedules
Legal Basis: EEG § 11
Grid operators are allowed to reduce the power of renewable energy plants in case
- Grid security / stability is jeopardized
- Priority of renewable energy is granted.
Reference

Intraday optimization of municipal power

- Aim: balance production and load
- Exploit storage capacities, e.g. heat buffers, pump stores, electrical mobility
OPTIMAX® PowerFit

Benefits

- New system layout with online optimization connected directly to automation networks (either physically or through VPN)
- Mathematical optimization running in control loops
- Simple engineering exploiting Modelica technology
- Human operators take supervisory role
- Increase flexibility of power production, including: secondary control, minute reserve, direct trading
- Always run at economic best point
- Implemented in OPTIMAX PowerFit, based on ABB Dynamic Optimization
- Successful references for real-time and intraday optimization
Power and productivity for a better world™