Enhanced LP-Based OPF for Transmission Operations

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Agenda

- Security Enhancement ?
- Driving Forces for enhanced Optimisation tools
- Security Enhancement Features
- Operational Business Cases
- Conclusions & Questions ?

Security Enhancement ?

- LP based optimization application
- Assesses the security of the power system
- Handles basecase and/or contingent network states
- Do all components operate within their limits?
- Can operating cost be reduced?

- Controls – MW, MVAR, Voltage Set Points, taps
- Constraints – Branch flows, interface flows, Voltage
- Objective Function – Operational Security and cost of operation

Driving Forces for Enhanced Optimisation tools

- Increasing System Complexities
  - Emerging power generation patterns
  - Renewable energy resources
  - Market impact
  - Unplanned usage of Network – Stressed networks
- Work Force aspects
  - Aging operators
  - Operational knowledge not enough with more complexities
  - New generation demands better tools
- Computation Power
  - Non-linear Power System
  - Optimization demands more computation
  - Better number crunching engines at affordable prices

Security Enhancement Features

- Real time mode of operation
  - Analyzed during real time sequence
  - Operational models – no additional integration
  - State Estimation and Contingency Analysis provide objective
- Look ahead mode of operation
  - Start from real time data for further analysis
  - Future models and operational data
  - Powerflow & Contingency Analysis
  - Separate application or integrated to look ahead sequence
- Handles ISO sized models
- Flexible definition of controls, constraints & Objectives

Operational Business Cases

- Voltage Support Services (VSS)
- Dynamic Remedial Action Plans (DRAP)
- Outage Evaluation (OE)

Voltage Support Services (VSS)

- VSS moves reactive controls to achieve acceptable voltage profile in the system
- Suggests operational voltage set points
- Real Time mode – starts from SE & CA Solution
- Study mode
- Controls
  - Units/SVCs: voltage target control
  - Transformers: voltage target control, Tap Settings
  - Capacitors/reactors: on/off control
- Constraints
  - Bus voltage limits: high voltage, low voltage
  - Device limits: unit VAR output limits

VSS / SENH modes

Mode	Control	Constraints
Constrained Dispatch (CD)	Base Case	Base case violations
Contingency Planning (CP)	Contingency Controls	Contingency violations
Preventive actions (PA)	Base Case	Base case and Contingency violations
Preventive & Corrective actions (PACP)	Base case + Contingency specific controls	Base case and Contingency violations

Dynamic Remedial Action Plans (DRAP)

- Dynamic Remedial Action provides a remedial MW re-dispatch to alleviate certain level of branch flow constraints
- Contingency Planning mode
- Controls – Unit MWs based on time frame of reference or market data
- Executes as part of the realtime network security applications after Contingency Analysis

Outage Evaluation (OE)

- Perform security and economic assessment for a series of future hours
  - Model and simulate system at a given date/hour
  - Dispatches MW and MVAR resources necessary to meet the load, reserve and to support voltages
  - Provides outage sensitivities make informed decisions on outages
- Multi model Support
- Save case mechanism for audits
- Various features to create future scenarios for making outage decisions

Conclusions & Questions

- Operational challenges
- Improved Optimization tools
- Various operational business needs

- Core engines that can cater different operational aspects with appropriate setup
- Integrated Solution

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