The 15th International Workshop on Electric Power Control Centers
Reykjavik, Iceland, May 12-15, 2019

Reactive Power – Real-time Management and Control

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Reactive Power is often overlooked in monitoring and analysis, yet it is needed to transfer active power in the AC system. Renewable energy penetration continues to increase in modern power systems each year. However, most renewable energy sources are located far away from populated areas and need to be transferred from the source to the consumers. Since reactive power cannot be sent over long distances, it is crucial to locally manage and balance reactive power.

Bigwood Systems has been providing control center solutions to plan and manage reactive power to several utilities worldwide. Planning and operation solutions for reactive power management include:

- *Zone Definitions and Localized Regions:* Beginning with planning, the utility service territory network is partitioned as reactive reserve zones are defined. Regional zoning is the practice of analyzing EMS operating snapshots to determine reactive power zone definitions in the network such that buses within the same zone are electrically coherent to each other. This study is performed several times a year to redefine zones for accurate planning studies.
- *Real-time VAR Monitoring and Analysis*: Real-time reactive power reserve status for each region is continuously monitored and analyzed by leveraging EMS output data. This process is automatically executed every time state estimation is performed. Users are provided with real-time situational awareness, alarms, status visualization, and accurate measures of local reactive power support. Furthermore, the ability to react to instabilities with control adjustment suggestions for current devices is presented.
- *Coordinated Control for Reactive Power:* Predict and remove voltage and thermal violations in the network in the most optimal manner. The coordinated reactive power scheduling is conducted through static and dynamic control options to mitigate expected hourly violations over a future time duration (12 hours to start, up to 48 hours ahead of real time). The powerful engine can prioritize various control types, constraints

(temporal, physical, reactive reserve, etc.), and user configurations to find the most optimal solution. Functions from several BSI control center software packages are built into our reactive power coordination (RPC) tool, and the plan is to continue to develop new functions and integrate these features into the tool.

These real-time control applications are used by large U.S. utilities such as Tennessee Valley Authority (TVA) and ERCOT, the system operator for the State of Texas. As renewable energy integration continues to increase, reactive power management will become more and more important.