CURENT

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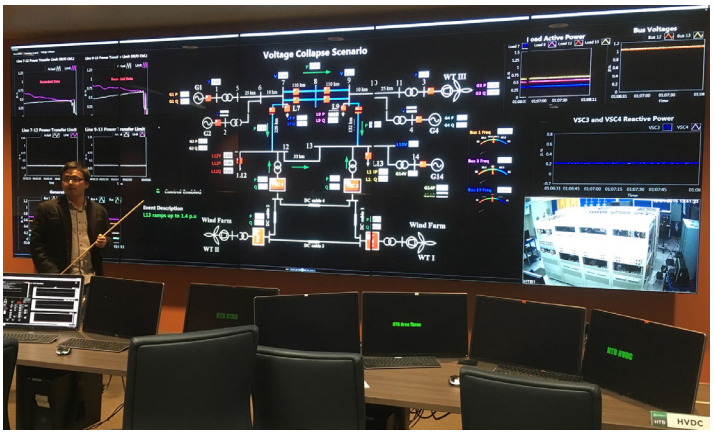
RESEARCH

Hybrid Voltage Stability Assessment

Overview

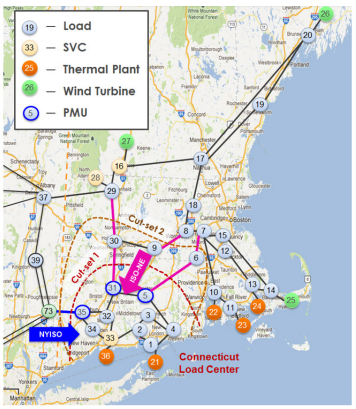
Voltage stability is a major concern in daily power system operations and a leading factor to limit power transfers in a prevailing open access environment. CURENT is developing a new hybrid voltage stability assessment method combining the traditional simulation-based approach and a new measurement-based approach. The hybrid method aims at calculating voltage stability margin directly from real-time measurements to identify vulnerable areas, and then identifying post-contingency voltage instability and remedial actions by simulations on those areas.

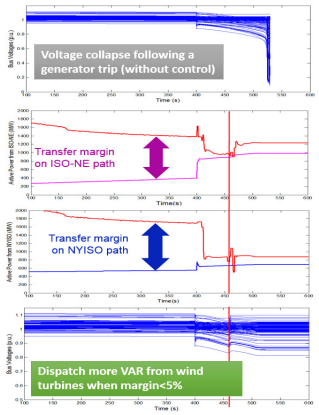


Technology Pathway

Presently, model- or simulation-based voltage stability assessment (VSA) programs are widely applied to study voltage stability following given contingencies. If applied in the online environment, such a simulation-based approach helps operators foresee the next most critical contingencies that may cause voltage problems based on the current system state estimate. However, its performance may be influenced by inaccurate models of generation, load, and transmission facilities, or divergence in state estimation under, e.g., stressed conditions. An alternative measurement-based approach is to directly use real-time measurement data to assess voltage stability. To integrate the two approaches, comprehensive voltage stability assessment would be achieved by the following tasks:

- Identify locations (e.g. load buses, transmission corridors, load centers, or grid interfaces), which are more vulnerable to voltage insecurity.
- Develop an accurate measurement-based algorithm to estimate real-time voltage stability margins at those locations. Low margins indicate that additional contingencies may cause voltage problems at those locations.
- Perform simulation-based VSA by high-performance computers (HPCs) focusing on the contingencies related to the locations with low margins based on the most recent state estimate. Identify potential post-contingency voltage insecurity and determine remedial actions.





Impact

- System operators would be aware of real-time voltage stability issues and be provided with decision support.
- For such a hybrid scheme, the more accurate the measurement-based approach is, the fewer burdens the simulation-based approach will have.

POINT OF CONTACT

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