NPCC Task 5 Study

New York State Reliability Council
DSWG Meeting

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Presentation Outline

- Background
- Study Objectives
- Methodology
- Summary of Results
- Conclusions
- Recommendations

Background

- The Blackout Study included six separate tasks
- Final report (Task 6) issued following the completion of Tasks 1-4
  - Report approved Nov. 2005
- Task 5 is the remaining Blackout Study task to be completed
- Task 5 delayed due to prioritization of work (e.g. UFLS, OTA, etc.)

Objectives

- Investigate potential mitigation measures to improve ability of system to withstand a major system disturbance
- Review NERC technical reference on Power Plant and Transmission System Protection Coordination and recommend protection functions that could benefit from including explicit or screening models in studies

Methodology

- Develop study cases
- Assess coherent generation groups
- Investigate potential advance indicators of system separation
- Assess performance of post contingency actions including the benefits of tripping where out-of-step conditions occur

Results of Coherent Generation Groups Analysis

- Two coherent generation groups (N-S-C-E and NE-S-C-E) identified for Ontario
- One coherent generation group identified for the Maritimes consistent with prior study
- Two coherent generation groups (New England-Maritimes and Northern Maine-Maritimes) identified for New England
- One coherent generation group identified as West of Central East for New York

Evaluation of Potential Advance Indicators of System Separation

- Change in power flow supervised by change in bus voltage angle
- Triggers using Phasor Measurement Unit data
  - Bus voltage angle difference
  - Bus frequency difference and its derivative
  - Bus voltage magnitude and its derivative
- Bus voltage angular velocity vs. bus voltage angular acceleration
- Generator rotor speed/frequency and acceleration
- Reactive power and its derivative (Q-Qdot)

Performance of post contingency actions

- Bus frequency responses demonstrated controlled system separation/islanding along boundaries that minimize generation load mismatch is preferable to uncontrolled separation
- Out-of-step generation rejection demonstrated potential for preventing uncontrolled system separation

Results on Tripping where OOS conditions occur

- System separation at locations where out-of-step conditions occur helps reduce voltage and power oscillations
- The system would still have separated as it did on August 14, 2003 even if the two 120 kV cables connecting Southern and Northern Detroit were tripped

Conclusions

- It is beneficial to separate the system where out-of-step conditions occur
- Controlled system separation is preferred in the presence of a single coherent generation group
- A reliable advance indicator for system separation could not be determined from this study
- Uncoordinated generation protection schemes should be modeled in planning and system studies

Recommendations

- Further studies are needed to determine the reliability of the advance indicators for system separation
  - Need to be specific to particular locations, regional boundaries, or interfaces
- Types of study identified which would benefit from including explicit or screening models for generator protection functions

Study Type	Generator Protection Functions to be Modelled	
	via explicit Models	**via Screening Models**
UFLS Assessment	Over/under-frequency (81), OOS (78)	V/Hz (24), under-voltage (27), over-voltage (59)
UVLS Study	Under-voltage (27), over-voltage (59)	over-current (51V)
Analysis of Large System Disturbance (eg. Event reconstruction of large scale blackout/system breakup)	Over/under-frequency (81), under-voltage (27), over-voltage (59), OOS (78)	V/Hz (24), over-current (51V)
Overall Transmission Assessments	Over -frequency (81), OOS (78)	under-voltage (27), over-voltage (59)
Inter-regional Transmission Studies	Over-frequency (81), OOS (78)	under-voltage (27), over-voltage (59)