SC MC
MMWG

ERAG

Eastern Interconnection
Reliability Assessment Group

2016
Special Weather Study
Phase 2

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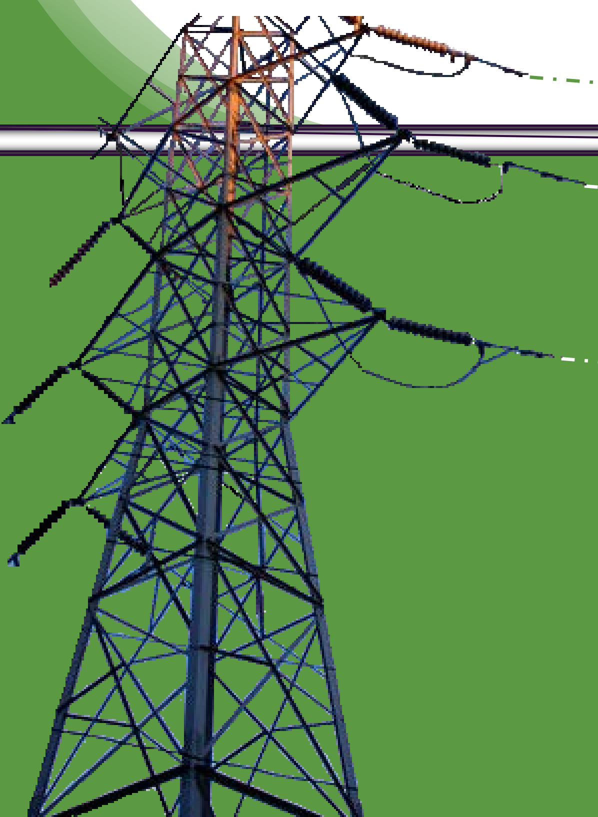

Executive Summary

In 2015 the ERAG WG conducted an appraisal of the Eastern Interconnection by examining extreme weather scenarios, including extreme drought summer and extreme cold polar vortex winter type conditions and determining their potential impacts on power flows across the Eastern Interconnection.

This assessment builds on the 2015 Special Transmission Assessment Weather study by examining the impact of N-2 events on the 300 kV and above transmission facilities and flow-gates covered by the Eastern Interconnection. The assessment was limited to N-2 simulations around N-1 outages identified in the 2015 study as potentially overloading transmission facilities in neighboring areas. There were ten power flow areas assessed for the three following power flow cases:

1. 2015 Summer Peak Base case
2. 2015/16 Winter Peak Base case
3. South to North 10,000 MW Transfer case

For the 2015 Summer Peak case, six out of ten power flow areas experienced fifty-three N-2 overloads that ranged from 1 overload to 22 overloads per area. For the six impacted power flow areas the results can be represented by: mean = 8.83, median = 6.5 and mode = 1.

For the 2015/16 Winter Peak case, four out of ten power flow areas experienced twenty-seven N-2 overloads that ranged from 2 overload to 10 overloads per area. For the four impacted power flow areas the results can be represented by: mean = 6.75, median = 7.5 and mode = n/a.

For the South to North 10,000 MW Transfer case, six out of ten power flow areas experienced eighty-eight N-2 overloads that ranged from 1 overload to 22 overloads per area. For the six impacted power flow areas the results can be represented by: mean = 12.57, median = 13 and mode = 6.

The thermal overloads resulting from variations of special weather conditions are used as indicators of the relative strength of the interconnected system and are not absolute indices of the operating capability of the system. As indicated in Section 3, Discussion of Results, changes to system conditions can mitigate the thermal overloads identified by this assessment. Changes to system conditions can include, but are not limited to, variations in generator dispatch, switching configurations, facility re-rates and system improvements.

Section 4, Special Weather N-2 Significant Facilities, identifies the thermal overloads for which mitigating actions are planned or currently available. For those overloads which do not have any planned or currently available mitigating actions, it is recommended that the affected power flow areas evaluate the need for developing mitigation actions.

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1. Introduction

The ERAG Seasonal Working Group (ERAG WG) conducts appraisals of the Eastern Interconnection for special scenarios to determine impacts on power flows. During 2015 (Phase 1), under the direction of the ERAG Steering Committee (ERAG SC), the ERAG WG conducted an appraisal of the Eastern Interconnection by examining extreme weather scenarios, including extreme drought summer and extreme cold polar vortex winter type conditions and determining their potential impacts on power flows across the Eastern Interconnection. This appraisal was performed in support of the Regional and Interregional Self-Assessment Reliability Reports and North America Electric Reliability Corporation (NERC) Standard TOP-002 - Normal Operations Planning. For more information on NERC standards, refer to the NERC home page[1].

For 2016 (Phase 2), the ERAG Management Committee (ERAG MC) has initiated the 2016 ERAG Reliability Assessment that builds on the 2015 Special Weather Scenario Assessment to consider N-2 contingency analysis. The assessment will be performed using both a summer and winter peak base case as well as a South to North sensitivity case that was built from a 2015/16 Winter peak base case starting model. This sensitivity case has the South exporting from one-hundred (100%) percent load reduction with North importing one-hundred (100%) percent from generation reduction case from the previous year's weather-based transfer analysis.

The 2016 ERAG Reliability Assessment includes N-2 contingency analyses to evaluate impacts on the eastern interconnection BES (300 kV and above) transmission system, both, lines transformers and flow-gates using PowerGEM's TARA860. Specifically, the assessment requires performing N-1-1[2] analysis (without system reconfiguration) on the three following power flow cases:

4. 2015 Summer Peak Base case
5. 2015/16 Winter Peak Base case
6. South to North 10,000 MW Transfer case[3], South exports consisting of 100% load reduction and North imports consisting of 100% generation reduction (modified 2015/16 Winter Base case).

The results from the N-2 analysis were screened with an emphasis on identifying the limiting element as being from a different power flow area than either of the power flow area(s) associated with either the first or second contingencies. The identified limiting elements will include all N-2 overloads even if after the review of these limiting elements it is determined to not be an issue of concern due to an existing operating guide and/or Remedial Action Scheme (RAS) which is available to mitigate the overload.

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[1] www.nerc.com

[2] The Phase 2 study performed a N-2 analysis without system reconfiguration between the first and second contingency. For the remainder of this report, the N-2 analysis without system reconfiguration will be referred to as N-2 analysis.

[3] The South to North 10,000 MW Transfer case will be referred to in the remainder of this report as the "South to North" case.

2. Background Information

Information regarding the basis for the analysis, the simulated test scenarios, and the study procedure are discussed in this section in order to help the reader understand how the constraints were calculated and to properly interpret the results. It should be noted that this effort is intended to find reliability constraints based on case study of the interconnected system, instead of economic limits.

2.1 Base Case Development

The 2016 ERAG Reliability Assessment is performed using summer and winter peak base cases as well as the South to North sensitivity case from the previous year's weather-based transfer analysis.

As previously mentioned, the analysis is completed using PowerGEM's TARA860 in order to evaluate the Eastern Interconnection BES (300 kV and above) transmission system, lines, transformers, and flow-gates due to outages caused by extreme weather scenarios.

Simulation Procedure:

1) Monitor transmission at 300 KV and above as well as 100 kV and above facilities that appear as the monitored facility in a NERC Flowgate. Note: The Flowgate branches are monitored individually rather than using the Flowgate rating as a limit which might be less than the sum of the branch thermal ratings.
2) For the N-2 study, the first level contingency contained those contingencies that caused an overload in the Phase 1 study and are either an N-1 Transmission facility contingency at 300 kV and above or the contingency events from a 100 kV and above NERC Flowgate. The second level contingency contained an N-1 transmission contingency at 100 kV or above.

   The analysis was performed by running all combinations of N-2 events as described above using DC linear contingency screening on the following three cases:
   1. Summer Peak case
   2. Winter Peak case
   3. South to North Winter Peak case

2.2 Study Assumptions

For Phase 1, study areas relating to four (4) compass directions were defined as outlined below to build power flow models with 10,000 MW of North-to-South, South-to-North, West-to-East, and East-to-West transfers.

For the purposes of this study, SPP region was defined as SPP Regional Entity (RE) footprint, which included Central Louisiana Electric Company (CLECO), Lafayette Utilities (Lafayette) and Louisiana Energy Power Authority (LEPA). Lincoln Electric System (LES), Nebraska Public Power District (NPPD), Omaha Public Power District (OPPD) and the Integrated System (Western Area Power Authority (WAPA), Basin Electric Power Cooperative (BEPC), and

Heartland) were not included in the SPP RE subsystem for transfer analysis, but are included in the MRO subsystem.

(1) North = MRO + NPCC + RF + DVP
(2) South = SPP + SERC + FRCC – DVP
(3) West = MRO + SPP + ComEd + Gateway + Delta
(4) East = NPCC + RF + SERC + FRCC – ComEd – Gateway – Delta

For Phase 2, the assessment was performed using summer and winter peak base cases as well as the South to North sensitivity case from the Phase 1 weather-based transfer analysis. The South to North case was selected as the directional case because of its most realistic representation of actual exporting and importing subsystems.

3. Discussion of Results

Thermal overloads resulting from variations of special weather conditions are used as indicators of the relative strength of the interconnected system. They should not be used as absolute indices of the operating capability of the system because they are only determined for the specific system conditions represented in the transfer cases. Any changes to the system conditions, such as variations in generation dispatch or other transfers not modeled can significantly affect these values. The overloads determined for the special weather conditions are summarized in Appendix B.

The reported values do not attempt to maximize or optimize transmission utilization nor do they attempt to simulate market-based operations within MISO, NYISO, PJM, and SPP. In actual operation, market-based dispatching would be employed as required, resulting in remedial actions to alleviate congestion on facilities.

The results from the N-2 analysis were screened with an emphasis on identifying the limiting element as being from a different power flow area than either of the power flow area(s) associated with either the first or second contingencies. The identified limiting elements will include all N-2 overloads even if after the review of these limiting elements it is determined to not be an issue of concern due to an existing operating guide and/or Remedial Action Scheme (RAS) which is available to mitigate the overload.

The results of the study were mixed with some areas having a few or no N-2 events, as defined by this study, and other areas have multiple N-2 events. For the areas that have N-2 events identified, most had mitigation plans in effect or under development. Detailed results for each area can be found in the non-public report.

4. Conclusion

This assessment identified numerous overloads that resulted from N-2 contingencies where a limiting element was from a different power flow area than either of the power flow area(s) associated with either the first or second contingencies. While many of the identified overloads have planned or currently existing mitigating action, not all of the identified overloads have mitigation plans.

For those overloads which do not have an associated mitigation plan, it is recommended that the affected power flow areas evaluate the need for developing mitigation plans.

5. Contact Information

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