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Xcel Energy
Docket No.: E002, ET2/CN-06-1115
Response To: Elizabeth Goodpaster and Mary Marrow, Wind on the Wires, et al — Information Request No. 15
Date Received: April 3, 2008

Question:

Please describe the power flow model software used to run the power flow studies demonstrating the need for the CAPX2020 facilities. Please provide hard-copy computer output for each of the power flow model runs backing up the normal operation and contingencies referenced in our IR No. 7. These should be the detailed outputs showing power flows and bus voltages on all regional power facilities for each contingency. Note: because of the large amount of output to review, our witness Larry L. Schedin PE is willing to review the requested output reports at the offices of the study authors.

Response:

The power flow software used to execute the power flow studies referenced in the Application was Power System Simulator for Engineering (also known as PSS/E or PSS™E). The software is developed by Siemens PTI and is used by many of the utilities in the eastern United States as their primary power system modeling software package. Managing and Utilizing System Transmission is an extension to PSS/E (also known as MUST or PSS™MUST) that is sometimes used to incrementally scale load or process large numbers of contingencies in quick succession.

Both programs provide planning engineers with a way to efficiently execute multiple contingencies under various system conditions. This allows planning engineers to develop an understanding of how the power system behaves under a variety of assumptions. These assumptions include contingency information for the region from a contingency file maintained by the members of the Midwest Reliability Organization ("MRO"). These contingencies include common tower (double-circuit) outages, breaker-to-breaker contingency definitions, and significant contingencies that could result in significant regional transmission system limitations.

The principal benefit to using MUST is that it automatically formats output, making it much easier to analyze precisely which contingencies cause overloads or voltage problems on the system.

To perform power system performance simulations (system intact and first contingency analysis), planning engineers use the computer modeling tool, Power System Simulator for Engineering (also known as PSS/E or PSS™E). Specifically, the PSS/E activities AC Contingency Checking ("ACCC") and Transfer Limit Table Generator ("TLTG"). ACCC sequentially examines all relevant contingencies (including both single contingencies, double contingencies, and/or any contingencies defined by the user) in the region of interest for a given load and transfer base case, while TLTG performs a similar contingency analysis while progressively incrementing power transfer between a defined "source" and "sink" location.

By monitoring the power flow results under contingent conditions and observing the overloads and/or low voltage conditions that result, planning engineers are able to ascertain the precise behavior of the transmission system, where the power tends to flow, and what areas have transmission issues that need to be addressed. Analyzing the system in this manner cuts down on the amount of program output, makes the results much easier to manage, and allows planning engineers to focus their attention on the information that is most pertinent to determining transmission system weaknesses.

The output from these TLTG and ACCC runs, which show power flow and bus voltage output, are included in the appendices to the Southwestern Minnesota Study, the TIPS Update and Rochester/La Crosse Study. See Bates CapX2020 0000105.

Applicants understand that this request seeks Automap diagrams for all of the studied N-1 and N-2 contingencies. These diagrams are no longer generated as a matter of course in engineering studies and were not developed for either the TIPS Update or the Rochester/La Crosse Study. In the Southwestern Minnesota Study, Automap diagrams for nine critical outages were printed and are contained in Appendix D, Powerflow Diagrams & Logsheets, to the Southwestern Minnesota Study.

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