DISCUSSION OF [redacted] ("Customer") GENERATION SYSTEM IMPACT STUDY RESULTS FOR THE 29 MW INCREMENTAL INCREASE TO THE PROPOSED GENERATING FACILITY AT BUCK TIE STATION. TOTAL SUMMER PEAK OUTPUT IS EXPECTED TO BE 650 MW.

REPORT DATE: February 2, 2011

SOURCE: DUKE ENERGY CAROLINAS, LLC (TRANSMISSION) ("Transmission Provider")

Following are the results of the Generation System Impact Study for the installation of an incremental increase of 29 MW to the proposed generating facility in Rowan County, NC. The site is located at Buck Tie Station and has an estimated Commercial Operation Date of October 15, 2011. The study evaluated the requested Network Resource Interconnection Service (NRIS).

A. Study Assumptions and Methodology

The power flow cases used in the study were developed from the Transmission Provider's internal year 2012 summer peak and 2013 summer peak cases. These cases contain the planned generation additions at Cleveland County, Cliffside and Dan River where applicable. The results of the Transmission Provider's annual screening were used as a baseline to identify the impact of the new generation. To determine the thermal impact on the Transmission Provider's transmission system, the new generation was modeled directly connected to the 230 kV bus at Buck Tie. The economic generation dispatch was also changed by adding the new generation and forcing it on prior to the dispatch of the remaining Customer Balancing Authority Area units. Buck Steam units 3 and 4 are assumed to be retired in coincidence with the addition of the new combined cycle facility. The impacts of changes in the Generator Interconnection Queue were evaluated by creating models with combinations of previously queued generation in and out of service. The study cases were re-dispatched, solved and saved for use.

The NRIS thermal study uses the results of the Transmission Provider's annual internal screening as a baseline to determine the impact of the new generation. The annual internal screening identifies violations of the Transmission Provider's Transmission System Planning Guidelines and this information is used to develop the transmission asset expansion plan. The annual screening provides branch loading for postulated transmission line or transformer contingencies under various generation dispatches. The thermal study results following the inclusion of the new generation were obtained by the same methods, and are therefore comparable to the annual screening. The results are compared to identify significant impacts to the Transmission Provider's transmission system.

Stability studies are performed using an MMWG dynamics model that has been updated with the appropriate generator and equipment parameters for the new units. The SERC dynamically reduced 2011 summer model was used for this study. The case was modified to turn off some units not local to the new generators to offset the new generation. NERC Category B, Category C, and Category D faults were evaluated.

Fault studies are performed by modeling the new generator and previously queued generation ahead of the new generator in the interconnection queue. Any significant changes in fault duty resulting from the new generators' installation are identified. Various faults are placed on the system and their impact versus equipment rating is evaluated.

Reactive Capability is evaluated by modeling a facility's generators and step-up transformers (GSU's) at various taps and system voltage conditions. The reactive capability of the facility can be affected by many factors including generator capability limits, excitation limits, and bus voltage limits. The evaluation determines whether sufficient reactive support will be available at the Connection Point.

B. Thermal Study Results

NRIS Evaluation

There were no upgrades identified in the System Impact Study as attributable to the additional generation at the Customer's facility.

C. Stability Study Results

The proposed Buck 650 MW combined cycle units connected to the existing Buck Tie 230 kV switchyard are transiently stable for all but the most severe contingencies.

When it comes to delayed clearing faults, the steam and both gas units lose synchronism and must have generator out of step relay protection. To improve the situation and prevent loss of stability, delayed fault clearing times should not exceed 11 cycles where possible.

The manufacturer proposed power system stabilizers (PSS) were not studied because there was sufficient damping without them. However, a PSS should be purchased along with each exciter and optionally placed in service. If problems arise in the future, then the facility can quickly implement a PSS solution.

Addition of the proposed Buck 650 MW combined cycle facility does present some stability concerns. However, with the appropriate relay protection systems, the units will not negatively impact the overall reliability of the interconnected transmission system.

D. Fault Duty Study Results

The incremental increase to the proposed generating facility does not result in an increase in the amount of available fault current. Therefore no additional breakers will need to be replaced.

E. Reactive Capability Study Results

With the proposed generating facility, the level of reactive support supplied by the units has been determined to be acceptable at this time. Evaluation of MVAR flow and voltages in the vicinity of Buck indicates adequate reactive support exists in the region. Should future studies show the need for additional support, Transmission Provider will evaluate solutions and make appropriate changes to the system.

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