Feasibility Study Report

For: [redacted] ("Customer")

Queue #: 42544-01

Service Location: Laurens County, SC

Total Output: 88.6 MW

Commercial Operation Date: 12/1/2017

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1.0 Introduction

Following are the results of the Generation Feasibility Study for the installation of 88.6 MW of generating capacity, equally split between two facilities in Laurens County, SC. These sites are located near Clinton Tie and have an estimated Commercial Operation Date of 12/1/2017. This study includes both Network Resource Interconnection Service (NRIS) and Energy Resource Interconnection Service (ERIS).

2.0 Study Assumptions and Methodology

The power flow cases used in the study were developed from the Duke Energy Carolinas (DEC) internal year 2018 summer peak case. The results of DEC's annual screening were used as a baseline to identify the impact of the new generation. To determine the thermal impact on DEC's transmission system, the new generation was modeled as two new interconnections—one on each of the Clinton 100 kV lines. All cases were modified to include 44.3 MW of additional generation at each of the Customer's two facilities. The economic generation dispatch was changed by adding the new generation and forcing it on prior to the dispatch of the remaining DEC Balancing Authority Area units. The study cases were re-dispatched, solved and saved for use. The impacts of changes in the Generator Interconnection Queue were not evaluated, because it was determined that no earlier queued generators would have a significant impact on the study results.

The NRIS thermal study uses the results of DEC Transmission Planning's annual internal screening as a baseline to determine the impact of new generation. The annual internal screening identifies violations of the Duke Energy Power 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 DEC transmission system.

The ERIS thermal study utilizes a model that includes the new generation with relevant earlier queued projects and associated known upgrades. The new generation economically displaces DEC Balancing Authority Area units. Transmission capacity is available as long as no transmission element is overloaded under N-1 transmission conditions. The thermal evaluation will only consider the base case under N-1 transmission contingencies to determine the availability of transmission capacity. ERIS is service using transmission capacity on an "as available" basis; adverse generation dispatches that would make the transmission capacity unavailable are not identified. The study will also identify the maximum allowable output without requiring additional Network Upgrades at the time the study is performed.

Short circuit analysis is performed by modeling the new generator and earlier queued generation ahead of the new generator in the interconnection queue. Any significant changes in short circuit current resulting from the new generator's 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 (GSUs) 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.

Any costs identified in the short circuit or reactive capability studies are necessary for both ERIS and NRIS service.

3.0 Thermal Study Results

3.1 NRIS Evaluation

No earlier queued projects were deemed to have a material impact on the results of the study.

The following network upgrades were identified as being attributable to the studied generating facility:

Facility Name/Upgrade	Existing Size/Type	Proposed Size/Type	Mileage	Estimated Cost	Lead Time (months)
A. Interconnection Cost				$1.5 MM	24
B. Upgrade Clinton 100 kV Lines (Bush River-Laurens) and install OPGW[1]	477 ACSR, 2/0 Cu, 336 ACSR	954 ACSR	29.23	$44 MM	48
CUSTOMER TOTAL COST ESTIMATE				$45.5 MM	48

3.2 ERIS Evaluation

Under the terms of ERIS service, the full output of the plant can be delivered at the time of the study. The upgrades required for ERIS service are the same upgrades required for NRIS service. The estimated costs and lead times for these upgrades are identified in section 3.1.

[1] The need to rebuild the Clinton 100 kV lines is driven by the installation of Optical Ground Wire (OPGW) that would be associated with the Customer's facility; the need to rebuild the Clinton 100 kV lines is not driven by thermal loading issues. DEC utilizes OPGW for providing a communication path for system protection purposes and at times to populate the Energy Management System with operating data (MW, MVAR, etc.). The 100 kV transmission line the Customer desires to interconnect to uses structures that cannot support the additional weight of OPGW. As a result, the entire 29.23 mile 100 kV transmission line would need to be rebuilt in order to install OPGW. DEC will consider alternative forms of communication proposed by the Customer. Any alternative communication schemes must be presented to and approved by DEC during the Facility Study.

4.0 Short Circuit Analysis Study Results

The following breaker(s) will need to be replaced:

1. The Clinton Tap Bl, Clinton Tap Wh, and the Cotton Mill all at Clinton Tie.

Total estimated cost for breaker replacements: $0.36 MM

Regardless of whether or not the Clinton 100 kV lines are rebuilt due to the installation of OPGW, these breaker replacements are necessary.

5.0 Reactive Capability Study Results

The Customer proposed installing a 12.5 MVAR capacitor bank at each of its facilities; however, the maximum allowable size for a capacitor bank associated with each facility is 11.7 MVAR, which allows the Customer to compensate only for plant losses. With an 11.7 MVAR capacitor bank installed and in service at each facility, the maximum output of each facility that meets the reactive capability requirements set forth in DEC's Facility Connection Requirements document is 44.3 MW. If the Customer does not install the capacitors or the capacitors are not in service, the maximum output of each facility that meets the reactive capability requirements is 39.9 MW. Given these considerations, the level of reactive support supplied by the Customer's facility has been determined to be acceptable at this time. Evaluation of MVAR flow and voltages in the vicinity of Clinton Tie indicates adequate reactive support exists in the region. The recommended tap setting at the high side of the GSU is 99 kV.

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