Generator Interconnection Request

Feasibility Study Report

For: Customer

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Service Location: Rutherford County

Total Output: 79.2 MW

Commercial Operation Date: 9/1/2014

In-Service Date (if given): 9/1/2014

Prepared By: Jeff Rhyne

Date: 04/11/2013
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1.0 Introduction

Following are the results of the Generation Feasibility Study for the installation of 79.2 MW of generating capacity in Rutherford County, North Carolina with an estimated Commercial Operation Date of 09/01/2014.

2.0 Study Assumptions and Methodology

The power flow cases used in the study were developed from the Duke internal year 2014 summer peak case. The results of Duke’s annual screening were used as a baseline to identify the impact of the new generation. All cases were modified to include 79.2 MW of additional generation at the customer site. To determine the thermal impact on Duke’s transmission system, the new generation was modeled on the 100 kV line at the connection point. The customer will install a substation and 100/34.5 kV transformer. The economic generation dispatch was also changed by adding the new generation and forcing it on prior to the dispatch of the remaining Duke Balancing Authority Area units. The study cases were re-dispatched, solved and saved for use.

The Network Resource Interconnection Service (NRIS) thermal study uses the results of Duke Energy Power Delivery’s annual internal screening as a baseline to determine the impact of new generation. The annual internal screening identifies violations of the Duke Energy 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 Duke Energy transmission system.

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 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.
3.0 Thermal Study Results

3.1 NRIS Evaluation

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

<table>
<thead>
<tr>
<th>Facility Name/Upgrade</th>
<th>Existing Size/Type</th>
<th>Proposed Size/Type</th>
<th>Mileage</th>
<th>Estimated Cost</th>
<th>Lead Time (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Install 100 kV Circuit Switcher, relaying, and metering at the connection point. Customer will install substation and 100/34.5 kV transformer.</td>
<td></td>
<td></td>
<td></td>
<td>$778,447</td>
<td>12</td>
</tr>
<tr>
<td>2. Tap transmission line w/ GOAB; 100 kV transmission line to the connection point.</td>
<td></td>
<td></td>
<td></td>
<td>$350,000</td>
<td>12</td>
</tr>
<tr>
<td>3. Off-site relaying upgrades.</td>
<td></td>
<td></td>
<td></td>
<td>$954,000</td>
<td>12</td>
</tr>
<tr>
<td>CUSTOMER TOTAL COST ESTIMATE</td>
<td></td>
<td></td>
<td></td>
<td>$2,082,447</td>
<td>12</td>
</tr>
</tbody>
</table>

3.2 ERIS Evaluation

Energy Resource Interconnection Service (ERIS) allows the interconnection customer to connect its generation facility to the transmission system and be eligible to deliver its output using the existing firm or non-firm capacity of the transmission system on an “as available” basis. This section is not applicable for the NC jurisdictional generator interconnection requests.

4.0 Fault Duty Study Results

The following breakers will need to be replaced:

No breakers were found to have over duty concerns.

Total estimated cost for breaker replacements: N/A

The fault duty impact was reviewed with the installation of the proposed generation. Breakers at the two nearest tie stations and buses two tiers away were evaluated. There were no breakers overdutied or significantly impacted by the generation.
5.0 Reactive Capability Study Results

The Duke Energy Carolinas Facilities Connection Requirements (FCR) for generators connected directly to the Transmission System requires that the generator must be able to operate in a power factor range from .93 lag (producing VARS) to .97 lead (absorbing VARS), measured at the connection point.

The facility must be capable of supplying at least 0.395 MVAR (0.93 lagging power factor) of dynamic reactive power for each MW supplied at the connection point. The facility shall have the capability to supply this reactive power on a continuous basis at rated MW at a transmission voltage of 1.0 p.u.

The facility must also be capable of absorbing 0.251 MVAR (0.97 leading power factor) of dynamic reactive power for each MW supplied at the connection point. The facility shall have the capability to absorb this reactive power on a continuous basis at rated MW at a transmission voltage of 1.05 p.u.

For information on generator reactive requirements, reference the ‘Generator Power Factor Requirements’ document on the Duke Energy OASIS site:
http://www.oatioasis.com/DUK/DUKdocs/Generator_Interconnection_Information.html

Assuming the proposed generating facility will meet the VAR requirements as outlined in the Transmission Facilities Connection Requirements, evaluation of MVAR flow and voltages in the vicinity of the Customer’s site indicates adequate reactive support exists in the region.

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