Generator Interconnection
Feasibility Study Report

Wayne County, NC
Queue # 255-258: 01/01/2013
Total MW’s: 1000/1104 MW (Summer/Winter)

Queue #255-  195/224 MW (S/W)
Queue #256-  195/224 MW (S/W)
Queue #257-  415/432 MW (S/W)
Queue #258-  195/224 MW (S/W)

August 20, 2009
Progress Energy Carolinas, Inc.
Transmission Operations and Planning
PURPOSE
The purpose of this feasibility study is to assess the impacts of a group of generator interconnection requests on the reliability of the Progress Energy Carolina, Inc. (PEC) transmission system with respect to power-flow and short circuit issues. Estimates of the cost and time required to interconnect the generation as well as to resolve the impacts as determined in this feasibility analysis are also included. The PEC internal system analysis consists of an evaluation of the internal PEC transmission system utilizing documented transmission planning criteria. A scoping meeting for these requests was held on June 30th, 2009.

The requests are described in Table 1 below.

<table>
<thead>
<tr>
<th>PEC Generator Interconnection Queue No.</th>
<th>MW s/w</th>
<th>In-Service Date</th>
<th>County</th>
<th>PEC Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Queue #255</td>
<td>195/224</td>
<td>01/01/2013</td>
<td>Wayne County, NC</td>
<td>Lee Plant</td>
</tr>
<tr>
<td>Queue #256</td>
<td>195/224</td>
<td>01/01/2013</td>
<td>Wayne County, NC</td>
<td>Lee Plant</td>
</tr>
<tr>
<td>Queue #257</td>
<td>415/432</td>
<td>01/01/2013</td>
<td>Wayne County, NC</td>
<td>Lee Plant</td>
</tr>
<tr>
<td>Queue #258</td>
<td>195/224</td>
<td>01/01/2013</td>
<td>Wayne County, NC</td>
<td>Lee Plant</td>
</tr>
</tbody>
</table>

ASSUMPTIONS
The following feasibility study results are from the PEC internal power-flow models that reflect specific conditions of the PEC system at points in time consistent with the generator interconnection requests being evaluated. The cases include the most recent information for load, generation additions, transmission additions, interchange, and other pertinent data necessary for analysis. Future years may include transmission, generation, and interchange modifications that are not budgeted for and for which no firm commitments have been made. Further, PEC retains the right to make modifications to power-flow cases as needed if additional information is available or if specific scenarios necessitate changes. For the systems surrounding PEC, data is based on the ERAG MMWG model. The suitability of the model for use by others is the sole responsibility of the user. Higher queued generator interconnection requests were considered in this analysis.

The results of this analysis are based on Interconnection Customer’s queue requests including generation equipment data provided. If the facilities’ technical data or interconnection points to the transmission system change, the results of this analysis may need to be reevaluated.
RESULTS

Power-flow Analysis Results

Facilities that may require upgrade within the first three to five years following the in-service date are identified. Based on projected load growth on the PEC transmission system, facilities of concern are those with post-contingency loadings of 95% or greater of their thermal rating and low voltage of 0.92 pu and below, for the requested in-service year. The identification of these facilities is crucial due to the construction lead times necessary for certain system upgrades. This process will ensure that appropriate focus is given to these problem areas to investigate whether construction of upgrade projects is achievable to accommodate the requested interconnection service.

The generator was studied interconnected to PEC’s existing Lee 230 kV Substation at both 230 and 115 kV buses. Contingency analysis study results show that interconnection of this generation facility results in the following thermal issues on the PEC system. Based on study results for 2013 summer, Table 2 shows thermal facility loadings for this request:

<table>
<thead>
<tr>
<th>Transmission Facility</th>
<th>Loading %</th>
<th>Contingency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee Plant-Lee Sub 115 kV North Line</td>
<td>180.4</td>
<td>Lee Plant-Lee Sub 115 kV South Line</td>
</tr>
<tr>
<td>Lee Plant-Lee Sub 115 kV South Line</td>
<td>179.5</td>
<td>Lee Plant-Lee Sub 115 kV North Line</td>
</tr>
<tr>
<td>Goldsboro- Lee Sub 115 kV Line</td>
<td>142.8</td>
<td>Common Tower Outage of Lee Plant-Goldsboro 115 kV North and South Lines</td>
</tr>
<tr>
<td>Lee Plant 115 kV West Bus</td>
<td>134</td>
<td>Lee – Selma 230 kV Line</td>
</tr>
<tr>
<td>Lee Plant 115 kV East Bus</td>
<td>120</td>
<td>Lee Plant 115 kV West Bus</td>
</tr>
<tr>
<td>Lee Plant- Clinton 115 kV Line</td>
<td>96.4</td>
<td>Common Tower Outage of (future) Clinton-Lee 230kV Substation and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lee Sub – Wallace 115kV Lines</td>
</tr>
</tbody>
</table>

Estimate of Resolutions for Power-flow Impacts

The following are PEC’s current best estimates for resolution of impacts identified in Table 2 based on all four queue requests: Q255, 256, 257, and 258. Solutions, cost estimates and implementation schedules will be refined in the Customer’s Generator Interconnection Impact Study Report.

Cost Estimate: $30,000,000 (total)
Lee Plant – Lee Sub 115 kV North and South Lines

Potential Solution: Uprate to full conductor rating by replacing ancillary equipment & loop-in the existing Lee Plant-Clinton 115 kV Line into the Lee 230 kV Substation to create a third Lee Plant-Lee Sub 115 kV Line.

This project also requires rebuilding the section of 115 kV line between Lee SEP and Lee 230 kV substation that will become the third line. (Figure 1 & 2)

Estimated Cost: $2,000,000
Estimated Schedule: 06/01/2012

Goldsboro– Lee Sub 115 kV Line

Potential Solution: Construction of approximately 4 miles of new common tower 115 kV line between Seymour Johnson 115 kV Substation and Goldsboro 115kV Switching Station. This will create the Goldsboro 115 kV SS - Lee 230kV Sub 115 kV North Line using the existing Lee 230 kV Sub-Hemlock 115 kV Feeder. Also requires rebuilding of the existing section of Goldsboro 115 kV SS- Lee 230 kV Sub-South Line between Seymour Johnson 115 kV Substation and Goldsboro 115 kV SS. (Figure 3)

Estimated Cost: $10,000,000
Estimated Schedule: 01/01/2013

Lee Plant 115 kV East and West Busses

Potential Solution: Rebuild/Uprate the Lee Plant 115 kV East and West busses and relocate the bus tie breaker position. (Figure 4 & 5)

Estimated Cost: $3,000,000
Estimated Schedule: 06/01/2012, bus tie relocation 01/01/2013

Lee Plant– Clinton 115 kV Line

Potential Solution: Rebuild/Uprate the first two segments (approximately 10 miles) of the presently named Lee Plant-Clinton 115 kV Line between Lee 230 kV Sub and Tri-County EMC Dudley 115 kV Substations. (Figure 6)

Estimated Cost: $15,000,000
Estimated Schedule: 06/01/2014
LGIP Power Factor Requirements

PEC’s Large Generator Interconnection Procedure (LGIP) requires the proposed generating units be capable of delivering the power to the point of interconnection at a 0.95 lagging power factor. At the time of this report, specific MW generation levels and detailed generator step up (GSU) transformer information was not available. However, the generator capability curves and maximum estimated MW levels were provided by the Customer. Based on this information, operation will be at less than 234 MW Gross for each combustion turbine and less than 405 MW Gross for the steam turbine. Also, it is assumed that the GSU impedances will be fairly typical of existing similar installations. Under these assumptions, sufficient margin exists for the proposed generation to meet this requirement. If the Customer data changes from that provided, these results will need to be reevaluated.

Short Circuit Impacts and Facility Study Results

The proposed Wayne County units will result in the interrupting capability of area equipment being exceeded. Two 40 kA 230 kV breakers at Lee 230 kV Sub will have to be replaced with 63 kA breakers. Also, the replacement of 2-47 kA 115 kV breakers at Lee Plant which are currently associated with Queue request # 235 will be required.

These proposed units will also require the installation of a breaker failure scheme at Lee Plant. It is projected that this will require the construction of a completely new control building for Lee Plant switchyard.

Cost Estimate: $3,000,000 (total)
Estimated Schedule: 06/01/2012 (breaker failure scheme complete by 01/01/2013)

Interconnection of Customer’s Generation

This interconnection request is for the interconnection of a combined cycle (CC) generation facility consisting of four units (3 CTs and 1 ST). Two of the Combustion Turbines (CTs) will be connected to electrically separate 115 kV buses at the plant site. These two units will then be connected to the Lee 230 kV Sub 115 kV Switchyard through 2-115 kV lines, with one unit being connected to each 115 kV bus. The remaining CT and the Steam Turbine (ST) units will be connected through a single 230 kV Line from the plant site to the Lee 230 kV Sub 230 kV switchyard. The points of interconnection for the facility are shown on Figure 1.

Project: Construct 1- 230 kV Line from the plant site to the Lee 230 kV Sub 230 kV Switchyard, reterminate the Wommack North and Wommack South 230kV Lines and alter the future Clinton 230 kV Line termination.

Construct 2- 115 kV Lines from the plant site to the Lee 230 kV Sub 115 kV Switchyard connecting a 115 kV Line to each of the 115 kV buses at Lee 230 kV Sub. The interconnection of this generation will also require the expansion of the existing 115 kV switchyard at Lee 230 kV Sub.

Cost Estimate: $3,000,000 (total)
Estimated Schedule: 06/01/2012
SUMMARY
This Generator Interconnection Feasibility Study assesses the feasibility of interconnecting a new generation facility consisting of 4 units with a total NET summer/winter rating of 1000/1104 MW. Studies indicate that both thermal and short circuit upgrades are necessary to the PEC Transmission System to accommodate this queue request.

Additional studies will be performed if the customer proceeds with the System Impact Study to further verify these results and address generator stability.

<table>
<thead>
<tr>
<th>Category</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power-flow</td>
<td>$30,000,000</td>
</tr>
<tr>
<td>Stability</td>
<td>N/A as part of Feasibility</td>
</tr>
<tr>
<td>Short Circuit</td>
<td>$3,000,000</td>
</tr>
<tr>
<td>Interconnection</td>
<td>$3,000,000</td>
</tr>
<tr>
<td>Total Estimate</td>
<td>$36,000,000</td>
</tr>
</tbody>
</table>
- Figure 1 -
- Figure 2 -

**LEE 230 KV SUB**

- Replace switches & CTA with 2000 amp min. equipment.

**LEE SUB 115 KV NORTH & SOUTH**

- Upgrade LEE SEP.
- LEE 230KV SUB 115KV NORTH & SOUTH.
- Expected line ratings are: 303S/334MVA - NORTH & 300S/346MVA - SOUTH.

**Lee SEP**

- Replace switches & CTA with 2000 amp min. equipment.

**Target Date: 01-01-13**

- LEE SEP - LEE 230 KV SUB.
- Upgrade North & South 115 KV Lines (associated with Wayne CC).

REV. 06/29/09

YKZ 1 OF 1
REBUILD EAST AND WEST 115 KV BUSES
MINIMUM CAPACITY TO BE 797 MVA (4000A)

INSTALL BREAKER FAILURE SCHEME AT LEE SEP,
THIS WILL REQUIRE CONSTRUCTION OF A
COMPLETELY NEW CONTROL BUILDING

REV. 08/20/09

| TARGET DATE: 06-01-12 | LEE PLANT REBUILD 115 KV EAST & WEST
|------------------------| BUSES & INSTALL BREAKER FAILURE SCHEME
| JDW | 1 OF 1 | (ASSOCIATED WITH WAYNE CC)
- Figure 5 -

[Diagram of Lee Plant with labels and connections]

REV. 08/18/09

<table>
<thead>
<tr>
<th>TARGET DATE: 01-01-13</th>
<th>LEE PLANT RELOCATE 115 KV EAST &amp; WEST BUSES TIE</th>
</tr>
</thead>
<tbody>
<tr>
<td>YKZ</td>
<td>1 OF 1 (ASSOCIATED WITH WAYNE CC)</td>
</tr>
</tbody>
</table>

Generator Interconnection Feasibility Study Report:
Wayne County, NC Queue #255, 256, 257, 258
Progress Energy Carolinas
Transmission Operations and Planning
August 20, 2009