

Transmission Facilities Study of Resource Options for the Public Works Commission of Fayetteville, North Carolina

CP&L

**September 1, 2000
System Planning & Operations Department**

Purpose

An agreement to perform studies per CP&L's OATT was made effective on July 7, 2000 with a signed agreement between CP&L and Fayetteville PWC. The purpose of this study is to determine facilities needed to provide transmission service for power supply options B, E, G, and I as specified by The Public Works Commission of Fayetteville, North Carolina (PWC or FayPWC).

Methodology

The results were obtained using the Power Technologies Incorporated (PTI) PSS/E and MUST software. The solutions described below address the issues identified in the System Impact Study. These solutions were also tested against approved NERC, SERC, and CP&L Planning and Operating Standards.

Request

The period of the study is July 1, 2004 through June 30, 2014. The information provided by FayPWC in their request document dated February 25, 2000 was utilized. The proposals in that document are restated below:

- B. Delivery of full requirements service from a new resource located on CP&L's 230 kV transmission system near the BWGP combined with BWGP, SEPA, and South Carolina Electric and Gas Company (SCE&G) system resources. The new resource is expected to be interconnected with CP&L at the BWGP bus. Up to 300 MW from the new resource, 260 MW from BWGP, and 400 MW from the SCE&G system may be utilized as network resources. Under this alternative, PWC's load will be incorporated into SCE&G's control area.
- E. Delivery of full requirements service from a new gas-fired resource located near Laurinburg combined with the BWGP and SEPA resources. The new resource near Laurinburg will be interconnected with CP&L's Weatherspoon Plant - Laurinburg 230 kV transmission line. Network resources are expected to include up to 500 MW from the new resource and 260 MW from BWGP.
- G. Delivery of full requirements service from system resources of SCE&G combined with the BWGP and SEPA resources. SCE&G's system resources will be supplied over interconnections between CP&L and SCE&G. Network resources are expected to include up to 500 MW of SCE&G system generation and 260 MW of BWGP output. Under this alternative, PWC's load will be incorporated into SCE&G's control area.
- I. Delivery of full requirements service from system resources of American Electric Power Company (AEP) combined with the BWGP and SEPA resources. AEP's system resources will be supplied over interconnections between CP&L and AEP. Network resources are expected to include up to 500 MW of AEP system generation and 260 MW of BWGP output. Under this alternative, PWC's load may be incorporated into AEP's control area.

Assumptions

This analysis includes the impact of firm transactions from the known sources and sinks as well as any committed transmission system upgrades or the addition of generation that CP&L is currently aware of. This analysis does not include the impacts that any future transactions may have on the CP&L transmission system. Additionally, this analysis does not include the impact a future Regional Transmission Organization (RTO) may have.

This analysis focuses on the impacts to the CP&L system due to FayPWC's proposals of generation additions internal to the CP&L control area and proposals for importing power from control areas external to the CP&L system.

Results

The following are the results of CP&L's analysis of FayPWC options. If appropriate, the explanation is categorized by the *generation addition* and *external purchase*. These results are not applicable for modification to the stated resource size, location, or schedule. In addition, the cost estimates to mitigate the transmission system limits found are good faith estimates based on the current knowledge and assumptions.

- B. Install a new 300 MW unit at BWGP; SCE&G 400 MW purchase; existing FayPWC resources.
300MW Unit at BWGP and SCE&G 400 MW Purchase

System Impact Study Results

300 MW Unit at BWGP

In 2004, with this new generator online at 300 MW, one of CP&L's Fayetteville 230/115 kV banks overloads to 103% under contingency.

In 2006, CP&L's Weatherspoon Plant – Delco 115 kV line overloads to 110% under contingency.

SCE&G 400 MW purchase

For the impact of the SCE&G purchase see the results for **G**.

Transmission Facilities Study Results

300 MW Unit at BWGP

The generator interconnection for the 300 MW Unit at BWGP will require the addition of a second bus at the Fayetteville East 230 kV substation. This generation addition will require the relocation of two CP&L line terminations into breaker and 1/2 and double breaker arrangements. This generation addition will also require the connection for Fayetteville PWC to be placed into a double breaker arrangement. Please see Figure 1 for the details of this arrangement.

The proposed solution to mitigate the overload of the Fayetteville 230/115 kV transformer banks is to accelerate the replacement of the two existing 200 MVA

transformer banks with two 300 MVA transformer banks from 2005 to 2004. This project is currently in CP&L's Transmission Plan with a target date of June 2005. Please see Figure 2 for the details of this arrangement.

The overload of the Weatherspoon Plant - Delco 115 kV line will require that the project to upgrade this line from its current ratings be accelerated from 2005 to 2004. This upgrade will require two sections of the transmission line, the Weatherspoon - Bladenboro and the Bladenboro - Elizabethtown, to be raised to its full conductor capacity. This project is currently in CP&L's Transmission Plan with a target date of June 2005. Please see Figure 3 for the details of this arrangement.

SCE&G 400 MW purchase

South Carolina Electric & Gas personnel reviewed the import capability limit identified in the System Impact Study for imports from SCE&G. This additional review determined the import limit identified would not limit CP&L imports from SCE&G. Therefore the full import amount of 400 MW requested from SCE&G can be accommodated by the CP&L transmission system.

Cost Responsibility and Schedule

The costs of Network Upgrades at the Fayetteville East 230 kV Substation are estimated to be \$2,060,204 and the cost of Transmission Connection Facilities are estimated to be \$1,315,144. Fayetteville PWC will be responsible for all costs. Once Fayetteville PWC takes transmission service for this option B under CP&L's OATT, FPWC will begin receiving credits against transmission service for costs that are Network Upgrades. The addition of the new facilities will result in the termination of Fayetteville PWC's current leased facilities charges associated with the Fayetteville East 230 kV Substation.

The cost to accelerate the replacement of the two transformer banks at the Fayetteville 230 kV Substation is estimated to be \$973,343. This will be a Network Upgrade cost.

The cost to accelerate the upgrade of the two sections of the Weatherspoon Plant - Delco 115 kV Line is estimated to be \$227,893. This will be a Network Upgrade cost.

The projected completion date of the above transmission upgrades is June 1, 2004.

- E. Install a new 500 MW unit on CP&L's Weatherspoon Plant - Laurinburg 230 kV line; existing FayPWC resources.
500 MW unit on CP&L's Weatherspoon Plant - Laurinburg 230 kV line

System Impact Study Results

The unit was modeled as 500 MW at CP&L's Rowland 230 kV tap approximately midway on CP&L's Weatherspoon Plant - Laurinburg 230 kV line. In 2004, the section of line between the Rowland 230 kV tap (assumed point of interconnection) and the Weatherspoon 230 kV terminal overloads to 110 % under contingency. Similar results would occur if the unit was tapped instead near Maxton, NC on the Weatherspoon Plant - Laurinburg 230 kV line. In addition, stability study results found prolonged oscillations with magnitudes large enough to recommend the installation of power system stabilizers on the new unit(s).

Transmission Facilities Study Results

The connection of the generation to the CP&L transmission system will require the establishment of a 230 kV generator switching station. CP&L's existing Weatherspoon Plant - Laurinburg 230 kV transmission line will be looped into the generator switching station. Please see Figure 4 for the details of this arrangement.

The solution to the line overload identified in the system impact study is to construct a new 230 kV transmission line approximately 25 miles long from the generator switching station to the Weatherspoon Plant 230 kV bus. This solution will also require the installation of two 230 kV circuit breakers at the Weatherspoon Plant. These facilities will be Network Upgrades. Please see Figure 4 for the details of this arrangement.

Cost Responsibility and Schedule

The cost to construct the generator switching station is estimated to be \$5,512,538. The cost to loop the existing Weatherspoon-Laurinburg 230 kV Line into the generator switching station (assumed to be 0.5 miles away) is estimated to be \$537,676. These costs will be the responsibility of Fayetteville PWC and will be Transmission Connection Facilities.

The cost of the Network Upgrade to construct the 25 mile transmission line from the generator switching station to the Weatherspoon Plant is estimated to be \$14,908,273. The cost of the Network Upgrade to install the two additional breakers at the Weatherspoon Plant is estimated to be \$1,031,058. The cost of these Network Upgrades will be the responsibility of Fayetteville PWC. Once Fayetteville PWC takes transmission service for this option E under CP&L's OATT, FPWC will begin receiving credits against transmission service for costs that are Network Upgrades.

The projected completion date of the above transmission upgrades is June 1, 2004. This schedule assumes the availability of R-O-W for construction of the new transmission line and substation.

- G. SCE&G 500 MW purchase; existing FayPWC resources.
SCE&G 500 MW purchase

System Impact Study Results

In 2004, no problems were found with a SCE&G import of up to 223 MW. This import is the amount required to serve the FayPWC forecasted load with Butler Warner Generation Plant online at 260 MW.

Imports from the SCE&G interface are limited to a maximum value of 300 MW. CP&L's transfer capability reaches zero under contingency when imports exceed this amount.

Transmission Facilities Study Results

South Carolina Electric & Gas personnel reviewed the import capability limit identified in the System Impact Study for imports from SCE&G. This additional review determined the import limit identified would not limit CP&L imports from SCE&G. Therefore the full import amount of 500 MW requested from SCE&G can be accommodated by the CP&L transmission system.

- I. AEP 500 MW purchase; existing FayPWC resources.
AEP 500 MW Purchase

System Impact Study Results

In 2004, no problems were found with an AEP import of up to 223 MW. This import is the amount required to serve the FayPWC forecasted load with Butler Warner Generation Plant online at 260 MW.

Imports from the AEP interface are limited to a maximum value of 450 MW. CP&L's transfer capability reaches zero under contingency when imports exceed this amount.

Transmission Facilities Study Results

Additional investigation into the import capability limit revealed that two switches were the limiting elements at the Raleigh Blue Ridge 230 kV tap on the Method - Duke Power East Durham 230 kV line. These switches are currently rated for 1600 A. Replacing these switches with switches rated for 2000 A can mitigate this import capability limit. Please see Figure 5 for the details of this arrangement.

Cost Responsibility and Schedule

The cost to install the new 2000 A switches is estimated to be \$85,459. The cost of this Network Upgrade will be the responsibility of Fayetteville PWC. Once Fayetteville PWC takes transmission service for this option I under CP&L's OATT, FPWC will begin receiving credits against transmission service for costs that are Network Upgrades.

The projected completion date of the above transmission upgrades is June 1, 2004.