

***PJM Generator Interconnection  
S102 Ladysmith 230-kV  
Feasibility Study***

## **Preface**

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

In some instances an interconnection customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, may also contribute to the need for the same network reinforcement. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

## **General**

The Queue S102 project was studied as a 170 MW (Capacity) injection at Ladysmith 230 kV substation. The project was evaluated for compliance with reliability criteria for summer peak conditions in 2012. Potential network impacts are provided in the Network Impacts section below.

Dominion's Planning Criteria requires that the transmission system must be capable of importing and exporting power in excess of existing scheduled transfers between utilities. The system must be capable of handling this incremental transfer with any single facility (first contingency) out of service and not exceed the maximum continuous rating of any remaining facility. Any new facility that is connected to the transmission system should not significantly decrement First Contingency Incremental Transfer Capability (FCITC) for transfers between utilities. Also Dominion's Planning Criteria requires that no facility be loaded to more than 94% of its emergency rating for an outage. For this same outage voltages can not be less than 93% of nominal with the exception of 500 kV voltages where it is desired to maintain a minimum of 101% of nominal voltage for an outage. A complete listing of Dominion's Planning Criteria along with interconnection requirements can be found in Dominion's Facility Connection Document which is publicly available on the Dominion Web Site.

Dominion used a 2012 RTEP case for the generation feasibility study. This case was supplied to Dominion on August 16, 2007 by PJM. Dominion modified this case to include all higher order Queue generation requests including proposed network facilities associated with these projects. This included the following Queue requests being modeled: P8 – 600 MW, P9 – 91 MW, P16 340 MW, P38 - 625 MW, Q65 - 1594, R19-340 MW, R31 – 8 MW, R63 – 19 MW, S52-600 MW S74 through S99 Projects. Generation was scaled down proportional throughout the PJM System, including the Dominion System, to accommodate this increase in generation.

## **Network Impacts**

### **Generator Deliverability**

*(Single or N-1 contingencies for the Capacity portion only of the interconnection)*

No Problems were identified.

### **Multiple Facility Contingency**

*(Double Circuit Tower Line contingencies only for the full energy output. Stuck breaker and bus fault contingencies will be performed for the Impact Study)*

No Problems were identified.

### **Contribution to Previously Identified Overloads**

*(This project contributes to the following contingency overloads, i.e. “Network Impacts”, identified for earlier generation or transmission interconnection projects in the PJM Queue)*

1. Contribution of 24 MW further overloads the Conastone – Peachbottom CKT 1 500 kV line is from 157% to 158% of its emergency rating (2598 MVA) for the outage of Conastone – Peach Bottom CKT 2 (Cont Id. PJM17\_2). The first project to cause this overload is Q90. Other projects which contribute to this overload are: R03, R14, R15, R16, R17, R29, R30, R33, R35, R44, R47, R60, R61, R64, R77, R76, R78, R80, R88, R96, S12, S17, S18, S23 and S29.
2. Contribution of 24 MW further overloads the Conastone – Peachbottom CKT 2 500 kV line is from 157% to 158% of its emergency rating (2598 MVA) for the outage of Conastone – Peach Bottom CKT 1 (Cont Id. PJM17). The first project to cause this overload is Q90. Other projects which contribute to this overload are: R03, R14, R15, R16, R17, R29, R30, R33, R35, R44, R47, R60, R61, R64, R76, R77, R78, R88, R96, S12, S17, S18, S23 and S29.
3. Contribution of 27 MW further overloads the Kemptown – N NWest 500 kV line from 192% to 193% of its normal rating (2078 MVA).

The first project to cause this overload is P43. Other projects which contribute to this overload are: P54, Q01, Q03, Q43, Q48, Q49, Q50, Q51, Q57, Q65, Q68, Q75, R17, R19, R30, R33, R35, R44, R61, R76, R77, R78, R80, R88, S12, S17, S18, S29, S31, S52, S55, S56, S57, S58, S62 and S100.

4. Contribution of 23 MW further overloads the N NWest – Conastone 500 kV line from 119% to 120% of its normal rating (2078 MVA). The first project to cause this overload is S18. Other projects which contribute to this overload are: S29, S52, S56, S100, S102, S110, S112, S114 and S115.
5. Contribution of 26 MW further overloads the Kemptown – N NWest 500 kV line is from 218% to 219% of its emergency rating (2901 MVA) for the **tower** outage of Granite to High Ridge Ckts #2312 & #2332-A (Cont Id. GRNITE\_HRDG). The first project to cause this overload is P38. Other projects which contribute to this overload are: P39, P42, P43, P46, P54, Q01, Q03, Q32, Q39, Q43, Q48, Q49, Q50, Q51, Q57, Q60, Q65, Q68, Q75, Q79, Q80, R03, R16, R17, R19, R22, R29, R30, R33, R35, R44, R47, R49, R52, R54, R55, R59, R60, R61, R64, R65, R76, R77, R78, R79, R80, R88, R96, S06, S12, S14, S17, S18, S26, S29, S31, S36, S37, S45, S46, S51, S52, S54, S55, S56, S57, S58, S62, S71, S72, S73, S100 and S101.

### **New System Reinforcements**

*(Upgrades required to mitigate reliability criteria violations, i.e. “Network Impacts”, initially caused by the addition of this project generation)*

To be determined at the System Impact Study.

### **Contribution to Previously Identified System Reinforcements**

As identified above, there are overloads initially caused by prior queue positions and additional contribution to the overloading by this project. This project will have a percentage allocation to the cost responsibility, which will be calculated and reported for the System Impact Study.

### **Short Circuit**

PJM and Dominion studies indicate that there is no impact to breaker interrupting capabilities in Dominion's service area due to S102. These results are subject to change due to changing system conditions.

**Dominion Facility Connection Requirements**

The results of the FCITC Studies under import and export conditions indicate the following.

**Import Study Results**

<b>Imports</b>			
<b>Area</b>	<b>Summer 2012</b>	<b>Summer 2012 with S102</b>	<b>Limiting Element</b>
AEP	2000+	2000+	NA
APS	2000+	2000+	NA
CPL	2000+	2000+	NA
PJM	2000+	2000+	NA

**Export Study Results**

<b>Exports</b>			
<b>Area</b>	<b>Summer 2012</b>	<b>Summer 2012 with S102</b>	<b>Limiting Element</b>
AEP	2000+	2000+	NA
APS	2000+	2000+	NA
CPL	1646	1585	Halifax – Person (CP&L)
PJM	1436	1277	Pleasant View – Dickerson(PEPCO)

This facility contributes to a previously identified import and export violation. The previous queue project that caused the initial violation was Q65. The reinforcement for this violation was identified as:

*Establish a new 230 kV Switching Substation at Ladysmith CT Substation and loop Line #256 (Elmont – Four Rivers) into the site. The line extension would be 5 miles long and would use existing right-of-way. This project is estimated to cost \$11 million dollars and is estimated to take five years to complete.*

In addition to S102, R19 also contributes to this violation. Both R19 and S102 projects will have a percentage allocation to the cost responsibility, which will be calculated and reported for the Impact Study.

**Attachment Facilities**

The work and material listed below are required to connect the new combustion turbines to the new five breaker ring bus at Ladysmith CT Substation. Purchase and install the following:

- One (1) 230kV, 3000 amp, 50kA SF6 circuit breakers
- One (1) 230kV, 3000 amp center-break disconnect switches.
- One (1) 230kV, Relay Accuracy Coupling Capacitor Voltage Transducers(CCVTs). One of the four will be installed on bus #1 for existing units.
- 5” aluminum bus, steel support structures (including switch supports, bus supports, CCVT supports and arrester supports), conduit, control cable and cable trough, grounding material, conductor and connectors, and foundations as required.

The estimated cost for the Attachment Facilities is \$ 650,000.