

**PJM Generator Interconnection  
X1-038 Union Camp 115 kV  
0 MW Capacity / 38 MW Energy  
Feasibility Study Report**

*August 2011  
DMS #654142v1A*

## **Introduction**

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, §36.2, as well as the Feasibility Study Agreement between Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Virginia Electric and Power Company.

## **Preface**

The intent of this Feasibility Study is to determine a plan, with preliminary cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by IC. As a requirement for interconnection, IC 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 and the underlying system. All facilities required for interconnection of a generation interconnection project must be designed to meet ITO technical specifications.

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. IC is responsible for its right of way, real estate, and construction permit issues.

## **General**

Queue project X1-038 was studied as a(n) 35.0 MW (0.0 MW of which was Capacity) injection into Dominion's system at the Union Camp 115 kV substation. Project X1-038 was evaluated for compliance with reliability criteria for summer peak conditions in 2015.

## **Network Impacts:**

### **Generator Deliverability**

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

No problems identified.

### **Multiple Facility Contingency**

*(Double Circuit Tower Line Contingencies only with full energy output. Stuck Breaker and Bus Fault contingencies will be applied during the Impact Study)*

No problems identified.

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

*(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have % allocation of cost responsibility which will be calculated and reported for the Impact Study.)*

No problems identified.

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

*(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)*

None.

### **Short Circuit**

*(Report Overdutied breakers here)*

Existing facility; not required.

### **Energy Portion of Interconnection Request**

*PJM also studied the delivery of the energy portion of the surrounding generation. Any potential problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Transmission Interconnection request.*

*Note: Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which analyzes all overload conditions associated with the overloaded element(s) identified. As a result of the aggregate energy resources in the area, the following violations were identified.*

No problems identified.

## ITO Analyses

IC requested an interconnection of one (1) 69.35 MVA gas generator and one (1) 42.5 MVA biomass generator (PJM Queue X1-038). The IC's generator units are located at 34040 Union Camp Drive, Franklin, Virginia 23851. IC desires to export all excess power generated during startup or maintenance for a total of 35 megawatts (MW) to be injected into the ITO's distribution system. IC has specified that the Franklin Mill load consists of induction motors and lightning loads which total 32 MW.

### Modifications Required:

Modifications are required to existing Union Camp Substation to accommodate proposed interconnection. Modifications inside the substation will include:

Replace existing metering to accommodate real time data. The total estimated cost of the metering modification work is \$10,000.

### Existing Facilities Required:

The existing facilities required to provide the interconnection will include:

1. Metering
2. Generator out of sync protection
3. Reverse power guard

The existing facilities were installed under a January 7, 2002 Purchase of Electricity Agreement and a Letter Supplement to that agreement dated December 18, 2009 for an estimated cost of \$86,875, of which \$34,339 was not paid for upfront. This \$34,339 includes the out of synchronization protection and reverse power guard and must be paid for upfront, before an ISA can be executed.

IC will be responsible for the upfront cost of the new metering of \$10,000 and the \$34,339 that was not paid upfront for the out of sync protection and reverse power guard for a total of \$44,339.

The IC will also be responsible for providing and maintaining telephone lines to the ITO's metering

equipment at the Point of Interconnection and provide all communication lines necessary to transmit data from the metering to PJM.

The estimated time for engineering, material acquisition and construction of this interconnection is approximately three months. Detailed engineering, costs, material lead times and construction time requirements will be determined as part of the System Impact Study.

### Technical Requirements

Based on the information provided, the IC site will be interfacing with the ITO source in the following manner:

- IC facility is fed by Union Camp Substation Transformers # 1, 2 , 4 and 5 all fed by both Suffolk line 68 and Southampton line 93 through the 115 kV bus #1.
- The load data for the pertinent sectionalizing devices are as follows:
  - Line 93 to Southampton NUG has a typical "light" loading of 5.24 MVA
  - Line 68 to Suffolk has a typical "light" loading of 3.26 MVA
- IC parallel operation will not be limited to any particular time or utility circuit-loading condition.
- IC will be contracted to export power into the ITO system.

Based on the minimum circuit loads given for the ITO sectionalizing devices, the following minimum "Local Load to Customer Generation Capacity" ratios will apply for this installation:

ITO Transmission Line	Minimum Ratio
Line 68	0.07
Line 93	0.12

These minimum ratios applicable for this installation will require the customer to have Direct Pilot Wire Tripping (or Transfer Trip) installed from the ITO devices 6882, 9382 to all four IC main (i.e. 602A, 603A, U-609B and U-607B). The direct trip control features are meant to ensure that a "prolonged" (or "permanent") islanding condition (with the IC generation supplying utility load in the absence of the ITO source) will not be set-up.

In its current design, the protection scheme at the Union Camp substation is set up to initiate tripping of all IC's breakers during a system disturbance through basic over-current or breaker failure scheme for disturbances at the local level. A transfer trip combined with an islanding scheme initiated from the affected portion of the line to the other non-affected line (i.e. Line 93 or 68) will operate all IC main and the terminal breakers 6882 and 9382 for disturbances at the transmission level. Those direct tripping functions should be sufficient to sectionalize the customer generation for any opening of the respective devices and prevent an islanding condition. In addition, the base protection package described below will also be required.

The required relay functions (each sectionalizing all of the IC generation) and the corresponding setting ranges, applying for each of the designated ITO feeds, are listed in the following tables:

Function	Set Point	Duration To Disconnection (seconds)		
		Preferred	Maximum	
27	Undervoltage	90% of nominal operating voltage	Less than 2.0	2.0
59	Overvoltage	106 to 110% of nominal operating voltage	Less than 2.0	2.0
81U	Underfrequency	59.0 to 59.5 Hz	Less than 2.0	2.0
810	Overfrequency	60.5 to 61.0 Hz	Less than 2.0	2.0
51	Phase Time-delay Overcurrent	Set for minimum, with adequate load allowance	Maintain proper coordination	
51N	Ground Time-delay Overcurrent	Set for minimum, with adequate imbalance allowance	Maintain proper coordination	

