

***Generation Interconnection
Feasibility Study Report***

For

***PJM Generation Interconnection Request
Queue Position AC2-125***

***Ladysmith1 230kV
14.9MW Capacity / 19MW Energy***

October / 2017

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 the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Virginia Electric and Power Company (VEPCO).

Preface

The intent of the Feasibility Study is to determine a plan, with high level estimated cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the IC. The IC may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the IC may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, 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 IC is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by ITO, the costs may be included in the study.

General

The IC has proposed to uprate a natural gas generating facility located in Woodford, VA (Carolina County). The installed facilities will have a total capability of 209 MW with 166 MW of this output being recognized by PJM as capacity. This queue request is for an additional 19 MW of energy and 14.9 MW of capacity over the current Interconnection Agreement. The proposed in-service date for this project is 6/01/2017. **This study does not imply an ITO commitment to this in-service date.**

Point of Interconnection

AC2-125 interconnects with the ITO transmission system at Ladysmith 230kV substation.

The AC2-125 project may be responsible for a contribution to the following costs:

| Description | Total Cost |
|--------------------------------|---------------------|
| New System Upgrades | \$0 |
| Previously Identified Upgrades | \$50,000,000 |
| Total Costs | \$50,000,000 |

Cost allocations for these upgrades will be provided in the System Impact Study Report.

Transmission Owner Scope of Work

The existing attachment facilities are sufficient. The single line is shown below in Attachment 1.

System Reinforcement

| Violation # | Upgrade Description | Upgrade Cost |
|------------------------|---|---------------------|
| # 1 | Wreck and rebuild the existing Chance – Ladysmith 500kV line since overload exceeds conductor rating of 2913 MVA by 3.1% new line rating 4300 MVA. It is estimated to 36-48 months to engineer, permit and construct (VA CPCN is required). | \$50,000,000 |
| Total Network Upgrades | | \$50,000,000 |

Interconnection Customer Requirements

ITO's Facility Connection Requirements as posted on PJM's website

<http://www.pjm.com/~media/planning/plan-standards/private-dominion/facility-connection-requirements1.ashx>

Revenue Metering and SCADA Requirements

PJM Requirements

The IC will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Sections 24.1 and 24.2.

Network Impacts

The Queue Project AC2-125 was evaluated as a 14.9 MW (Capacity 14.9 MW) uprate to Ladysmith Unit 1 in the ITO area. AC2-125 also requested a 19 MW MFO increase that is achievable during the non-summer months. Project AC2-125 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC2-125 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2020

Generator Deliverability

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

None

Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

None

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

None

Contributions to previously identified circuit breakers found to be over-duty:

None

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)

None

Steady-State Voltage Requirements

(Summary of the VAR requirements based upon the results of the steady-state voltage studies)

To be determined during Impact Study

Stability and Reactive Power Requirement for Low Voltage Ride Through

(Summary of the VAR requirements based upon the results of the dynamic studies)

To be determined during Impact Study

New System Reinforcements

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

None

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

Potential Congestion due to Local Energy Deliverability

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

Note: Only the most severely overloaded conditions are listed below. 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 shall study all overload conditions associated with the overloaded element(s) identified.

None

Light Load Analysis

Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

ITO Analysis

ITO assessed the impact of the proposed Queue Project #AC2-125 interconnection of a 19 MW Energy (14.9 MW Capacity) injection into the ITO's Transmission System at the Ladysmith 230kV substation, for compliance with NERC Reliability Criteria on ITO's Transmission System. The system was assessed using the summer 2020 RTEP case provided to ITO by PJM. When performing a generation analysis, ITO's main analysis will be load flow study results under single contingency (both normal and stressed system conditions). ITO Criteria considers a transmission facility overloaded if it exceeds 94% of its emergency rating under normal and stressed system conditions. A full listing of ITO's Planning Criteria and interconnection requirements can be found in the ITO's Facility Connection Requirements which are publicly available at: <http://www.dom.com>.

The results of these studies evaluate the system under a limited set of operating conditions and do not guarantee the full delivery of the capacity and associated energy of this proposed generation facility under all operating conditions. NERC Planning and Operating Reliability Criteria allow for the re-dispatch of generating units to resolve projected and actual deficiencies in real time and planning studies. Specifically NERC Category C Contingency Conditions (Bus Fault, Tower Line, N-1-1, and Stuck Breaker scenarios) allow for re-dispatch of generating units to resolve potential reliability deficiencies. For ITO's Planning Criteria the re-dispatch of generating units for these contingency conditions is allowed as long as the projected loading does not exceed 100% of a facility Load Dump Rating.

As part of its generation impact analysis, the ITO routinely evaluates the impact that a proposed new generation resource will have under maximum generation conditions, stress system conditions and import/export system conditions (greater than 20 MW). The results of these studies are discussed in more detail below.

Category B Analysis (Single Contingency):

1. System Normal – No deficiencies identified
2. Critical System Condition (No Surry 230 kV or Possum Point 6 Unit) –

Critical Condition - No Possum Point 6

| # | Contingency | | Affected Area | Facility Description | Bus | | | Power Flow | Loading % | | Rating | | MW Contribution |
|---|-------------|--------|---------------|------------------------------|--------|--------|---------|------------|-----------|--------|--------|--------|-----------------|
| | Type | Name | | | From | To | Circuit | | Initial | Final | Type | MVA | |
| 1 | N-1 | LN 568 | DVP - DVP | 8LDYSMTH-8CHANCE 500 kV line | 314911 | 314905 | 1 | DC | 99.93 | 100.04 | ER | 2738.2 | 3.01 |

Category C Analysis: (Multiple Facility Analysis)

1. Bus Fault - No deficiencies identified
2. Line Stuck Breaker - No deficiencies identified

3. Tower Line – No deficiencies identified

The import and export conditions into and out of the ITO System are evaluated with any new interconnection greater than 20 MW, any new facility that is interconnected with the ITO System should not significantly decrement FCITC between utilities. These studies will be performed during the System Impact Study.

New System Reinforcements

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

| Violation # | Overloaded Facility | Upgrade Description | Network Upgrade Number | Upgrade Cost |
|----------------------------|------------------------------|--|------------------------|--------------|
| # 1 | 8LDYSMTH-8CHANCE 500 kV line | Wreck and rebuild the existing line since overload exceeds conductor rating of 2913 MVA by 3.1% new line rating 4300 MVA. It is estimated to 36-48 months to engineer, permit and construct (VA CPCN is required). | Pending | \$50,000,000 |
| Total New Network Upgrades | | | | \$50,000,000 |

Affected System Analysis & Mitigation

Duke, Progress & TVA Impacts:

Duke Carolina, Progress, & TVA Impacts to be determined during later study phases (as applicable).

Attachment 1.
System Configuration