Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AA1-038

Lexington – Low Moor 230kV 10.1MW Capacity / 78.2MW Energy

February / 2015

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 (VEPCO).

Preface

The intent of the Feasibility Study is to determine a plan, with ballpark 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

Rocky Ford Wind I, LLC, the Interconnection Customer (IC), has proposed a wind generating facility located south east of Daggers Springs, VA. The installed facilities will have a total capability of 78.2 MW with 10.1 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is 8/14/2021. **This study does not imply an ITO commitment to this in-service date.**

Point of Interconnection

AA1-038 will interconnect with the ITO transmission system via a new three breaker ring bus switching station that connects on to the Lexington – Low Moor 230kV transmission line.

Cost Summary

The AA1-038 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$1,800,000
Direct Connection Network Upgrades	$5,300,000
Non Direct Connection Network Upgrades	$0
Total Cost	**$7,100,000**

Attachment Facilities

Transmission Line - facilities include one feed from the ITO's switching station to the IC's collector station. Since the IC's arrangement is unknown at this time, the estimate for this study includes an overhead line estimated at 1000' from ITO's switching station with one intermediate structure, a 230kV backbone structure at the IC collector station and 230kV backbone at the switching station. Once the IC's plant layout and proximity is determined, this can be reevaluated to better determine the most cost effective attachment arrangement. Estimated Cost $1,800,000 dollars (including metering). These costs do not include CIAC Tax Gross-up. It is estimated to take 24-30 months to complete this work. The single line is shown in Attachment 1.

Direct Connection Cost Estimate

Substation - The cost and scope for the direct connection network upgrades includes cutting the 2084 line between Lexington and Low Moor Substations and turning it into a newly constructed 230kV switching station with a three breaker ring. Since the arrangement and exact location of the IC collector station is not known, an assumption had been made that property for the switching station will need to be acquired and graded and these costs are included. Once the IC's plant layout is determined, this can be reevaluated to better determine the most cost effective attachment arrangement. Estimated cost to construct a three breaker 230 kV ring bus is $4,500,000 dollars and is estimated to take 24-30 months to permit and construct. See Attachment 1.

Transmission – Install transmission structure in-line with transmission line to allow the proposed interconnection substation to be interconnected with the transmission system. Estimated cost $800,000 dollars and is estimated to take 24-30 months to complete. See Attachment 1.

Non-Direct Connection Cost Estimate

Remote Terminal Work: During the Facility Study, ITO's System Protection Engineering Department will review transmission line protection as well as anti-islanding required to accommodate the new generation and interconnection substation. System Protection Engineering will determine the minimal acceptable protection requirements to reliably interconnect the proposed generating facility with the transmission system. The review is based maintaining system reliability by reviewing ITO protection requirements with the known transmission system configuration which includes generating facilities in the area. This review may determine that transmission line protection and communication upgrades are required at remote substations.

Interconnection Customer Requirements

VEPCO 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 Interconnection Customer 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 AA1-038 was studied as a 78.2 MW (Capacity 10.1 MW) injection as a tap of the Lexington – Lowmoor 230 kV line in the Dominion area. Project AA1-038 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners) for summer peak analysis in 2018. Project AA1-038 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Contingency Descriptions

The following contingencies resulted in overloads:

None

Generator Deliverability

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

None

Multiple Facility Contingency

(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)

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 the System 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 if required 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)

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 developer 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

ITO Analysis

ITO assessed the impact of the proposed Queue Project #AA1- 038 interconnection of a 10.1 MW Capacity (78.2 MW Energy) injection into the ITO's Transmission System, for compliance with NERC Reliability Criteria on ITO Transmission System. The system was assessed using the summer 2018 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's 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, 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. 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 Unit) – No deficiencies identified.

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's System are evaluated with any new interconnection greater than 20 MW, any new facility that is interconnected with the ITO's System should not significantly decrement FCITC between utilities. No studies are required since the proposed queue request is less than 20 MW Capacity.

Attachment 1.

System Configuration