

PJM Generator Interconnection
W3-019 Shawboro 230 kV
19.5 MW Capacity / 150 MW Energy
Feasibility Study Report

January 2011
DMS #628848v1

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 W3-019 is an IC 150 MW energy (19.5 MW Capacity) wind farm interconnection request. W3-019 generation will be located nowrthwest of Shawboro, NC. The project was studied as an injection into ITO's system at the 50.0% tap between Fentress 230 kV and Sligo 230 kV line. Project W3-019 was evaluated for compliance with reliability criteria for summer peak conditions in 2014. The requested in-service date is December 31, 2013.

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 Overduty breakers here)

No problems identified.

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.

The Fredericksburg 230 kV-Cranes Corner 230 kV 230 kV line (from bus 314137 to bus 314134 ckt 1) loads from 100.91% to 101.12% (DC power flow) of its emergency rating (637 MVA) for the operational contingency 'LN 568'. This project contributes approximately 8.42 MW to the thermal violation.

ITO Analyses

ITO assessed the impact of the proposed queue project W3-019 interconnection of 19.5 MW of Capacity and 150 MW of energy on the ITO system. The system was assessed using the summer 2014

RTEP case provided to ITO by PJM, where the proposed generation capacity was injected on ITO 230 kV line #269 between Fentress and Sligo Substations. This analysis did include the impacts of the generation capacity for all higher order queue generators within the ITO system. When performing a generation analysis, ITO main analysis will be load flow study results under single contingency (both normal and stressed system conditions) and import/export system conditions. An ITO criterion considers a transmission facility overloaded if it exceeds 94% of its emergency rating under normal and stressed system conditions. For import/export studies ITO considers a transmission facility overloaded if it exceeded 100% of its emergency rating. A full listing of ITO planning criteria and interconnection requirements can be found in the ITO *Facility Connection Requirements* which are publicly available at: <http://www.dom.com>.

As part of its generation impact analysis ITO routinely evaluates the impact that a proposed new generation resource will have under maximum generation conditions and stressed system conditions. For the W3-019 evaluation, three different assessments were conducted:

- 1) The first being when local generation including the proposed W3-019 facility is operated at their maximum capability. The result of this study is shown below.

No problems identified for either 19.5 MW Capacity or 150 MW energy from W3-019.

- 2) The second being a stressed system condition where the largest generator in the area is unavailable. With the W3-019 generator geographically located in Eastern North Carolina, Surry Unit 2 is considered the most critical generating unit in the area. The impact of W3-019 was studied with the outage of Surry Unit 2. The result of this study is shown below.

No problems identified for either 19.5 MW Capacity or 150 MW energy from W3-019.

- 3) Light load analysis will be necessary during the System Impact Study to determine the effects of full energy level generation on the ITO system during light load conditions. System upgrades may be necessary to resolve problems identified in this analysis.

Attachment Facilities

The proposed layout and Attachment Facilities are illustrated below in Figure A. The interconnection arrangement shown assumes the proposed W3-019 facility is adjacent to the Fentress to Sligo 230 kV Transmission Line. The Attachment Facilities interconnection costs are estimated to be \$1.0 million dollars (2011 dollars). This cost includes metering, protection equipment and 230 kV line work to directly connect the proposed facility with the proposed 230 kV switching station. This work will take an estimated time of 24 to 30 months to engineer and construct.

Direct Connection Network Upgrades

To reliably interconnect the proposed generation with the ITO transmission system it will be necessary to create a three breaker 230 kV ring bus at the IC site. At this new 230 kV switching substation, three 230kV breakers and associated equipment will be installed. The estimated cost of this work is \$3.0 million dollars (2011 dollars) and is estimated to take 24 to 30 months to engineer and construct.

Non-Direct Connection Network Upgrades

None required.

Network Upgrades for full Energy

This overload can be resolved by upgrading the existing 230 kV line between Fredericksburg and Cranes Corner, #2104, by replacing the wave trap at Fredericksburg Substation. The cost of this upgrade is estimated to be \$50,000 dollars (2011 dollars) and is expected to take 12 months to complete. As indicated in the PJM Energy, a Merchant Transmission request would be needed to proceed with this upgrade.

Figure A

