PJM Generator Interconnection

W2-022 Pantego 115 kV

10.4 MW Capacity / 80 MW Energy

Feasibility Study Report

revised

November 2010
DMS #616495v1

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. The Affected System Owner is North Carolina Electric Membership Corporation.

Preface

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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

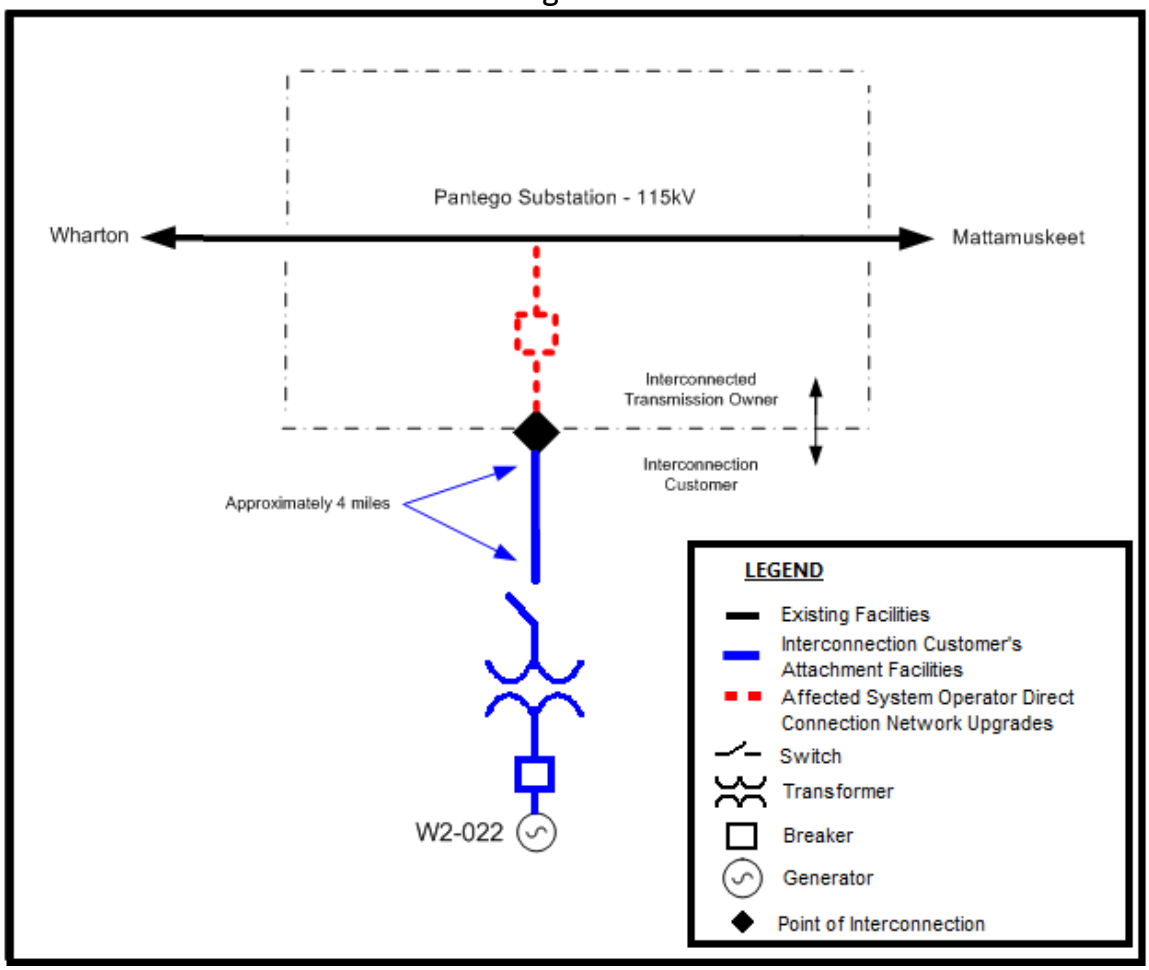
Queue W2-022 is an IC 80 MW energy (10.4 MW Capacity) wind farm interconnection request. W2-022 generation will be located east of Pantego, NC. Output from the generation will be studied as two options:

1. The primary option was at Pantego Substation 115kV line; and
2. The secondary option was a tap of the Pantego-Mattamuskeet 115kV line. The secondary modeling point was not available in PJM's case due to portions of the system being equivalized, so the secondary option was modeled as a direct connection to the Pantego 115kV substation.

Project W2-022 was evaluated for compliance with reliability criteria for summer peak conditions in 2014. The following configurations were studied:

Option 1: Pantego 115 kV

Figure A



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.

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.

Short Circuit

(Report Overdutied breakers here)

No problems identified.

Energy Portion of Interconnection Request

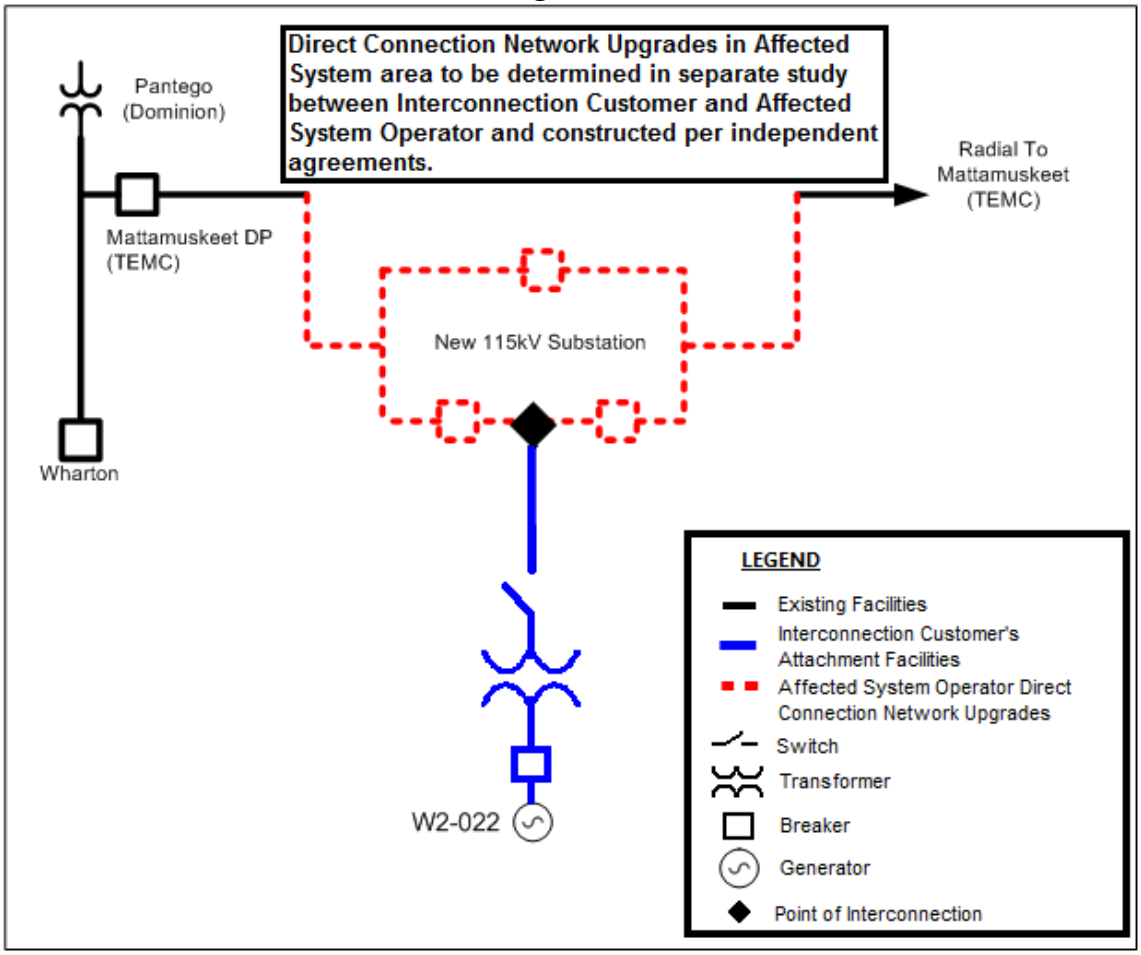
PJM also studied the delivery of the energy portion of the surrounding generation. Any potential problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion 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 W2-022TAP1-3FIVE PT 115 kV line (from bus 902350 to bus 314576 ckt 1) loads from 0.18% to 101.09% (DC power flow) of its emergency rating (79 MVA) for the single line contingency ('LN 82 & 189_W2-022A').

Option 2: NCEMC 115 kV

Figure B



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No problems identified.

ITO Analyses

ITO assessed the impact of the proposed 10.4 MW Capacity and 80.0 MW generation 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 and energy was injected at two optional points: 1) at ITO's Pantego Substation 115kV bus and 2) tapped on Tideland EMC's 115kV transmission line between Lake Mattamuskeet Delivery Point (TEMC) and Mattamuskeet Substation (TEMC). This analysis did include the impacts of the generation capacity for all higher order queue generators within the ITO Transmission System. When performing a generation analysis, ITO's main analysis will be load flow study results under single contingency (both normal and stressed system conditions) and import/export system conditions. ITO Criteria 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'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 this study indicate that the proposed W2-022 generation capacity does not adversely impact ITO's Transmission System. However, the generation energy adversely impacts ITO's Transmission and would require upgrades to transfer the full 80 MW of energy.

Capacity Portion of Interconnection Request

ITO studied the delivery of the capacity 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.

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Table A – Overload Due To Energy Portion (80.0 MWE)

Overloaded Element	Element Operating Number	Cont Loading (MVA)	Rating	Cont Loading (%)	Contingency
314576 3FIVE PT 115 902350 W2-022TAP1 115 1	Line 189	74.5	79	94.2	314592 3PANTEGO 115 902350 W2-022TAP1 115 1

The overload shown in Table A exists for both Options 1 (connecting at ITO's Pantego Substation) and Option 2 (connecting at Tideland EMC's 115kV Mattamuskeet line). The radial transmission line from Wharton Substation to Pantego Substation is limited by the summer line rating of 79 MVA.

The worst case condition would be with no load on the **Wharton to Pantego Line, which would limit the proposed generation to 94% of the line rating or 74 MVA.** If IC wishes to inject the full 80 MW capability of the facility, upgrades would be required.

Attachment Facilities - Option 1 – Connect at ITO's Pantego Substation 115kV

In accordance with ITO Facility Connection Requirements and as depicted in Figure A, the proposed W2-022 facility will need to interconnect with ITO's Pantego Substation 115kV. IC is responsible to construct approximately a four mile Attachment Facility line to the Pantego Subsation. The ITO work to accommodate the interconnection at Pantego Substation will require expanding and grading the substation, one 115kV breaker, line switches, line terminal and associated equipment. ITO work is estimated to cost $600,000 and is estimated to take 12-18 months to complete.

Optional Non-Direct Connection Network Upgrades for Option1 & Option 2

The results of these studies, as indicated in Table A and explained in the paragraph before Table A, describe the line overload condition with the proposed 80 MWE. To reliably interconnect proposed generation above 74 MVA with the ITO Transmission System, the following upgrade would be required:

Reconductor 20.4 miles of the 115kV transmission line #189 between Pantego and Wharton. This is estimated to cost $21 Million and take 24 months to complete. Note that the remaining 9.8 miles of 115kV transmission line between Pantego and Wharton has a sufficient rating.

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1. The primary option was a tap of the Pantego-Five Points 115kV line; and
2. The secondary option was a tap of the Pantego-Mattamuskeet 115kV line. The secondary modeling point was not available in PJM's case due to portions of the system being equivalized, so the secondary option was modeled as a direct connection to the Pantego 115kV substation.

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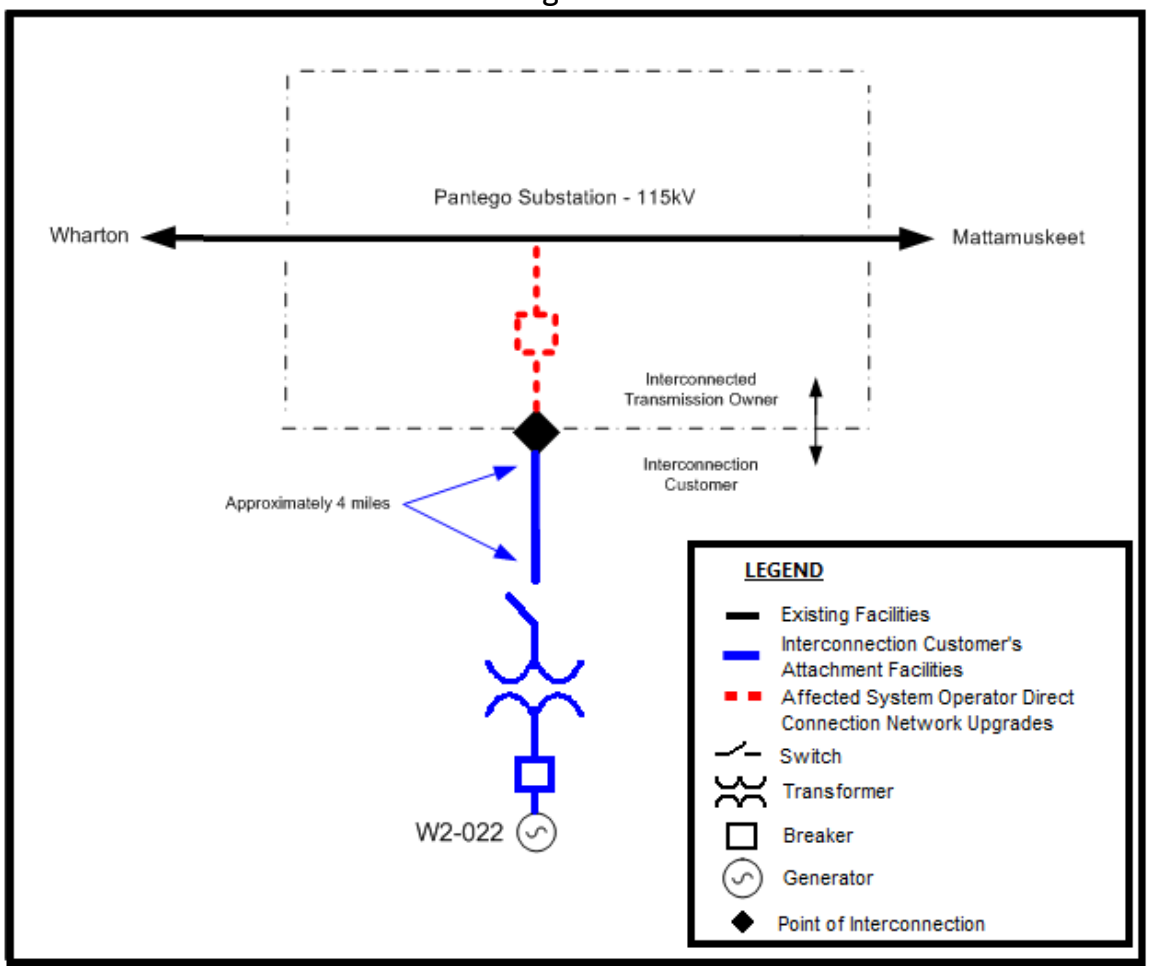

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Option 2: NCEMC 115 kV

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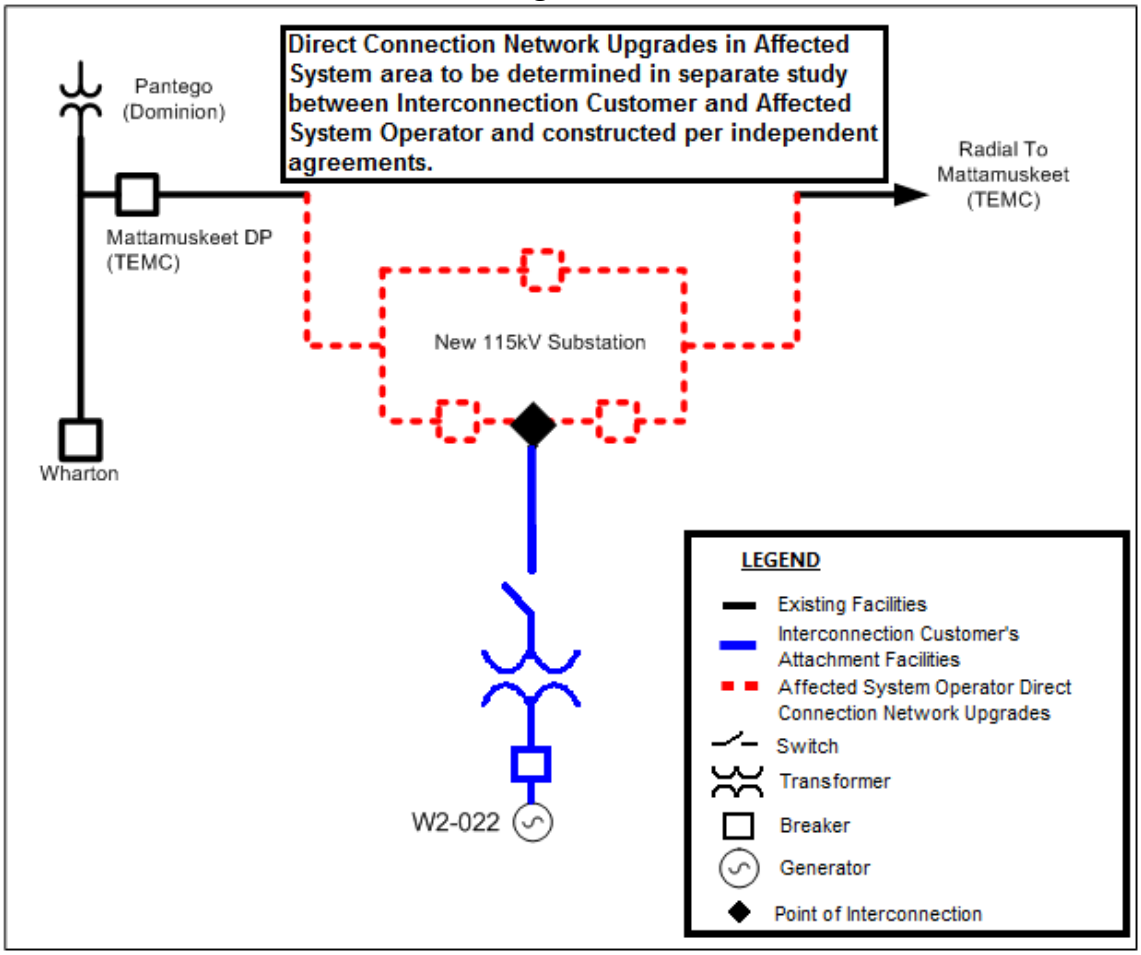

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