

***Generation Interconnection  
System Impact Study Report***

***For***

***PJM Generation Interconnection Request  
Queue Position Z1-036***

***Winfall – Chowan 230kV***

**Sept / 2014**

## Introduction

This System Impact Study (SIS) has been prepared in accordance with the PJM Open Access Transmission Tariff, Section 205, as well as the System Impact Study Agreement between Timbermill Wind, L.L.C. (Interconnection Customer (IC)) and PJM Interconnection, LLC (Transmission Provider (TP)). The Interconnected Transmission Owner (ITO) is Virginia Electric and Power Company (VEPCO) .

## Preface

The intent of the System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer 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 system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

In some instances an Interconnection Customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, 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 System Impact Study is performed.

The System Impact Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

## General

Timbermill Wind, L.L.C., the Interconnection Customer (IC), has proposed a wind generating facility located in Perquimans County, NC. The installed facilities will have a total capability of 300.3 MW with 39 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is December 1, 2016. **This study does not imply an ITO commitment to this in-service date.**

## Point of Interconnection

Z1-036 will interconnect with the ITO transmission system via a new three breaker ring bus switching station that connects to the Windfall – Mackey’s 230kV line.

## Cost Summary

The Z1-036 project will be responsible for the following costs:

<b>Description</b>	<b>Total Cost</b>
Attachment Facilities	\$1,600,000
Direct Connection Network Upgrades	\$6,000,000
Non Direct Connection Network Upgrades	\$0
<b>Total Costs</b>	<b>\$7,600,000</b>

## **Attachment Facilities**

Direct Connection Generation Substation: Install metering and associated Protection Equipment. Estimated Cost \$600,000.

Transmission Line: Construct approximately one span of 230 kV Attachment line between the generation substation and Z1036 Switching Substation. The estimated cost for this work is \$1,000,000.

The estimated total cost of the Attachment Facilities is \$1,600,000. It is estimated to take 18-24 months to complete this work after execution of Interconnection Service Agreement (ISA) and (Interconnection Construction Service Agreement (ICSA). These preliminary cost estimates are based on typical engineering costs. A more detailed engineering cost estimates are normally done when the developer provides an exact site plan location for the generation substation during the Facility Study phase. These costs do not include CIAC Tax Gross-up. The single line is shown below in Attachment 1.

## **Direct Connection Cost Estimate**

Substation: PJM network upgrade # n4265 to establish the new 230 kV Z1036 Switching Substation (interconnection substation). The arrangement in the substation will be as shown below on Attachment "A": One-Line Diagram. The estimated cost of this facility is \$6,000,000. It is estimated to take 24-36 months to complete this work after execution of ISA and ICSA.

## **Non-Direct Connection Cost Estimate**

None

## **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 Z1-036 was studied as a 300.3 MW (Capacity 39.0 MW) injection tapping the Edenton – South Hertford 230 kV line in the VEPCO area. Project Z1-036 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners) for summer peak conditions in 2017. Project Z1-036 was studied with a commercial probability of 100%. 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)*

Normal VEPCO criteria will allow for steady-state voltage on the transmission system under normal and contingency conditions to vary between 0.9 pu and 1.05 pu. Generators connected to the 230 kV System are usually expected to maintain a voltage schedule of 1.009 pu.

### **Stability and Reactive Power Requirement for Low Voltage Ride Through**

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

Stability analysis will be performed during the Facilities Study.

### **Light Load Analysis**

*(Study to determine that the Transmission System is capable of delivering the system generating capacity at light load)*

Light Load analysis will be performed during the Facilities 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.*

1. (DVP - DVP) The 8NO ANNA-8LDYSMTH 500 kV line (from bus 314918 to bus 314911 ckt 1) loads from 99.6% to 100.65% (**DC power flow**) of its emergency rating (3424 MVA) for the single line contingency outage of '8MORRSVL \_8NO ANNA \_033'. This project contributes approximately 43.05 MW to the thermal violation.

CONTINGENCY '8MORRSVL \_8NO ANNA \_033'

DISCONNECT BRANCH FROM BUS 314916 TO BUS 314918 CKT 1 /\* 500/500KV,  
AREA 345/345.  
END

2. (DVP - DVP) The 8NO ANNA-8MORRSVL 500 kV line (from bus 314918 to bus 314916 ckt 1) loads from 120.55% to 122.16% (**DC power flow**) of its emergency rating (2598 MVA) for the single line contingency outage of '8LDYSMTH\_8NO ANNA \_025'. This project contributes approximately 49.73 MW to the thermal violation.

CONTINGENCY '8LDYSMTH\_8NO ANNA \_025'

DISCONNECT BRANCH FROM BUS 314911 TO BUS 314918 CKT 1 /\* 500/500KV,  
AREA 345/345.  
END

### **Duke Energy / Progress Impacts**

Impacts to be determined during the Facility study.

### **ITO Analysis**

ITO assessed the impact of the proposed Queue Project #Z1-036 interconnection as 300.3MW of energy (Capacity 39.0 MW) for compliance with reliability criteria on ITO's Transmission System. The system was assessed using the summer 2017 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 VEPCO 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 VEPCO 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

# Attachment 1.

## Z1-036 System Configuration

