

**PJM Generator Interconnection  
Y2-066 Suffolk 34.5 kV  
9 MW Capacity / 9 MW Energy  
Combined Feasibility & System Impact Study  
Report**

*March 2013  
DMS #742080v1*

## **Introduction**

This Combined Feasibility & System Impact Study has been prepared in accordance with the PJM Open Access Transmission Tariff, §110, as well as the Feasibility Study Agreement between Interconnection Customer, (IC), Virginia Electric and Power Company, and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Virginia Electric and Power Company.

## **Preface**

The intent of this combined 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.

## **General**

The queue project Y2-066 was studied as a 9 MW Capacity and 9 MW Energy increase injection at the Suffolk substation in the ITO area. Project Y2-066 was evaluated for compliance with reliability criteria for summer peak conditions in 2016. Potential network impacts were as follows:

### **Network Impacts:**

#### **Impactful Contingencies**

*(The following contingencies resulted in overloads identified below)*

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 only with full energy output. Stuck Breaker and Bus Fault contingencies will be applied during the Impact Study)*

None.

### **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.)*

None.

### **Short Circuit**

*(Report Overduty breakers here)*

There is no impact to breaker interrupting capabilities.

### **Distribution Company Analysis**

IC is requesting interconnection of four 3516 Caterpillar generators and six 320 Jenbacher generators for an approximate total of ten machines. The four Caterpillar units are already interconnected to the IC system through a retail agreement. The IC site electrical load is approximately 500 kW. The IC's generating units will be located at the Suffolk Landfill site in Suffolk, Virginia. The IC has requested to export excess power generated for a total of 9.0 MW to be injected into the ITO system.

#### **Local Non-Direct Connection Upgrades:**

Modifications are required to existing metering to accommodate sells into the wholesale market. The modification is to replace line fuses with a 3-phase electronic recloser.

The total estimated cost of the modification is \$59,397.

#### **Attachment Facilities Required:**

1. Replace revenue metering to accommodate real time data; and
2. replace three fuses with solid blade disconnects.

The total estimated cost of these incremental modifications is \$24,000.

## **Existing Facilities:**

The existing facilities required to provide the interconnection will include:

- metering;
- generator transfer trip equipment; and
- 34.5 KV line extension.

The existing facilities were installed under "The Sale of Electrical Output to Virginia Electric and Power Company" agreement effective April 15, 1992 at an estimated cost of \$38,725.

The Interconnect IC will be responsible for the upfront cost of new attachment facilities and upgrades for this is agreement of \$83,397. Construction time is estimated at three months.

Facility Charges to be included in the ISA will be the existing \$38,725 plus the Attachment Facilities installed on this agreement of \$24,000 for a total of \$62,725. The IC will pay a monthly facility charge of  $0.543\% \times \$62,725$  for a total of \$340.60 a month.

## **Operating Requirements**

Based on the information provided, the IC's site will be interfacing with the ITO source in the following manner:

- The IC facility is fed by new electronic recloser 342R53, existing recloser 342R1, Suffolk Circuit 34242, Suffolk Substation 34.5 kV bus #6, Suffolk Substation transformer #4 sourced from the 230 kV bus #4 and line 246 to Earleys and line 289 to Chuckatuck and transformers #5 and #8. The estimated power factor used to convert load MVA to MW is 0.85;
- The load data for the pertinent sectionalizing devices are as follows:
  - 342R53 has a typical light loading of 0.1 MVA;
  - 342R1 has a typical light loading of 2.2 MVA;
  - 34242 has a typical light loading of 7.2 MVA;
  - 34.5 kV bus #6 has a typical light loading of 8.2 MVA;
  - transformer #4 has a typical light loading of 8.2 MVA;

- bus #4 has a typical light loading of 8.2 MVA;
- IC parallel operation will not be limited to any particular time or ITO circuit-loading condition; and
- IC will be contracting with PJM to export power into the ITO distribution system.

Based on the minimum loads given for the ITO sectionalizing devices, the following minimum "Local Load to IC Generation Capacity" ratios will apply for this installation:

<i>ITO Device</i>	<i>Minimum Ratio</i>
342R53	0.01
342R1	0.21
34242	0.68
bus #6	0.77
transformer #4	0.77
bus #6	0.77

These minimum ratios applicable for this installation will require the IC to have direct pilot wire tripping be installed at ITO devices 342R53, 342R1, 34242, bus #6, transformer #4, and bus #4. The requirement for direct pilot wire tripping, or transfer trip, to the IC main breakers has been partially satisfied as it is currently installed and operational. The existing DC loop direct trip controls will need to be upgraded to our current standard and additional device zones will now need to be added into the transfer trip scheme: 342R53, bus #6, transformer #4 and bus #4. The direct trip control features are meant to ensure that a "prolonged" or "permanent" islanding condition, where the IC generation supplying ITO load in the absence of the ITO source, will not be set-up. In addition, the direct tripping function would aid in protecting the IC generation equipment from an out-of-step re-closure with the ITO source.

The required relay functions, each sectionalizing all of the IC's generation, and the corresponding setting ranges, applying for each of the designated ITO feeds, are listed in the following tables:

Function		Set Point	Duration To Disconnection (seconds)	
			Preferred	Maximum
27	Under-voltage	90% of nominal operating voltage	Less than 2.0	2.0
59	Over-voltage	106 to 110% of nominal operating voltage	Less than 2.0	2.0
81U	Under-frequency	59.0 to 59.5 Hz	Less than 2.0	2.0
81O	Over-frequency	60.5 to 61.0 Hz	Less than 2.0	2.0
51	Phase time-delay over-current	Set for minimum, with adequate load allowance	Maintain proper coordination	
51N	Ground time-delay over-current	Set for minimum, with adequate imbalance allowance	Maintain proper coordination	

For records, please provide PJM and ITO with an updated operating one-line of your installation in addition to relay settings, including the operating times, applied for the protective functions at the Point of Interconnection, IC main 52-M, prior to the wholesale service.

# One-Line Diagram

