PJM Generator Interconnection

X2-060 & Y1-068

East Mill 115 kV

0 MW Capacity / 50 MW Energy

Combined Feasibility &

System Impact Study Report

July 2012
DMS #708833v1

Introduction

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, §36.2 and §111, 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

The queue project X2-060 was the 30 MW (0 MW Capacity) injection into the ITO area. Y1-068 was studied as an additional 20 MW (0 MW Capacity) injection at East Mill 115 kV substation in to the ITO area. The combine 50 MW represent generation not being consumed Behind the Meter by existing load at the facility. Project Y1-068 was evaluated for compliance with reliability criteria for summer peak conditions in 2015. 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 Overdutied breakers here)

Not required.

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

Will be provided as a revision to this report.

Delivery of Energy Portion of Interconnection Request

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. 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 will study all overload conditions associated with the overloaded element(s) identified.

None.

ITO Analysis

ITO requested an interconnection of one (1) 80 MW biomass generator, PJM queue X2-060. IC generator unit is located at Meadwestvaco Covington Mill Site, Covington, Virginia. IC desires to export a total of 50 MW to be injected into the Interconnection Transmission Owners distribution system as specified in the additional energy request Y1-068. The remaining generation will be consumed Behind the Meter.

Attachment Facilities

Modifications are required to existing Westvaco and East Mill Substations to accommodate proposed interconnection. Modifications inside the substations will include:

Metering Enclosure:

Generator meter will be installed in a 36 inch wide metering enclosure to be supplied by ITO at IC expense and installed by IC and mounted indoors, inside the new 80 MVA generator switchgear room. Metering enclosure will be designated: *Dominion Virginia Power Metering Enclosure*. The center of the metering enclosure shall be mounted eye-level, with sufficient overhead clearance to allow lid to swing up and lock open. All secondary conductors between the metering PTs and CTs and generator meter cabinet will be #10 American Wire Gauge (AWG) and installed in National Electric Code (NEC)-approved conduit, provided and installed by IC. Meter enclosure will be bonded and grounded in accordance with NEC.

Note: The metering enclosure described above must be accessible to ITO personnel for purposes of periodic testing and maintenance of the metering equipment. Metering enclosure will be secured under ITO lock and key, with a small auxiliary hatch available for IC to view watt-hour meter register readings.

Auxiliary Power:

If a 120 Volt AC ground fault circuit interrupter outlet is not located within ten (10) feet of meter enclosure, a set of two (2) #10 AWG conductors must be installed for the purpose of providing 120 Volt AC auxiliary power in the metering cabinet, and must be installed within NEC-approved conduit between the IC breaker panel and the metering cabinet. All conduit and conductors for auxiliary power shall be provided and installed by IC.

Metering Instrument Transformers:

The 15 kV metering current transformers (CT's) and potential transformers (PT's) will be purchased by IC, at IC expense and approved by ITO. Metering CTs and PTs will be installed

by IC in a compartment separate from the IC switchgear. The compartment containing the metering CT's and PT's will be secured under ITO lock and key and designated: *Dominion Virginia Power Metering TX's*. Note: H1 bushings of CT's should be turned to face generator, H2 bushings should be turned to face line-side.

Generator Watt-Hour Meter:

IC will install a standard, copper, dedicated telephone line at the ITO generator metering enclosure. IC will maintain the phone line for the sole purpose of allowing ITO to communicate with ITO metering equipment, and will not install any other telephone equipment (e.g. fax machine) on the phone line provided for the ITO metering equipment. IC will make available to ITO the phone number assigned to the dedicated phone line.

Additional Watt-Hour Meters:

An additional six (6) watt-hour meters will be installed to meter the excess generation injected into the ITO system through the six (6) existing transformers located in Westvaco and East Mill substations. These six (6) watt-hour meters will include dial-up POTS modems for communication. A new metering panel will be built by the ITO, at IC expense, and installed in East Mill Substation to accommodate the additional three (3) watt-hour meters for transformers #4, #5 and #6.

The cost for this work is estimated to be $71,174.41 and be completed in three months.

New Attachment Facilities:

Transfer trip equipment modifications for new generation. The cost of this equipment and modifications will be $220,409.

Existing Attachment Facilities:

Existing facilities required to provide this interconnection include:

1. Metering
2. Generator out of sync protection
3. Telemetering Equipment

The existing facilities were installed under *Purchase of Electricity Agreements* in September 1975, September 1980, December 1983 and January, 2001 and are covered in the IC current *Agreement for Electric Service* dated September 1, 2004.

Listed below are costs that were not paid upfront and **must be paid before executing an ISA**. After payment is received the charges will be carried over to the new ISA as facility charges at 0.54%:

• September 1975	$ 3,000
• September 1980	$47,000
• January 2001	$11,210
Total	$61,210

Listed below are charges that were paid upfront and will be carried over to the new ISA as facility charges at 0.54%:

• September 1980	$20,350
• December 1983	$26,107
Total	$46,457

The IC will also be responsible for providing and maintaining telephone lines to the ITO metering equipment at the Point of Interconnection and provide all communication lines necessary to transmit data from the metering to PJM.

The estimated time for engineering, material acquisition and construction of this interconnection is approximately three months. Detailed engineering, costs, material lead times and construction time requirements will be determined as part of the Combined System Impact & Facilities Study.

Technical Requirements:

IC site will be interfacing with the ITO source in the following manner:

- IC facility is fed by both Westvaco Substation transformers #1, #2, and #3 sourced from the 138 kilovolt (kV) Bus #6 and lines 109 (East Mill) and 155 (Fudge Hollow) and East Mill Substation Transformers #4, #5 and #6 sourced from the 138 kV Bus #1 and lines 109 (Westvaco) and 161 (Low Moor).

- The load data for the pertinent sectionalizing devices are as follows:

    - Line 109 has a typical "light" loading of 0.0 MVA
    - Line 155 has a typical "light" loading of 0.0 MVA
    - Line 161 has a typical "light" loading of 6.7 MVA

- IC parallel operation will not be limited to any particular time or ITO circuit-loading condition.

- IC will be contracted to export power into the ITO system.

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

Utility Transmission Line	Minimum Ratio
Line 109	0.00
Line 155	0.00
Line 161	0.22

These minimum ratios applicable for this installation will require the customer to have direct pilot wire tripping (or transfer trip) and an islanding scheme installed to ITO breakers L182, L282 and L382 in Westvaco Substation and to all three customer main breakers 7AUT4, 11AUT5 and 13AUT6

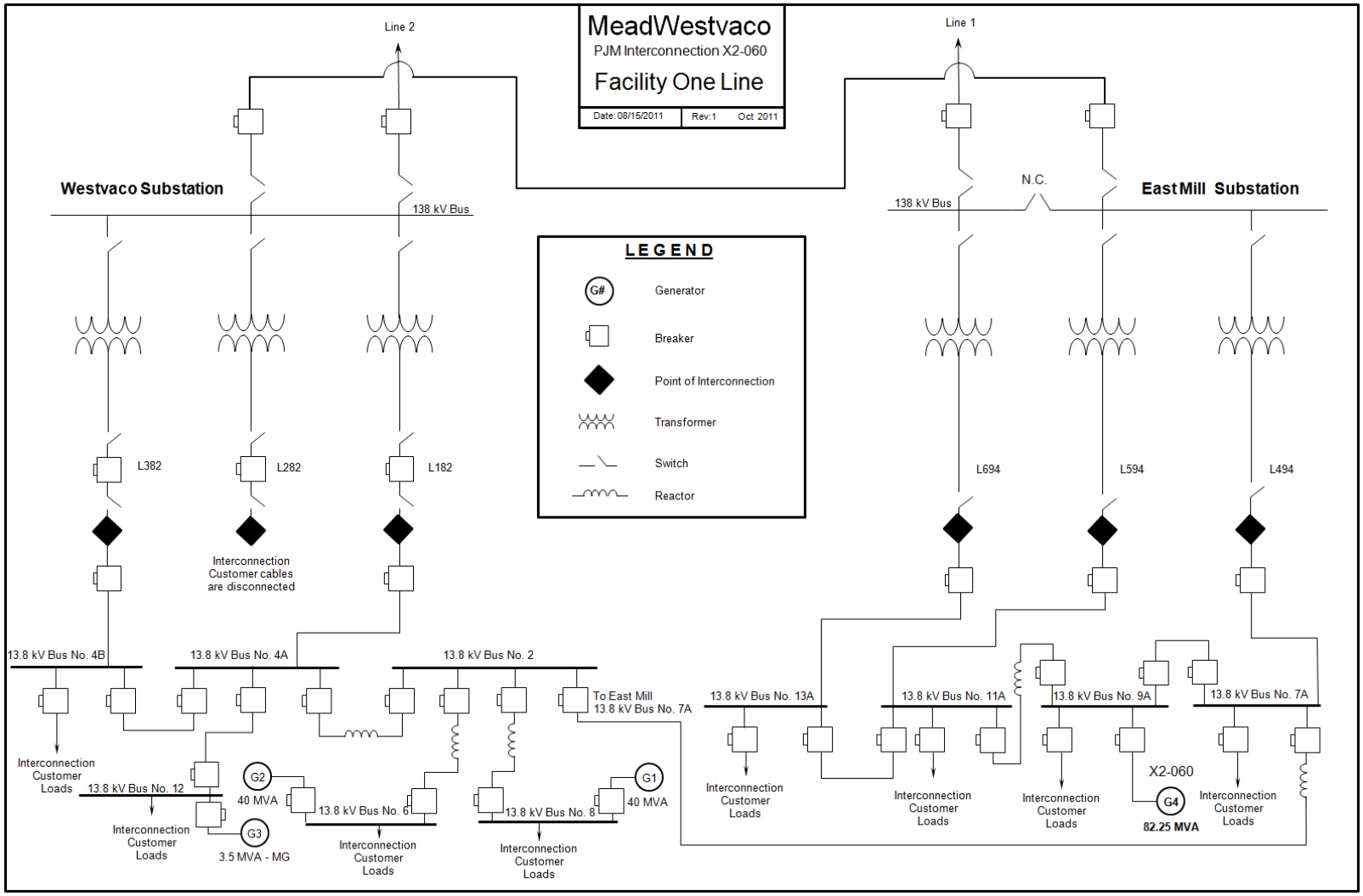
sourced from East Mill Substation. The islanding and direct trip control features are meant to ensure that a "prolonged" (or "permanent") islanding condition (with the customer generation supplying utility load in the absence of the utility source) will not be set-up. In addition, the direct tripping and islanding scheme function would aid in protecting the customer generation equipment from an out-of-step reclosure of the utility source.

In its current design, the protection scheme at the Westvaco and East Mill substations is set up to initiate tripping of both the ITO breakers and IC breakers during a system disturbance through basic overcurrent or breaker failure scheme for disturbances at the local level. With the addition of the new generation in the East Mill, the existing islanding scheme will be expanded and reconfigured to ITO current design. These direct tripping functions and expanded islanding scheme should be sufficient to sectionalize the IC generation for the opening of the respective devices and prevent an islanding condition. In addition, the base protection package described below will also be required.

The required relay functions (each sectionalizing all of the customer'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
59	Overvoltage	106% to 110% of nominal operating voltage	Less than 2.0	2
81U	Underfrequency	59.0 to 59.5 Hz	Less than 2.0	2
81O	Overfrequency	60.5 to 61.0 Hz	Less than 2.0	2
51	Phase Time-Delay Overcurrent	Set for minimum, with adequate load allowance	Maintain proper coordination	
51N	Ground Time-Delay Overcurrent	Set for minimum, with adequate imbalance allowance	Maintain proper coordination	

Proposed One-Line:



Appendix A – Stability Study Results

To be published separately as a revision to this combined study report.