PJM Generator Interconnection

W4-020 Mount Zion 69 kV

3.8 Capacity / 10.1 MW Energy

Feasibility Study Report

April 2011
DMS #644443v1

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).

Preface

The intent of a combined Feasibility and System Impact 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 Local and Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM and underlying system. All facilities required for interconnection of a generation interconnection project must be designed to meet ITO technical specifications.

The Feasibility and 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. IC is responsible for any right of way, real estate, and construction permit issues.

General

Queue project W4-020 was studied as a 10.1 MW (3.8 MW of which was Capacity) injection into ITO's system at the Mount Zion 230 kV substation. Project W4-020 was evaluated for compliance with reliability criteria for summer peak conditions in 2014.

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 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.

No violations identified.

ITO Analyses

ITO's Asset Strategy & Planning has investigated a 13 kV and a 69kV route to supply the proposed 10 MW solar facility. The facility is located at 5600 Riggs Road in Gaithersburg, MD:

Direct Connection Scope of Work:

ITO has examined two options for connecting the Customer to the ITO System.

Option 1: 69 kV

Extend Norbeck Sub. 158 Feeder 69080 approximately 1.44 miles using 795 kCM to the Customer Site. Feeder 69080 would be tapped at the corner of Olney – Laytonsville Road and Fieldcrest Road and extended along Olney – Laytonsville Road and Riggs Road to the customer site. This option requires 69kV metering equipment and installation of fiber optic cable between Mt. Zion Substation (the closest ITO Substation) and the Customer's facility to provide trip control of the intertie breaker. The estimated costs to extend feeder 69080 and the required fiber, to purchase and install the necessary substation, communication and metering equipment, set up, inspect and witness test the Customer's facilities is $1,392,641, which includes $54,490 for Contributions in Aid of Construction (CIAC). Note that the CIAC (4.072%) is based on the Tax Relief, Unemployment Insurance Reauthorization and Job Creation Act of 2010. This rate, per the provisions of this act, is applicable for property acquired or placed in service through January 1, 2012.

Option 2: Alternative Supply from 13.8 kV Circuit

ITO examined an alternative supply from a 13.8 kV circuit and found that this alternative was not viable. The alternative was based on the following:

Extend a new 13.8 kV express feeder from Mt. Zion Sub. 165 following the public roads in the area to the Riggs Road Site. This feeder would consist approximately 0.1 mile of 3-600 kcm Cu 1/c EPR underground cable and approximately 2.2 miles of 500 kcm Al Pre-assembled Aerial Cable (PAC). Installation of a new feeder cubicle at Mt. Zion Sub. 165 would also be required for this feeder.

ITO found in the power flow studies that were conducted that the voltage at the Point Of Interconnection (POI) was 14,297 V or 3.6 % over the maximum allowed voltage at the customer terminal. These results were determined assuming that the customer generation was operating at a 0.95 leading (absorbing) power factor to mitigate the voltage drop from the generator to the substation bus. This voltage is in excess of ITO's criteria. In addition, a reverse power condition was observed on one of the supply transformers to the Mt. Zion 13.8 kV bus.

ITO conducted similar studies using 1000 kcm Al PAC, which is not a standard conductor size for ITO.

ITO found in the power flow studies that were conducted that the voltage at the Point Of Interconnection (POI) was 13,990 V or 1.4 % over the maximum allowed voltage at the customer terminal. These results were determined assuming that the customer generation was operating at a 0.95 leading (absorbing) power factor to mitigate the voltage drop from the generator to the substation bus. This voltage is in excess of ITO's criteria. In addition, a reverse power condition was observed on one of the supply transformers to the Mt. Zion 13.8 kV bus.

General Requirements:

Direct Transfer Trip

ITO will require transfer trip equipment between the ITO normal supply Feeder breaker and the customer's intertie breakers should the IC utilize dynamic type inverters or inverter types that do not meet the anti-islanding criteria as defined in IEEE 1547-2008 and UL 1741 - 2005. The transfer trip scheme should also be designed such that loss of communication between ITO's normal supply substation and the IC facility should result in an alarm sent to ITO's control center operations.

This requirement may be waived provided the inverters proposed by the IC are designed with anti-islanding capability and meet IEEE 1547-2000 and UL1741-2005 standards.

Isolation Transformer:

The IC shall supply transformer(s) that will be used as isolation transformer(s). The transformer(s) shall have a BIL level which will be specified when the supply voltage level has been finalized by ITO. ITO recommends the isolation transformers be connected in a Delta-Wye configuration according to ITO's "Engineering Requirements and Performance Standards for ICs on the Potomac Electric Power Company System", Revision I, Dated 1-31-2007. The isolation transformer is required in order to attenuate harmonics due to the customer's inverter based generation.

Intertie Protection:

The following protection will be required for tripping the designated intertie breaker(s); Undervoltage (27), Overvoltage (59), Underfrequency (81U), and Overfrequency(81O). ITO may require additional voltage and frequency protection if system studies indicate voltage regulation concerns.

Revenue Metering Requirements – Metering requirements:

The customer will need to supply and install infrastructure for metering instrument transformers and meters, for both Revenue and Telemetry Meters. The customer will need to follow the appropriate interconnection or service agreement requirements for the meter installation.

SCADA Requirements:

The IC may use the Arcom director-based internet option as described in Attachment H, "Small Generator (10 MW and Below) Technical Requirements and Standards", to PJM Manual 14B.

The IC shall provide the following data for all new generators:

- Real time MW
- Real time MVAR
- Real time amperes
- Real time voltage

Control (tripping only) of designated inter-tie breaker(s) is required. The above listed data shall be transmitted to the Control Center via fiber to the nearest substation. The data shall be transmitted via DNP3 protocol. There may be additional equipment that is required at the substation to facilitate the transmission of the data to the Control Center.

The IC must provide the following status data:

- Open / Close status for IC inter-tie circuit breakers
- Real time KW
- Real time amperes
- Single phase voltage
- Trip control of the IC inter-tie breaker(s)
- Three phase amperes for the IC inter-tie circuit breaker.
- KWH from bi-directional revenue meter

The customer must submit a switching sequence of operation as well as additional documentation for ITO's review.