Generation Interconnection Impact Study Report

For

PJM Generation Interconnection Request Queue Position AD2-025

Hillsborough 13 kV

October 2019

Preface

The intent of the System Impact Study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement.

For Local and Network Upgrades which are required due to overloads associated with the System Impact Studies of an individual New Services Queue, and have a cost less than $5,000,000, the cost of the Local and Network Upgrades will be shared by all proposed projects which have been assigned a Queue Position in the New Services Queue in which the need for the Local and Network Upgrades was identified. The Load Flow Cost Allocation methods discussed in this manual, including cutoffs, still apply to the individual projects.

For Local and Network Upgrades which are required due to the overloads associated with the System Impact Studies of an individual New Services Queue, and have a cost of $5,000,000 or greater, the cost of the Local and Network Upgrades will be allocated according to the order of the New Service Requests in the New Services Queue and the MW contribution of each individual Interconnection Request for those projects which cause or contribute to the need for the Local or Network Upgrades. The Load Flow Cost Allocation methods discussed in this manual, including cutoffs, still apply to the individual projects.

Cost allocation rules can be found in PJM Manual 14A, Attachment B. 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 impact study is performed.

An Interconnection Customer entering the New Services Queue on or after October 1, 2012 with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

The Interconnection Customer seeking to interconnect a wind generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per item 5.iv. of Schedule H to the Interconnection Service Agreement.

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

Viridity Energy Solutions, Inc., the Interconnection Customer (IC), has proposed a battery storage facility located in Somerset County, New Jersey. The installed facilities will have a total capability of 2 MW with 0 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is November 30, 2018. **This study does not imply a PSE&G commitment to this in-service date.**

Attachment facilities and local upgrades (if required) along with terms and conditions to interconnect AD2-025 will be specified in a separate two party Interconnection Agreement (IA) between PSE&G and the Interconnection Customer as this project is considered FERC non-jurisdictional per the PJM Open Access Transmission Tariff (OATT). From the transmission system perspective, no network impacts were identified in the System Impact Study.

Point of Interconnection

AD2-025 will interconnect with the PSE&G distribution system along the Sunnymeade SUN8022 13kV circuit.

Cost Summary

The AD2-025 project will be responsible for the following costs:

Description	Total Cost	
Transmission Owner facilities	$	108,110
Transmission Upgrades	$	0
PSEG Identified Upgrades	$	91,036
Total Costs	**$**	**199,146**

Transmission Owner Scope of Work

Detailed scope, cost, and schedule will be provided in a separate two party Interconnection Agreement (IA) between PSE&G and the Interconnection Customer after the conclusion of the Impact Study phase.

The total preliminary cost estimate for the Attachment work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost	
Line Tap on the Sunnymeade Rd 13.2kV circuit to the AD2-025 Point of Interconnection including costs associated with 13.2kV Metering Package	$	108,110
Total Direct Connection Facility Costs	**$**	**108,110**

Interconnection Customer Requirements

1. The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Section 4 of PJM Manual 14D for additional information.

2. The power factor requirement is as follows: Due to the high voltage in the PSEG 13.2kV distribution zone during certain times, The Interconnection Customer shall design its Customer Facility with the ability to maintain a power factor of at least 0.95 leading to 0.95 lagging measured at the Point of Interconnection. The specific operational power factor requirement will be specified in a separate two party Interconnection Agreement (IA) between PSE&G and the Interconnection Customer as this project is considered FERC non-jurisdictional per the PJM Open Access Transmission Tariff (OATT).

3. Specific Operational Power Factor Requirement: PSEG will complete a technical analysis during the Impact Study Phase to determine the specific Power Factor requirement.

4. PSE&G's Information & Requirements for Electric Service Handbook
http://www.pseg.com/business/builders/new_service/before/pdf/RequirementsElecSvc2005.pdf

5. PSE&G Customer Equipment Requirements – Primary Service
https://www.pseg.com/business/builders/new_service/before/pdf/pepp/sec03.pdf

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.

Public Service Electric and Gas (PSE&G) Requirements

The Interconnection Customer will be required to comply with all PSE&G Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "Information and Requirements for Electric Service" document located at the following links:

http://www.pseg.com/business/builders/new_service/before/
http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx

Network Impacts

The Queue Project AD2-025 was evaluated as a 2.0 MW (Capacity 0.0 MW) injection at the Sunnymeade Rd. 13.2kV substation in the PSEG area. Project AD2-025 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD2-025 was studied with a commercial probability of 100%. Potential network impacts were as follows:

Summer Peak Analysis - 2021

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

None

Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

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

Short Circuit

(Summary of impacted circuit breakers)

None

Steady-State Voltage Requirements

(Summary of the VAR requirements based upon the results of the steady-state voltage studies)

None

Stability and Reactive Power Requirement for Low Voltage Ride Through

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

Not required

Light Load Analysis - 2021

Not required

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 developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

None

Power Flow Analysis of PSEG's <100 kV underlying system

PJM performed a power flow analysis of the transmission system using a 2021 summer peak load flow model and the results were verified by PSEG. Additionally, PSEG performed an analysis of its underlying transmission <100 kV system. At the Primary POI, the AD2-025 project contributes to overloads on the FE transmission <100 kV system as shown below.

From the study results PSEG did not identify any issues with charging and discharging of 2MW Frequency battery that will be installed at Sunnymeade. However, the battery needs to be disconnected from the feeder under an N-1 condition as the battery is close to a substation and when we lose the other side, the battery will be at the end of the feeder and there are voltage flicker issues. PSEG identified the following scope of work to mitigate the operational concern:

Engineering, Installation and Commissioning of SCADA equipment and wiring to provide station breaker status outputs at the site for the IC's use in inhibiting inverter operation during specified outputs. The total preliminary cost estimate for the Attachment work is ***$91,036.*** *This cost does not include CIAC Tax Gross-up.*

Not included in the estimate is the expected effort by the IC to connect with the above and modify their inverter settings and operation to inhibit their charging/discharging when given a signal from this system.

Detailed scope, cost, and schedule will be provided in a separate two party Interconnection Agreement (IA) between PSE&G and the Interconnection Customer after the conclusion of the Impact Study phase.

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

Attachment 1. Single Line Diagram