Generation Interconnection System Impact Study Report

For

PJM Generation Interconnection Request Queue Position AB1-163

Glidden-Van Hiseville 34.5kV

December 2016

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

HESP Solar LLC, the Interconnection Customer (IC), has proposed a solar generating facility located in Ocean County, NJ. The installed facilities will have a total capability of 5 MW with 0 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is December 2016. **This study does not imply a Jersey Central Power & Light Company (JCPL) commitment to this in-service date.**

Attachment facilities and local upgrades (if required) along with terms and conditions to interconnect AB1-163 will be specified in a separate two party Interconnection Agreement (IA) between JCPL 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 as detailed below.

Point of Interconnection

AB1-163 will interconnect with the JCPL system along the Lakehurst – Van Hiseville 34 kV line.

Cost Summary

The AB1-163 project will be responsible for the following costs:

Description	Costs	Tax (if applicable)	Total Cost
Transmission Owner facilities	$ 457,300	$ 73,700	$ 531,000
Allocation for New System Upgrades	$ 0	$ 0	$ 0
Contribution for Previously Identified Upgrades	$ 0	$ 0	$ 0
Total Costs	**$ 457,300**	**$ 73,700**	**$ 531,000**

Transmission Owner Scope of Work

As defined by the Interconnection Customer and shown on Attachment 1, the proposed Interconnection Customer site will be located at a point approximately 1.6 miles from the existing Glidden substation facility. The direct connection of this project will be accomplished by tapping the Lakehurst – Van Hiseville (N-223) 34.5 kV line, and installing overhead 34.5 kV line to the point of interconnection ("POI"), 3-34.5 kV gang-operated SCADA controlled switches at the tap location, and 34.5 kV interconnection metering. Attachment 2show one-line diagram of the proposed direct connection of to the transmission system. The Interconnection Customer will be responsible for constructing all of the facilities on its side of the POI including the attachment line. The Interconnection Customer may not install above ground equipment within any JCP&L right-of-way unless permission to do so is expressly granted by JCP&L.

Description	Costs	Tax (if applicable)	Total Cost
Lakehurst – Van Hiseville (N-223) 34.5 kV Line: Tap the Lakehurst – Van Hiseville (N-223) 34.5 kV line and install 3 SCADA controlled load break switches, 34.5 kV Meter Package and associated facilities.	$ 363,500	$ 59,700	$ 423,200
Lakehurst Substation: Revise relay settings on the Lakehurst - Van Hiseville 34.5 kV (N-223) line for AB1-163 Interconnection.	$ 46,900	$ 7,000	$ 53,900
Van Hiseville Substation: Revise relay settings on the Lakehurst - Van Hiseville 34.5 kV (N-223) line for AB1-163 Interconnection.	$ 46,900	$ 7,000	$ 53,900
Total Facilities Cost Estimate	**$ 457,300**	**$ 73,700**	**$ 531,000**

Schedule

Based on the extent of the JCP&L primary Direct Connection and system upgrades required to support the generation project, it is expected to take a minimum of 15 months from the date of a fully executed Interconnection Construction Service Agreement to complete the installation. This includes the requirement for the Interconnection Customer to make a preliminary payment to FE which funds the first three months of engineering design that is related to the construction of the Direct Connection facilities. It further assumes that the Interconnection Customer will provide all rights-of-way, permits, easements, etc. that will be needed. A further assumption is that there will be no environmental issues with any of the new properties associated with this project, that there will be no delays in acquiring the necessary permits for implementing the defined Direct Connection and network upgrades, and that all system outages will be allowed when requested.

Interconnection Customer Requirements

Requirement from the PJM Open Access Transmission Tariff:

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.

In addition to the JCP&L facilities, the Interconnection Customer is will also be responsible for meeting all criteria as specified in the applicable sections of the FE "Requirements for Transmission Connected Facilities" document including:

1. The purchase and installation of fully rated 34.5 kV circuit breaker on the high side of the step-up transformer.

2. The purchase and installation of the minimum required FE generation interconnection relaying and control facilities. This includes over/under voltage protection, over/under frequency protection, and zero sequence voltage protection relays.

3. The purchase and installation of supervisory control and data acquisition ("SCADA") equipment to provide information in a compatible format to the FE Transmission System Control Center.

4. The establishment of dedicated communication circuits for SCADA to the FE Transmission System Control Center.

5. A compliance with the FE and PJM generator power factor and voltage control requirements.

6. The execution of a back-up service agreement to serve the customer load supplied from the generation project interconnection point when the units are out-of-service. This assumes the intent of the Interconnection Customer is to net the generation with the load.

The above requirements are in addition to any metering or other requirements imposed by PJM.

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.

JCPL Requirements

The Interconnection Customer will be required to comply with all FE Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "FirstEnergy Requirements for Transmission Connected Facilities" document located at the following links:

http://www.firstenergycorp.com/feconnect
http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx

Network Impacts

The Queue Project AB1-163 was evaluated as a 5.0 MW (Capacity 0.0 MW) injection tapping the Glidden-Van Hise 34.5kV line in the JCPL area. Project AB1-163 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB1-163 was studied with a commercial probability of 100%. Potential network impacts were as follows:

Base Case Used

Summer Peak Analysis – 2019 Case

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Description
L_GBRK-LNEL	CONTINGENCY 'L_GBRK-LNEL' /* GREEN BROOK TO LAKE NELSON DISCONNECT BUS 218334 /* LAKE NELSON LOSS OF BUS W SIDE DISCONNECT BUS 218522 /* REMOVE MIDDLESEX END

Generator Deliverability

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

None.

Light Load Analysis

Light Load Studies to be conducted during later study phases (applicable to wind, coal, nuclear, and pumped storage projects).

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)

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.

FE – System Protection Analysis

An analysis was conducted to assess the impact of the generation project on the system protection requirements in the area. The results of this review have identified that the current relaying at Lakehurst and Van Hiseville substations will require setting changes to accommodate this interconnection and to maintain adequate protection of the transmission system. The customer will also be required to have two relays providing high speed protection for faults past their interconnection. The Interconnection Customer will still be responsible for meeting the generator interconnection requirements in the FE "Requirements for Transmission Connected Facilities" document.

The fault currents on the Lakehurst - (N-223) 34.5 kV line, 1.6 miles from the Glidden substation (toward Van Hiseville) are listed below.

Three Phase Fault Current (Amps):	7,740
Single Line-to-Ground Fault Current (Amps):	4,310
Positive Sequence Impedance (Ohms):	0.7953 + j 2.4465
Zero Sequence Impedance (Ohms):	2.3935 + j 8.3942

These values are for the current system configuration. Any system changes in the area could have a significant impact on these values. It will be the responsibility of the Interconnection Customer to make any protection upgrades required should this occur. The proposed interconnection facilities must be designed in accordance with the "FirstEnergy Requirements for Transmission Connected Facilities" document.

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)

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 developer 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.

	Contingency		Affected		Bus			Power	Loading %		Rating		MW	
#	Type	Name	Area	Facility Description	From	To	Circuit	Flow	Initial	Final	Type	MVA	Contribution	Ref
1	N-1	L_GBRK-LNEL	PSEG	KILMER_I-LNELSN_I 230 kV line	218331	218333	1	AC	99.94	100.03	ER	805	0.82	

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

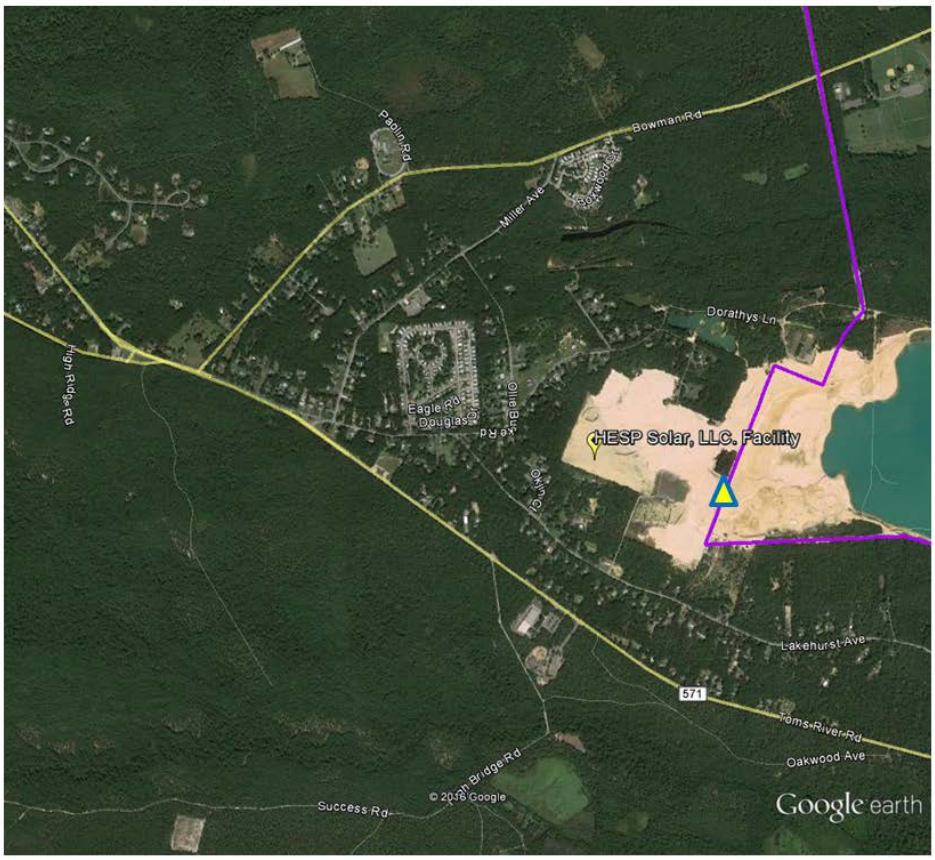
None.

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)

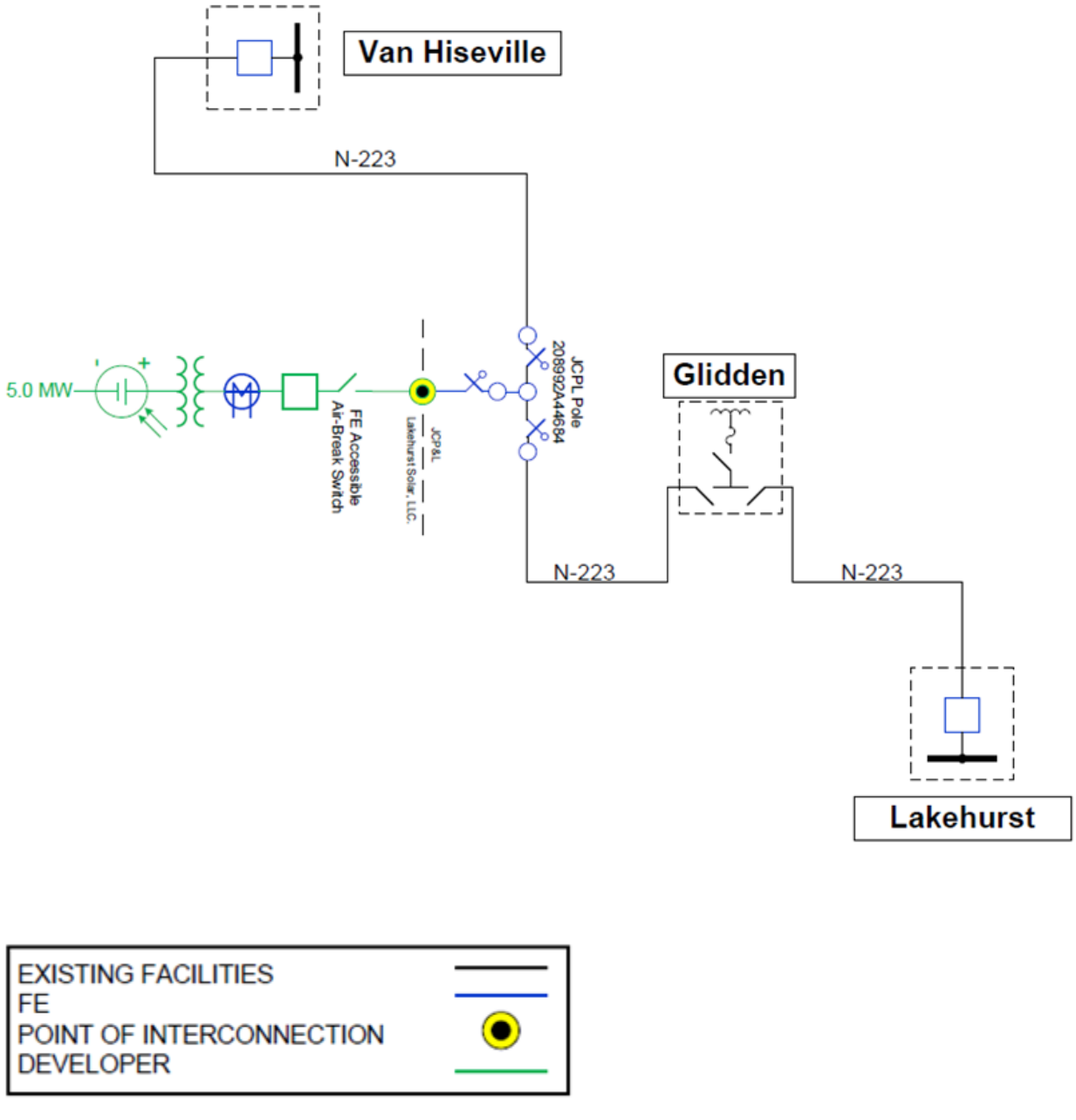
None.

Attachment 1. Site Location



Primary Point of Interconnection

Attachment 2. Single Line Diagram



Attachment 3. Engineering Single Line Diagram