Generation Interconnection

Impact Study Report

for

Queue Project AE2-112

CARVILLE 138 KV

6.46 MW Capacity / 17 MW Energy

February, 2020

Revised January 2022

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1 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.

The Interconnection Customer seeking to interconnect a wind or solar generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement and Section 8 of Manual 14D.

2 Revision History

This SIS report was updated in January 2022 to reflect the results of PJM's retool analysis.

3 General

The Interconnection Customer (IC), has proposed an uprate to an existing Solar generating facility located in Queen Anne's County, Maryland. This projects requests an increase to the install capability of 17 MW with 6.46 of MW of this output being recognized by PJM as Capacity. The installed facilities will have a total capability of 66 MW. The proposed in-service date for this project is November 30, 2021. This study does not imply a TO commitment to this in-service date.

Queue Number	AE2-112
Project Name	CARVILLE 138 KV
Interconnection Customer	CONCHO SOLAR I , LLC
State	Maryland
County	Queen Anne's
Transmission Owner	DPL
MFO	66
MWE	17
MWC	6.46
Fuel	Solar
Basecase Study Year	2022

3.1 Point of Interconnection

AE2-112 project will interconnect with the DPL transmission system at the same Point of Interconnection as prior queue project AD2-076. As a result, the AE2-112 project will connect with the DPL transmission system at the Carville 138 kV substation.

3.2 Cost Summary

The AE2-112 project will be responsible for the following costs associated with the physical interconnection of the project:

Description	Total Cost
Attachment Facilities	$0
Direct Connection Network Upgrade	$0
Non Direct Connection Network Upgrades	$0
Total Costs	$0

DPL reserves the right to reassess issues presented in this document and, upon appropriate justification, submit additional costs related to the AE2-112 project.

In addition, the AE2-112 project may be responsible for a contribution to the following costs associated with network upgrades:

Description	Total Cost
System Upgrades	$0

Cost allocations for these upgrades is provided in Section 11.5 System Reinforcements.

4 Transmission Owner Scope of Work

The AE2-112 project will interconnect via a new terminal position at the Carville 138 kV substation that shall be created as a part of the AD2-076 project. If the AD2-076 project were to withdraw from the queue, AE2-112 will be responsible for the attachment facilities, direct connection, and non-direct connection costs.

5 Attachment Facilities Cost Estimate

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
Total Attachment Facility Costs	$0

6 Direct Connection Cost Estimate

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

Description	Total Cost
Total Direct Connection Facility Costs	$0

7 Non-Direct Connection Cost Estimate

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

Description	Total Cost
Total Non-Direct Connection Facility Costs	$0

8 Schedule

DPL would take approximately 24 – 30 months to complete the design and construction of a new terminal position at the Carville 138 kV substation.

9 Interconnection Customer Requirements

The Interconnection Customer is responsible for all design and construction related to activities on their side of the Point of Interconnection. Site preparation, including grading and an access road, as necessary, is assumed to be by the IC. Route selection, line design, and right-of-way acquisition of the direct connect facilities is not included in this report and is the responsibility of the IC. Protective relaying and metering design and installation must comply with DPL's applicable standards. The IC is also required to provide revenue metering and real-time telemetering data to PJM in conformance with the requirements contained in PJM Manuals M-01 and M-14 and the PJM Tariff.

DPL requires that an IC circuit breaker is located within 500 feet of the DPL substation to facilitate the relay protection scheme between DPL and the IC at the Point of Interconnection (POI).

9.1 Special Operating Requirements

1. DPL will require the capability to remotely disconnect the generator from the grid by communication from its System Operations facility. Such disconnection may be facilitated by a generator breaker, or other method depending upon the specific circumstances and the evaluation by DPL.

2. DPL reserves the right to charge the Interconnection Customer operation and maintenance expenses to maintain the Interconnection Customer attachment facilities, including metering and telecommunications facilities, owned by DPL.

3. For the safety and reliability of the Transmission System, the Interconnection Customer shall design is non-synchronous generation 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.

10 Revenue Metering and SCADA Requirements

10.1 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 Section 8 of Attachment O.

10.1.1 Meteorological Data Reporting Requirement

The solar generation facility shall provide the Transmission Provider with site-specific meteorological data including:

- Temperature (degrees Fahrenheit)
- Atmospheric pressure (hectopascals)
- Irradiance
- Forced outage data

10.2 DPL Requirements

DPL interconnection requirements can be found at https://pjm.com/planning/design-engineering/to-tech-standards/private-dpl.aspx

10.2.1 Required Relaying and Communications

1. New protection relays are required for the new terminals.
2. An SEL-487 will be required for primary protection and an SEL-387 will be required for back-up protection.
3. One 20" relay panel for each generator terminal will be required for front line and back-up protection.
4. An SEL-451 relay on a 20" breaker relay panel for each generator terminal will be required for the control and operation of each new 138 kV circuit breaker (1 total).

The cost of the required relay and communications is included in the Substation Interconnection Estimate.

10.2.2 Metering

A three phase 138 kV revenue metering point will need to be established within the Interconnection Customer Facilities at the Point of Interconnection. The Interconnection Customer will purchase and install all metering instrument transformers as well as construct a metering structure per the DPL's specifications. The secondary wiring connections at the instrument transformers will be completed by the Interconnection Customer and inspected by DPL, while the connections at the metering enclosure will be completed by the DPL. The metering control cable and meter cabinets will be supplied by the DPL and installed by the Interconnection Customer. The Interconnection Customer will install conduit for the control cable between the instrument transformers and the metering enclosure. The location of the metering enclosure will be determined during construction. The Interconnection Customer will provide 120V power to the meter cabinet. The DPL will

provide, program, install, and own the primary & backup solid state multi-function meters for the new metering position.

Each meter will be equipped with load profile, telemetry, and DNP outputs. The Interconnection Customer will be provided with one-meter DNP output for each meter. DPL will supply a wireless modem for MV90 interrogation. In the event that a wireless modem is unable to reliably communicate, the IC will be required to make provisions for a POTS (Plain Old Telephone Service) line or equivalent technology approved by DPL within approximately three feet of the DPL metering position to facilitate remote interrogation and data collection. It is the Interconnection Customer's responsibility to send the data that PJM and DPL require directly to PJM. The Interconnection Customer will grant permission for PJM to send DPL the following telemetry that the Interconnection Customer sends to PJM: real time MW, MVAR, volts, amperes, generator status, and interval MWH and MVARH.

DPL's revenue meters will be the official meters and must be the source for reporting generation output to PJM. The Interconnection Customer is responsible for installing telemetry equipment necessary to obtain the revenue meter data and submitting the data to PJM.

11 Network Impacts

The Queue Project AE2-112 was evaluated as a 17.0 MW (Capacity 6.5 MW) injection at Carville 138kV in the DPL area. Project AE2-112 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-112 was studied with a commercial probability of 100%. Potential network impacts were as follows:

12 Summer Peak Load Flow

12.1 Generation Deliverability

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

None

12.2 Multiple Facility Contingency

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

None

12.3 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

12.4 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.

None

12.5 System Reinforcements

None

12.6 Flow Gate Details

The following indices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact. It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

None

12.7 Affected Systems

None

12.8 Contingencies

None

13 Light Load Analysis

Not Required.

14 Short Circuit

The following Breakers are overduty:

None

15 Stability and Reactive Power Requirement

Stability Analysis will be performed during the Facilities Study. **Additional reinforcements may be identified to mitigate stability concerns.**

16 Single Line Diagram