Generation Interconnection

System Impact Study Report

for

Queue Project AE1-040

GREENFIELD 69 KV

31.6 MW Capacity / 47.5 MW Energy

Revised: September, 2019

Original Issue: August, 2019

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:

- Original Issue: August 2019
- Revision 1: September 2019. The September 2019 issue revised the Cost Summary table in Section 3.2.

3 General

The Interconnection Customer (IC) has proposed a solar facility to be located in Fayette County near Greenfield, Ohio. The project will have a total capability of **47.5 MW** with **31.6 MW** of this output being recognized by PJM as capacity. The expected Commercial Operation Date for this uprate project is **June 30, 2021**. **This study does not imply a Dayton Power & Light Company (Dayton) commitment to this in-service date.**

Queue Number	**AE1-040**
Project Name	GREENFIELD 69 KV
Interconnection Customer	Fayette Solar, LLC
State	Ohio
County	Fayette
Transmission Owner	Dayton
MFO	47.5
MWE	47.5
MWC	31.6
Fuel	Solar
Basecase Study Year	2022

3.1 Point of Interconnection

The AE1-040 project will interconnect directly into the Greenfield 69 kV Substation. The physical Point of Interconnection (POI) will be the last takeoff structure leaving the Greenfield 69 kV yard. Dayton will own the takeoff structure and all attachment hardware. Customer will own the conductor terminating onto the structure.

Under the AE1-040 project, the IC will construct a single 69kV line up to the POI in the Greenfield 69 kV yard.

See Attachment 1 for a one line of the physical interconnection point.

3.2 Cost Summary

The AE1-040 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$0
Direct Connection Network Upgrade	$0
Non Direct Connection Network Upgrades	$1,655,000
Allocation for New System Upgrades	$0
Contribution for Previously Identified Upgrades	$0
Total Costs	**$1,655,000**

4 Transmission Owner Scope of Work

4.1 Attachment Facilities

The Interconnection Customer will construct the generator lead line to the proposed Point of Interconnection as depicted on the one line diagram in Attachment 1. The IC will also be responsible for the fiber/OPGW that Dayton requires on the generator line for the communication assisted trip scheme

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
None	$0
Total Attachment Facility Costs	$0

4.2 Direct Connection Cost Estimate

There are no Direct Connection costs associated with AE1-040.

4.3 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
Protection System changes at Greenfield Substation	$ 15,000
Protection System changes at Washington CH Substation	$ 15,000
Protection System changes at AEP Buckskin Substation	$ 250,000[1]
Install three new 69 kV breakers at the Greenfield Substation to interconnect the AE1-040 project. This will include the installation of all physical structures, P&C equipment, communications equipment, metering equipment, and associated facilities.	$1,375,000
Total Non-Direct Connection Facility Costs	**1,655,000**

The substation non-direct connection cost estimate for the AE1-040 project remote end relay and protection scope is approximately **$280,000**. Remote end relaying will need to be evaluated for settings changes at Greenfield, Washington CH, and Buckskin (AEP) Substations to facilitate the interconnection of the new generation.

[1] AEP will evaluate the true scope and cost of the Protection System Changes in the Facilities Study Phase.

The substation non-direct connection for the AE1-040 project modifications to the Greenfield 69kV substation is approximately **$1,375,000.** The substation non-direct connection work for this project includes the addition of three new 69 kV breakers to the Greenfield Substation. The Greenfield Substation is designed for a two bus, two breaker configuration. Thus, to create a reliable connection to the system will require three new breakers.

The 69 kV generator lead line will be constructed by the developer and will be terminated onto the 69 kV takeoff structure leaving the Greenfield Substation. The new 69kV breakers will be equipped with the necessary communication systems to facilitate remote supervisory control of the breaker and status monitoring. Dayton will install the physical structures, line relaying, communications, and interconnection metering to accommodate the interconnection of the AE1-040 generator.

5 Schedule

Based on the extent of the Dayton primary Direct Connection and Non-Direct Connection upgrades required to support the AE1-040 generation project, it is expected to take a minimum of **18 months** from the date of a fully executed Interconnection Construction Service Agreement to complete the installation subject to market conditions and vendor lead times. This includes the requirement for the Interconnection Customer to make a preliminary payment to Dayton which funds the first three months of engineering design that is related to the construction of the Non-Direct Connection facilities. It assumes that there will be no environmental or permitting issues to implement the Non-Direct Connection upgrades for this project and that all system outages will be allowed when requested.

6 Interconnection Customer Requirements

6.1 Dayton Interconnection Requirements

Dayton has prepared this Facilities Connection Requirements document to ensure compliance with North American Electric Reliability Council (NERC) Reliability Standards and applicable Regional Reliability Organization, sub regional, Power Pool, and individual Transmission Owner planning criteria and facility connection requirements in compliance to NERC Standard FAC-001-3. These connection requirements apply to all generation facilities, transmission facilities, and end-users connecting to the Dayton transmission system. Detailed information outlining Dayton interconnection requirements can be reviewed utilizing the following link:

http://www.pjm.com/~/media/planning/plan-standards/private-dayton/dayton-facilities-connection-requirements.ashx

7 Revenue Metering and SCADA Requirements

7.1 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 Attachment O, Appendix 2, Section 8.

7.2 Dayton Metering Requirements

The Interconnection Customer will be required to comply with all Dayton Revenue Metering Requirements for Generation Interconnection Customers as outlined in the link below. The Revenue Metering Requirements may be found within the Dayton Power & Light Co. "Requirements for the Connection of Facilities to the Dayton Power & Light Co. Transmission System" document located at the following link:

http://www.pjm.com/~/media/planning/plan-standards/private-dayton/dayton-facilities-connection-requirements.ashx
http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx

8 Network Impacts

The Queue Project AE1-040 was evaluated as a 47.5 MW (Capacity 31.6 MW) injection into the **Greenfield 69 kV substation** in the Dayton area. Project AE1-040 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE1-040 was studied with a commercial probability of 1.00. Potential network impacts were as follows:

Summer Peak Load Flow

9 Generation Deliverability

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

None

10 Multiple Facility Contingency

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

None

11 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 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

13 Stability and Reactive Power Requirement for Low Voltage Ride Through

Stability Analysis will be performed during the Facilities Study. **Note that it is possible for additional reinforcements to be identified to mitigate stability concerns.**

14 Light Load Analysis

No mitigations are required.

15 System Reinforcements

None

Affected Systems

16 Affected Systems

16.1 LG&E

A LG&E Affected System Study will be required for AE1-040. The AE1-040 customer will need to enter into an Affected System Study Agreement with LG&E.

16.2 MISO

MISO Impacts to be determined during later study phases (as applicable).

16.3 TVA

None

16.4 Duke Energy Progress

None

16.5 NYISO

None

Short Circuit

17 Short Circuit

The following Breakers are over duty:

None

Attachment 1: One Line Diagram