Generation Interconnection

Feasibility Study Report

for

Queue Project AF1-078

EAST SIDNEY-QUINCY 138 KV

30.4 MW Capacity / 80 MW Energy

January 2020

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1 Preface

The intent of the feasibility 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. Cost allocation rules for network upgrades 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.

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.

An Interconnection Customer 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 Feasibility 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.

2 General

The Interconnection Customer (IC), has proposed a solar generating facility located at 40.266347 latitude and -84.009411 longitude in Champaign County, Ohio. The installed facilities will have a capability of 80 MW with 30.4 of new request MW of this output being recognized by PJM as capacity. Note that this project is an increase to the Interconnection Customer's AE2-206 "East Sidney-Quincy 138kV" project, which will share the same property and connection point. The conduct of light load analysis as required under the PJM planning process is not performed during the Generation Interconnection Feasibility Study phase of the PJM study process. Additional reinforcement requirements for this Interconnection Request may be defined during the conduct of the light load analysis which shall be performed following execution of the System Impact Study agreement. The proposed in-service date for this project is **November 30, 2021. This study does not imply The Dayton Power and Light Company (Dayton) commitment to this in-service date.**

Queue Number	**AF1-078**
Project Name	EAST SIDNEY-QUINCY 138 KV
State	Ohio
County	Champaign
Transmission Owner	Dayton
MFO	179
MWE	80
MWC	30.4
Fuel	Solar
Basecase Study Year	2023

2.1 Point of Interconnection

The AF1-078 "East Sidney-Quincy 138 kV" uprate project will interconnect behind the same Point of Interconnection (POI) as the AE2-206 "East Sidney-Quincy 138 kV". The AE2-206 and AF1-078 projects will interconnect with The Dayton Power & Light Company transmission system via a new 138 kV three-breaker ring bus switchyard that will tap the East Sidney-Quincy 138 kV Line. The Point of Interconnection (POI) will be the 138kV takeoff structure leaving the new three breaker ring bus switchyard. Dayton will own the takeoff structure and all attachment hardware. The Interconnection Customer will own the generator lead line conductor terminating onto the structure. The new interconnection substation be located approximately 2.5 miles from Quincy Substation. This is the primary Point of Interconnection (POI) chosen by the IC. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection substation and the associated attachment facilities.

Attachment 1 shows a one-line diagram of the proposed primary direct connection of the (AF1-078) generation project to The Dayton Power & Light transmission system. Attachment 2 provides the proposed location for the point of interconnection. IC will be responsible for constructing all of the facilities on its side of the POI including the attachment line.

2.2 Cost Summary

The AE2-206 "East Sidney-Quincy 138 kV" project is responsible for the interconnection facilities to the Dayton Power and Light system. AF1-078 "East Sidney-Quincy 138 kV" will share the same interconnection facilities.

Should the AE2-206 project elect not to move forward, the AF1-078 project would assume the complete responsibility of the interconnection facilities.

The AF1-078 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$15,000
Direct Connection Network Upgrade	$0
Non Direct Connection Network Upgrades	$30,000
Total Costs	**$45,000**

In addition, the AF1-078 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	**$7,000,000 (PJM to update)**

Cost allocations for these upgrades will be provided in the System Impact Study Report.

The required Attachment Facilities, Direct Connection and Non-Direct Connection work for the interconnection of the AF1-078 generation project to the Dayton Transmission System is detailed in the

following sections. The associated one-line with the generation project attachment facilities and primary direct and non-direct connection are shown in Attachment 1.

Note that the Dayton findings were made from a conceptual review of this project. A more detailed review of the connection facilities and their cost will be identified in a future study phase. Further note that the cost estimate data contained in this document should be considered high level estimates since it was produced without a detailed engineering review. The applicant will be responsible for the actual cost of construction. Dayton herein reserves the right to return to any issues in this document and, upon appropriate justification, request additional monies to complete any reinforcements to the transmission systems.

3 Transmission Owner Scope of Work

The AF1-078 project will use the same interconnection facilities as the AE2-206 project, so the only Transmission Owner work associated with this project is to provide engineering oversight and make remote relay setting changes at the A2-206 interconnection substation and the Shelby and Logan substations.

Should the AE2-206 project elect not to move forward, the AF1-078 project would assume the responsibility of the interconnection facilities. This would include the installation of a new 138kV three breaker ring bus, any transmission line work, and any associated system upgrades.

4 Attachment Facilities

This report assumes that the Interconnection Customer will construct and own the attachment line from its generating facility into 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 costs included below are for the necessary protection system review and any subsequent field changes needed to coordinate with IC attachment facilities.

The metering may be classified as an Attachment Facility in future study reports. If separate metering for the AF1-078 project will be required, it will need to be installed on the generator side of the interconnection since there will be a single generator lead line for both the A2-206 and AF1-078 projects.

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**
Engineering review and commissioning.	$15,000
Total Attachment Facility Costs	**$15,000**

5 Direct Connection Cost Estimate

The AE2-206 project will be responsible for the connection facilities, therefore, there is no Direct Connection scope of work required for this project.

Should the AE2-206 project elect not to move forward, the AF1-078 project would assume the responsibility of the interconnection facilities.

6 Non-Direct Connection Cost Estimate

The total Non-Direct Connection cost estimate for the AF1-078 project is approximately $30,000.

Remote relay setting changes will need to be made at the Shelby and Logan Substations to facilitate the interconnection of the new generation.

Should the AE2-206 project elect not to move forward, the Non-Direct Connection costs for AF1-078 would increase to account for the remote end relay changes that were associated with AE2-206.

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**
Shelby 138 kV Substation - protection system settings changes	$15,000
Logan 138 kV Substation - protection system settings changes	$15,000
Total Non-Direct Connection Facility Costs	**$30,000**

7 Schedule

Based on the extent of the Dayton primary Attachment Facilities and Non-Direct Connection work required to support the AF1-078 generation project, it is expected to take a minimum of **twelve (12) months** from the date of a fully executed Interconnection Construction Service Agreement to complete the installation. This includes the requirement for the IC to make a preliminary payment to Dayton which funds the Non-Direct Connection work and the first three months of engineering design that is related to the construction of the Attachment Facilities. It further assumes that the IC 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 Attachment Facilities and Non-Direct Connection work, and that all system outages will be allowed when requested.

8 Transmission Owner Analysis

Power Flow Analysis

PJM performed a power flow analysis of the transmission system using a 2023 summer peak load flow model and the results were verified by Dayton. Additionally, Dayton performed an analysis of its underlying transmission <100 kV system. At the Primary POI, the [QUEUE] project contributes to overloads on the Dayton transmission system as shown in the "Network Impacts" section of the report. The estimated cost of system reinforcements necessary to mitigate these overloads are also provided.

Dayton identified the following violation on their lower voltage system:

Id	From Bus Number	From Bus Name	From Bus Area	To Bus Number	To Bus Name	To Bus Area	CKT ID	kV	CONT DESCRIPTION
	253041	09LOGAN	DAY	253119	09BELFON	DAY	1	69.0	Loss of Shelby to AE2-206
	253042	09LOGAN	DAY	253041	09LOGAN	DAY	1	138.0/69.0	Loss of Shelby to AE2-206

Short Circuit Analysis

PJM performed a short circuit analysis and the results were verified by Dayton. The connection of [QUEUE] project to the system does not result in any newly overdutied circuit breakers on the Dayton transmission system and does not have a significant fault current contribution to existing overdutied circuit breakers.

Stability Analysis

PJM will complete a dynamic stability analysis, if necessary, as part of the System Impact Study. The results of this analysis will be reviewed by Dayton. Should stability concerns be identified in PJM's study, Dayton will develop appropriate system reinforcement(s) and included the estimated cost of any reinforcement(s) in Dayton's System Impact Study report.

9 Interconnection Customer Requirements

Requirement from the PJM Open Access Transmission Tariff:

1. 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.

2. 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.

System Protection

The IC must design its Customer Facilities in accordance with all applicable standards, including the standards in Dayton's "Requirements for the connection of Facilities to the Dayton Power & Light company Transmission System" document located at: https://www.pjm.com/planning/design-engineering/to-tech-standards/private-dayton.aspx. Preliminary Protection requirements will be provided as part of the Facilities Study. Detailed Protection Requirements will be provided once the project enters the construction phase.

Compliance Issues and Interconnection Customer Requirements

The Dayton Power and Light Company (DP&L) 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-001-2. These connection requirements apply to all generation facilities, transmission facilities, and end-users connecting to the DP&L transmission system. Detailed information outlining DP&L interconnection requirements can be reviewed utilizing the following link:

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

Power Factor Requirements

The IC shall design its non-synchronous Customer Facility with the ability to maintain a power factor of at least 0.95 leading (absorbing VARs) to 0.95 lagging (supplying VARs) measured at the high-side of the facility substation transformer(s) connected to the Dayton transmission system.

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.

10.2 Dayton 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

11 Network Impacts

The Queue Project AF1-078 was evaluated as a 80.0 MW (Capacity 30.4 MW) injection as an uprate to AE2-206 tapping the East Sidney to Quincy 138 kV line in the Dayton area. Project AF1-078 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-078 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

Summer Peak Load Flow

12 Generation Deliverability

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

None

13 Multiple Facility Contingency

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

None

14 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

15 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

16 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
AF1-078-L1	N/A	**Logan - Bellefontaine 69kV Line**	**DAYr190032 : Reconductor Logan-Bellefontaine 69kV line with 795 ACSR** **Project Type : FAC** **Cost : $4,500,000** **Time Estimate : 18.0 Months**	$4,500,000
AF1-078-L2	N/A	**Logan 138/69kV XFMR**	**WP-AF1-F-0011 : Replace Logan 138/69kV transformer with 250 MVA transformer** **Project Type : FAC** **Cost : $2,500,000** **Time Estimate : 24.0 Months**	$2,500,000
			TOTAL COST	**$7,000,000**

17 Affected Systems

17.1 LG&E

LG&E Impacts to be determined during later study phases (as applicable).

17.2 MISO

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

17.3 TVA

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

17.4 Duke Energy Progress

Duke Energy Progress Impacts to be determined during later study phases (as applicable).

17.5 NYISO

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

18 Short Circuit

No overdutied breakers were identified.