Generation Interconnection

Feasibility Study Report

for

Queue Project AE2-206

EAST SIDNEY-QUINCY 138 KV

41.58 MW Capacity / 99 MW Energy

July, 2019

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.

PJM utilizes manufacturer models to ensure the performance of turbines is properly captured during the simulations performed for stability verification and, where applicable, for compliance with low voltage ride through requirements. Turbine manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is contained in Attachment B of Manual 14G. Manufacturer models may be updated from time to time, for various reasons such as to reflect changes to the control systems or to more accurately represent the capabilities turbines and controls which are currently available in the field. Additionally, as new turbine models are developed, turbine manufacturers provide such new models which must be used in the conduct of these studies. PJM needs adequate time to evaluate the new models in order to reduce delays to the System Impact Study process timeline for the Interconnection Customer as well as other Interconnection Customers in the study group. Therefore, PJM will require that any Interconnection Customer with a new manufacturer model must supply that model to PJM, along with a $10,000 fully refundable deposit, no later than three (3) months prior to the starting date of the System Impact Study (See Section 4.3 for starting dates) for the Interconnection Request which shall specify the use of the new model. The Interconnection Customer will be required to submit a completed dynamic model study request form (Attachment B-1 of Manual 14G) in order to document the request for the study.

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.

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2 General

The Interconnection Customer (IC) has proposed a Solar generating facility located in Champaign County, Ohio. The installed facilities will have a total capability of 99 MW with 41.58 MW of this output being recognized by PJM as Capacity. 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	**AE2-206**
Project Name	EAST SIDNEY-QUINCY 138 KV
State	OHIO
County	Champaign
Transmission Owner	Dayton
MFO	99
MWE	99
MWC	41.58
Fuel	Solar
Basecase Study Year	2022

2.1 Point of Interconnection

The AE2-206 project 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. The Interconnection Customer will own the generator lead line conductor terminating onto the structure.

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

2.2 Cost Summary

The AE2-206 project will be responsible for the following costs:

Description	**Total Cost**
Attachment Facilities	$0
Direct Connection Network Upgrade	$3,700,000
Non Direct Connection Network Upgrades	$150,000
Total Costs	**$3,850,000**

In addition, the AE2-206 project may be responsible for a contribution to the following costs

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Description	Total Cost
System Upgrades	$7,000,000

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

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3 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 metering may be classified as an Attachment Facility in future study reports.

Description	Total Cost
Attachment Facility	$0
Total Attachment Facility Costs	**$0**

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

4 Direct Connection Cost Estimate

The direct connection cost estimate for the AE2-206 project is approximately $3,700,000. The substation direct connection work for this project includes the construction of a 138 kV three breaker ring bus switchyard which will be tapped off the East Sidney-Quincy 138kV line. There will also be 138 kV transmission line construction required to accommodate the new switchyard. The 138 kV generator lead line will be constructed by the developer and will be terminated onto the 138kV takeoff structure leaving the new three breaker ring bus switchyard. The new 138kV breakers will be equipped with the necessary communication systems to facilitate remote supervisory control of the breaker and status monitoring. Dayton will install the line relaying, communications, and interconnection metering to accommodate the interconnection of the AE2-206 generator

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
Install a new 138 kV three breaker ring bus switchyard to interconnect the AE2-206 project. This will include the installation of all physical structures, P&C equipment, communications equipment, metering equipment, and associated facilities.	$3,200,000
Transmission Line Tie-In work to accommodate new AE2-206 Interconnection Switchyard.	$500,000
Total Direct Connection Facility Costs	**$3,700,000**

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5 Non-Direct Connection Cost Estimate

The substation non-direct connection cost estimate for the AE2-206 project is approximately $150,000. Remote end relaying will need to be evaluated for settings changes at Shelby and Logan Substations to facilitate the interconnection of the new generation.

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 Shelby Substation	$75,000
Protection System changes at Logan Substation	$75,000
Total Non-Direct Connection Facility Costs	**$150,000**

6 Schedule

Based on the extent of the Dayton primary Direct Connection and Non-Direct Connection upgrades required to support the AE2-206 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.

7 Transmission Owner Analysis

Dayton identified the following violation on their lower voltage system:

Id	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	kV	CONT DESCRIPTION
L1	253041	09LOGAN	DAY	253119	09BELFON	DAY	1	69.0	Loss of Blue Jacket to Kirby 138 kV line
L2	253042	09LOGAN	DAY	253041	09LOGAN	DAY	1	138.0 / 69.0	Loss of Blue Jacket to Kirby 138 kV line

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8 Interconnection Customer Requirements

8.1 Dayton Interconnection 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

8.2 Dayton Notes

The AE2-206 generator may be required to curtail for various N-1 contingencies to avoid N-1-1 loading issues.
Revenue Metering and SCADA Requirements

8.3 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.

8.4 Dayton Power and Light Company 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

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9 OPTION 1: Network Impacts

The Queue Project AE2-206 was evaluated as a 99.0 MW (Capacity 41.6 MW) injection tapping the East Sidney to Quincy 138kV line in the Dayton area. Project AE2-206 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-206 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

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Summer Peak Load Flow

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10 Generation Deliverability

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

None

11 Multiple Facility Contingency

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

None

12 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

13 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

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14 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
L1	See TO Analysis	**09LOGAN 69.0 kV - 09BELFON 69.0 kV Ckt 1**	**Reinforcement ID, r190015 : Re-conductor 138.0 kV line from Logan to Bellefontaine with 795 ACSR.** **Project Type : FACILITY** **Cost : $4,500,000** **Time Estimate : 18 Months**	$4,500,000
L2	See TO Analysis	**09LOGAN 138.0 kV - 09LOGAN 69.0 kV Ckt 1**	**Reinforcement ID, r190016 : Replace Logan 138/69kV transformer with 250 MVA transformer.** **Project Type : FACILITY** **Cost : $2,500,000** **Time Estimate : 24 Months**	$2,500,000
			TOTAL COST	**$7,000,000**

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15 Flow Gate Details

The following appendices 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.

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Affected Systems

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16 Affected Systems

16.1 LG&E

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

16.2 MISO

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

16.3 TVA

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

16.4 Duke Energy Progress

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

16.5 NYISO

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

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Short Circuit

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17 Short Circuit

The following Breakers are over duty

None.

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18 OPTION 2: Network Impacts

The Queue Project AE2-206 was evaluated as a 99.0 MW (Capacity 41.6 MW) injection at the Quincy 138kV substation in the Dayton area. Project AE2-206 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-206 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

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19 Generation Deliverability

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

None

20 Multiple Facility Contingency

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

None

21 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

22 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.

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None

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Affected Systems

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23 Affected Systems

23.1 LG&E

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23.2 MISO

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23.3 TVA

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

23.4 Duke Energy Progress

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

23.5 NYISO

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

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Short Circuit

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24 Short Circuit

The following Breakers are over duty

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25 Transmission Owner Analysis

Dayton identified the following violation on their lower voltage system:

Id	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	kV	CONT DESCRIPTION
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