Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AC1-212

"Minster 69 kV"

February 2017

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. 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 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.

General

The Interconnection Customer (IC) has proposed a battery storage generating facility located at 285 N. Ohio Street in Minster, Ohio. The installed facilities will have a total capability of **19.9 MW** with **19.9 MW** of this output being recognized by PJM as capacity. The proposed in-service date for this project is **April 1, 2018**. **This study does not imply a Dayton Power & Light Company commitment to this in-service date.**

Point of Interconnection

AC1-212 "Minster 69 kV" has requested that two physical interconnection points be scoped and estimated by Dayton Power & Light Company.

Option 1: The first physical interconnection point will be at the first dead-end structure outside the Minster Substation fence on the AC1-212 69 kV generator lead line. Presently Minster Substation serves as a 69 kV delivery point to the City of Minster. There are two 69 kV breakers that feed two 69/12 kV distribution transformers that feed the City of Minster load.

Option 2: The second physical interconnection point will be where the attachment hardware interconnects with tap switch to the Minster-Rossburg/Covington 69 kV line.

See Attachments 1 and 2 for one lines of both physical interconnection points. Electrically, both points are considered to be the same and are modeled at the Minster 69 kV bus.

Cost Summary: Option 1 - Minster 69 kV Bus

The **AC1-212** project will be responsible for the following costs for Option 1:

Description	Total Cost
Attachment Facilities	$ 0
Direct Connection Network Upgrades	$ 0
Non Direct Connection Network Upgrades	$ 1,000,000
Total Costs	**$ 1,000,000**

Cost Summary: Option 2 – Minster-Rossburg/Covington 69 kV Line Tap

The **AC1-212** project will be responsible for the following costs for Option 2:

Description	Total Cost
Attachment Facilities	$ 60,000
Direct Connection Network Upgrades	$ 100,000
Non Direct Connection Network Upgrades	$ 190,000
Total Costs	**$ 350,000**

In addition to the costs for either physical interconnection point in Option 1 and Option 2 above, the **AC1-212** project may be responsible for a contribution to the following costs:

Description	Total Cost
New System Upgrades	$ 0
Previously Identified Upgrades	$ 0
Total Costs	**$ 0**

Option 1: Minster 69 kV Bus Physical Interconnection

Attachment Facilities: Option 1

No Attachment Facilities. This report assumes that the Interconnection Customer will build and own its own generator lead line up to the point of interconnection.

Direct Connection Cost Estimate: Option 1

No Direct Connection facilities are required to support this interconnection.

Non-Direct Connection Cost Estimate: Option 1

The total preliminary cost estimate for the Non-Direct Connection work (*for physical POI Option 1*) is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
69kV breaker installation and associated physical substation modifications to existing equipment	$ 700,000
Metering, P&C, RTU Upgrades	$ 300,000
Total Non-Direct Connection Facility Costs	**$ 1,000,000**

The substation non-direct connection cost estimate for the AC1-212 project (*for physical POI Option 1*) is approximately **$1,000,000**. The scope of work at Dayton's Minster Substation involves installing a single 69kV breaker off the existing Minster 69kV bus, revenue class 69kV metering, fiber line relaying, and RTU to interconnect the AC1-212 generation. The existing Minster Substation and associated City of Minster owned equipment will be subject to detailed engineering review due to space limitations within the existing Minster Substation.

Option 2: Minster-Rossburg/Covington 69 kV Line Physical Interconnection

Attachment Facilities: Option 2

This report assumes that the Interconnection Customer will build and own its own generator lead line up to the point of interconnection.

The total preliminary cost estimate for the Attachment work (*for physical POI Option 2*) is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Tap the Minster Rossburg/Covington 69 kV line and install a three-way phase switch to interconnect the AC1-212 project. (One switch covering the generator lead line is considered an Attachment Facility).	$ 60,000
Total Attachment Facility Costs	**$ 60,000**

The substation Attachment Facility cost estimate for the AC1-212 project (*for physical POI Option 2*) is approximately **$160,000**. Dayton Power and Light plans to tap the Minster-Rossburg/Covington 69kV line and install a three-way phase over phase switch to interconnect the AC1-212 Minster Battery Storage Project. The three-way switch will be equipped with the necessary communication systems to facilitate remote supervisory control of the switch and status monitoring. One switch of the three-way switch will be considered to be an Attachment Facility (the switch covering the generator lead line). DP&L will install 69kV metering adjacent to the switch.

Direct Connection Cost Estimate: Option 2

No Direct Connection facilities are required to support this interconnection.

The total preliminary cost estimate for the Direct Connection work (*for physical POI Option 2*) is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Tap the Minster Rossburg/Covington 69 kV line and install a three-way phase switch to interconnect the AC1-212 project (Two network switches of the three-way switch are considered Direct Connection Facilities).	$ 100,000
Total Direct Connection Facility Costs	**$ 100,000**

The substation direct connection cost estimate for the AC1-212 project (*for physical POI Option 2*) is approximately **$100,000**. Dayton Power and Light plans to tap the Minster-Rossburg/Covington 69kV line and install a three-way phase over phase switch to interconnect the AC1-212 Minster Battery Storage Project. The three-way switch will be equipped with the necessary communication systems to facilitate remote supervisory control of the switch and status monitoring. Two switches of the three-way switch will be considered to be Direct Connection facilities (the two switches that are in network with the main circuit).

Non-Direct Connection Cost Estimate: Option 2 - Minster – Rossburg/Covington 69 kV Line Tap

The total preliminary cost estimate for the Non-Direct Connection work (*for physical POI Option 2*) is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Protection System changes at Minster, Rossburg and Covington	$ 190,000
Total Non-Direct Connection Facility Costs	**$ 190,000**

The substation non-direct connection cost estimate for the AC1-212 project (*for physical POI Option 2*) is approximately **$190,000**. Protection system changes will need to be made at Minster, Rossburg, and Covington Substations to facilitate the interconnection of the new generation.

Interconnection Customer Requirements

Requirement from the PJM Open Access Transmission Tariff:

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.

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:

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

Schedule

Based on the extent of the Dayton primary Non-Direct Connection and Attachment upgrades required to support the AC1-212 generation project, it is expected to take a minimum of **12 months for 'Option 1' (and 6 months for 'Option 2')** 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.

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.

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

Network Impacts

The Queue Project AC1-212 was evaluated as a 19.9 MW (Capacity 19.9 MW) injection at the Minster 69kV substation in the Dayton area. Project AC1-212 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC1-212 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2020

Generator Deliverability

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

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.

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.

Steady-State Voltage Requirements

(Summary of the VAR requirements based upon the results of the steady-state voltage studies)

To be determined in the Impact Study Phase.

Short Circuit

(Summary of impacted circuit breakers)

None.

Affected System Analysis & Mitigation

(Summary of impacts on systems external to PJM)

LGEE Impacts:

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

MISO Impacts:

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

OVEC Impacts:

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

Delivery of Energy Portion of Interconnection Request

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.

Not applicable.

Light Load Analysis

Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

Stability and Reactive Power Requirement for Low Voltage Ride Through

(Summary of the VAR requirements based upon the results of the dynamic studies)

To be determined in the Impact Study phase.

Attachment 1. AC1-212 'Minster 69 kV'
One Line Diagram (Option 1)

Attachment 2: AC1-212 'Minster 69 kV'
One Line Diagram (Option 2)