Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AD1-035

"Darby-East Liberty 69kV"

January 2018

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.

Note: PJM utilizes manufacturer models to ensure the performance of inverters is properly captured during the simulations performed for stability verification. Inverter manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is contained in Attachment G-2 of Manual 14A. 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 of inverters and controls which are currently available in the field. Additionally, as new inverter models are developed, inverter 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 2.2.2. of Manual 14A 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 G-1 of Manual 14A) in order to document the request for the study.

General

The Interconnection Customer (IC), has proposed a **solar** generating facility located in Liberty, Ohio. The installed facilities will have a total capability of **50 MW** with **19 MW** of this output being recognized by PJM as capacity. The proposed in-service date for this project is **October 1, 2019**. **This study does not imply a Dayton Power and Light (Dayton) commitment to this in-service date.**

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PJM studied AD1-035 as a 50 MWE (19 MWC) injection into the Dayton zone at a tap off of the Darby-East Liberty 69 kV circuit and evaluated it for compliance with reliability criteria for summer peak conditions in 2021.

Point of Interconnection

The **AD1-035 "Darby-East Liberty 69 kV"** project requested that PJM study **one** electrical point of interconnection in the Feasibility analysis. The primary option was studied as an injection into a new substation tapping the Darby-East Liberty 69 kV line. Dayton Power and Light is only required to provide Attachment Facilities, Direct Connection, and Non-Direct Connection scope and costs for the primary interconnection option.

For the primary Point of Interconnection (POI), **AD1-035 "Darby-East Liberty 69 kV"** will interconnect with the Dayton Power and Light transmission system at new substation location on the **Darby-East Liberty 69kV line**. Presently, the Darby-East Liberty 69kV line is a three terminal line with breakers located at Darby, Honda East Liberty, and Honda Marysville 69kV substations. Dayton will install a takeoff structure immediately inside the new substation fence which will serve as the Point of Interconnection (POI). The 69 kV generator lead line constructed by the developer will be terminated onto this POI takeoff structure immediately inside of the new three breaker ring bus substation fence.

Attachment 1 shows the one line diagram of the proposed interconnection.

Cost Summary

The **AD1-035 "Darby-East Liberty 69 kV"** project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$ 0
Direct Connection Network Upgrades	$ 2,325,000
Non Direct Connection Network Upgrades	$ 125,000
Total Costs	**$ 2,450,000**

In addition, the AD1-035 project **may** be responsible for a contribution to the following costs (see "**Network Impacts**" section below for details):

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

The transmission and substation costs given above exclude any applicable state or federal taxes. If at a future date Federal CIAC (contribution in aid of construction) taxes are deemed necessary by the IRS for this project, Dayton shall be reimbursed by the Interconnection Customer for such taxes.

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The required Attachment Facilities, Direct Connection, and Non-Direct Connection work for the interconnection of the AD1-035 generation project to the Dayton Transmission System is detailed in the following sections. The associated one-line with the generation project is shown in Attachment 1.

Note that all cost estimates contained in this document were produced without a detailed engineering review and are therefore subject to change. IC will be responsible for the actual cost of the required interconnection and upgrade work that is implemented. 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 or subtransmission systems.

Attachment Facilities

There is no Attachment Facilities scope of work required for this project.

Description	Total Cost
No attachment facilities are required on the Dayton end. The interconnection customer will be responsible for building the generator lead line and Dayton will terminate the line at the takeoff structure leaving the new substation. All connection work will be done inside the substation, Dayton will not build any structures outside of the substation for the generator lead line.	$ 0
Total Attachment Facility Costs	**$ 0**

The substation Attachment Facility cost estimate for the AD1-035 project is approximately **$0**. Dayton Power and Light plans to tap the Darby-East Liberty 69kV line and will build a three breaker 69kV ring bus substation.

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.

The substation Direct Connection work for this project includes the construction of a 69 kV three breaker ring bus substation which will be tapped off the Darby-East Liberty 69 kV line. Dayton will install a takeoff structure immediately inside the substation fence which will serve as the Point of Interconnection (POI). The 69 kV generator lead line constructed by the developer will be terminated onto this POI takeoff structure immediately inside of the new three breaker ring bus substation fence. Dayton will install the associated disconnect switches at the new substation, line relaying, communication systems, and interconnection metering to accommodate the interconnection of the AD1-035 generator.

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Description	Total Cost
Install a new three breaker 69kV ring bus substation which includes the protection, communication, and metering systems required to facilitate the interconnection of the AD1-035 project. (Dayton)	$ 2,325,000
Total Direct Connection Facility Costs	**$ 2,325,000**

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
69kV transmission line drops needed to tap the Darby-East Liberty 69 kV line. (Dayton)	$ 50,000
Protection System changes at Darby (Dayton)	$ 25,000
Protection System changes at Honda East Liberty (Dayton)	$ 25,000
Protection System changes at Honda Marysville (Dayton)	$ 25,000
Total Non-Direct Connection Facility Costs	**$ 125,000**

The total Non-Direct Connection cost estimate for the AD1-035 project is approximately **$125,000**.

Of the total, the transmission Non-Direct connection cost estimate for the AD1-035 project is approximately **$50,000**. Dayton Power and Light plans to tap the Darby-East Liberty 69kV line and install a new three breaker ring bus substation. This will require new 69kV line drops to the substation. One 69kV line drop will emanate from the Honda Marysville 69kV portion of the line and the other 69kV line drop will emanate from the Darby/East Liberty end of the line.

Of the total, the substation Non-Direct connection cost estimate for the AD1-035 project is approximately **$75,000**. Protection system changes will need to be made at Dayton's Darby, Honda East Liberty, and Honda Marysville Substations to facilitate the interconnection of the new generation. The protection system changes at each of the three substations are estimated to be $25,000 for a total of $75,000 in substation Non-Direct connection costs.

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

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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

Dayton Schedule for Attachment Facilities and Non-Direct Connection Work:

Based on the extent of the Dayton primary Direct and Non-Direct Connection upgrades required to support the AD1-035 generation project, it is expected to take a **minimum of 12 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 construction of the Non-Direct Connection facilities and the first three months of construction work in earnest for the Direct Connection upgrades. It assumes that there will be no environmental or permitting issues to implement the work required 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

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Network Impacts

The Queue Project AD1-035 was evaluated as a 50.0 MW (Capacity 19.0 MW) injection tapping Honda Marysville Tap to Honda Marysville Station 69kV line in the Dayton area. Project AD1-035 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD1-035 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2021

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

None

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

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
(Results of the steady-state voltage studies should be inserted here)

To be provided in the System Impact Study.

Short Circuit
(Summary of impacted circuit breakers)

None

Affected System Analysis & Mitigation

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).

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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.

Only the most severely overloaded conditions are listed. 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 will study all overload conditions associated with the overloaded element(s) identified.

None

Light Load Analysis - 2021

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

Not required for this project.

System Reinforcements

Short Circuit

(Summary form of Cost allocation for breakers will be inserted here if any)

None

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

To be determined in System Impact Study.

Summer Peak Load Flow Analysis Reinforcements

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

None

Contribution to Previously Identified System Reinforcements

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(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)
(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

None

Light Load Load Flow Analysis Reinforcements

New System Reinforcements
(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

None

Contribution to Previously Identified System Reinforcements
(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)
(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

None

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Attachment 1. One Line Diagram
AD1-035 "Darby-East Liberty 69 kV"

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Attachment 2. Site Plan

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