Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AC2-171

"Jeffersonville 69 kV"

July 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 **solar** generating facility located in Washington Courthouse, OH. The installed facilities will have a total capability of **29 MW** with **11 MW** of this output being recognized by PJM as capacity. The proposed in-service date for this project is **May 31, 2019**. **This study does not imply a Dayton Power and Light commitment to this in-service date.**

Point of Interconnection

The AC2-171 "Jeffersonville 69 kV" project requested that PJM study two electrical points of interconnection in the Feasibility analysis. The primary option was studied as an injection into the Jeffersonville 69 kV substation bus. The secondary option was studied as an injection into a tap off of the Jeffersonville Tap-Jamestown 69 kV line (also known as the Jamestown-Washington Courthouse 69 kV line). Dayton Power and Light is only required to provide Attachment Facilities, Direct Connection, and Non-Direction scope and costs for the primary interconnection option. However, during the study period, it was determined that the secondary option was a more feasible physical interconnection than the primary option. Therefore, Dayton Power and Light provided interconnection scope and costs in this report for the secondary option instead of the primary. Load flow results are provided for both options in this report.

The AC2-171 "Jeffersonville 69 kV" project will interconnect with the Dayton Power and Light transmission system at a tap location on the Jamestown-Washington Courthouse 69 kV line near the tap to Jeffersonville Substation. Presently the Jamestown-Washington Courthouse 69 kV line has a transmission tap to Jeffersonville Substation and a 69 kV customer. The physical Point of Interconnection (POI) will be where the attachment hardware interconnects with the tap switch to the Jamestown-Washington Courthouse 69 kV line. See Attachment 1 for the one line diagram.

Cost Summary

The AC2-171 "Jeffersonville 69 kV" project will be responsible for the following costs related to the interconnection to a tap off of the Jamestown-Washington Courthouse 69 kV line. :

Description	Total Cost
Attachment Facilities	$ 64,000
Direct Connection Network Upgrades	$ 0
Non Direct Connection Network Upgrades	$ 428,000
Total Costs	**$ 492,000**

In addition, the AC2-171 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**

Attachment Facilities

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
Tap the Jamestown-Washington Courthouse 69kV line and install a three-way phase switch to interconnect the AC2-171 project. (One switch covering the generator lead line is considered an Attachment Facility).	$ 64,000
Total Attachment Facility Costs	**$ 64,000**

The substation Attachment Facility cost estimate for the AC2-171 project is approximately **$64,000**. Dayton Power and Light plans to tap the Jamestown-Washington Courthouse 69kV line between the Jeffersonville 69kV tap and 69kV customer tap as shown in Attachment 1. At the tap location, Dayton will install a three-way phase over phase switch to interconnect the AC2-171 "Jeffersonville 69kV" 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 69 kV metering adjacent to the switch.

Direct Connection Cost Estimate

There is no Direct Connection scope of work required for this project.

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
Tap the Jamestown-Washington Courthouse 69kV line and install a three-way phase switch to interconnect the AC2-171 project. (Two network switches of the three-way switch are considered Non-Direct Connection Facilities).	$ 128,000
Protection System changes at Jamestown Substation	$ 100,000
Protection System changes at Jeffersonville Substation	$ 100,000
Protection System changes at Washington Courthouse Substation	$ 100,000
Total Non-Direct Connection Facility Costs	**$ 428,000**

The total Non-Direct Connection cost estimate for the AC2-171 project is approximately **$428,000**.

Of the total, the transmission Non-Direct Connection cost estimate for the AC2-171 project is approximately **$128,000**. Dayton Power and Light plans to tap the Jamestown-Washington Courthouse 69kV line between the Jeffersonville 69kV tap and 69kV customer tap. At the tap location Dayton will install a three-way phase over phase switch to interconnect the AC2-171 Jeffersonville 69kV 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 Non-Direct Connection facilities (the two switches that are in network with the main circuit).

Of the total, the substation Non-Direct Connection cost estimate for the AC2-171 project is approximately **$300,000**. Protection system changes will need to be made at Jamestown, Jeffersonville, and Washington Courthouse Substations to facilitate the interconnection of the new generation.

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 Non-Direct Connection and Attachment Facility upgrades required to support the AC2-171 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 (*interconnection to Jamestown-Washington Courthouse 69 kV line*) 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 Attachment Facility upgrades. 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

Option 1

The Queue Project AC2-171 was evaluated as a 29.0 MW (Capacity 11.0 MW) injection at the Jeffersonville 69 kV substation in the Dayton area. Project AC2-171 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC2-171 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2020

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Description
160_B3	CONTINGENCY '160_B3' OPEN BRANCH FROM BUS 253110 TO BUS 253100 CKT 1 / 253110 09ADKINS 345 253100 09ATLNTA 345 1 OPEN BRANCH FROM BUS 253100 TO BUS 253099 CKT 1 / 253100 09ATLNTA 345 253099 09ATLNTA 69.0 1 END

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.

Short Circuit

(Summary of impacted circuit breakers)

None.

Affected System Analysis & Mitigation

None.

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.

Overload Number	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Circuit	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Flowgate Appendix
1	N-1	160_B3	AEP - AEP	05BCKSKI-05LATTAVL8 69 kV line	243598	243608	1	DC	104	104	ER	100	1.65	

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)

None.

Option 2

The Queue Project AC2-171 was evaluated as a 29.0 MW (Capacity 11.0 MW) injection tapping the Jeffersonville Tap – Jamestown 69 kV line in the Dayton area. Project AC2-171 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC2-171 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2020

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Description
160_B3	CONTINGENCY '160_B3' OPEN BRANCH FROM BUS 253110 TO BUS 253100 CKT 1 / 253110 09ADKINS 345 253100 09ATLNTA 345 1 OPEN BRANCH FROM BUS 253100 TO BUS 253099 CKT 1 / 253100 09ATLNTA 345 253099 09ATLNTA 69.0 1 END

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.

Short Circuit

(Summary of impacted circuit breakers)

None.

Affected System Analysis & Mitigation

None.

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.

Overload Number	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Circuit	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Flowgate Appendix
1	N-1	160_B3	AEP - AEP	05BCKSKI-05LATTAVL8 69 kV line	243598	243608	1	DC	106	107	ER	100	1.65	
2	N-1	160_B3	DAY - AEP	AC2-087 TAP-05BCKSKI 69 kV line	931650	243598	1	DC	132	136	ER	72	2.99	

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)

None.

Attachment 1. One Line Diagram

AC2-171 "Jeffersonville 69 kV"

Attachment 2. Site Plan
AC2-171 "Jeffersonville 69 kV"