Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AC1-069

"Atlanta 69 kV II"

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 solar generating facility located along SR 207 in New Holland, Pickaway County, Ohio. The installed facilities will have a total capability of 49.9 MW with 34 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is December 1, 2019. **This study does not imply a Dayton Power & Light Company commitment to this in-service date.**

Point of Interconnection

AC1-069 "Atlanta 69 kV II" will interconnect with the Dayton Power & Light Company transmission system at the Atlanta Substation 69 kV bus. The first dead-end structure outside the Atlanta Substation fence on the AC1-069 69 kV generator lead line will be designated as the Point of Interconnection (*see One Line in Attachment 1*). Presently Atlanta Substation consists of two 345 kV line feeds, a 345/69 kV transformer, and a single 69 kV line. There is a proposed interconnection project, AC1-068 that will expand the 69 kV portion of the Atlanta Substation to a ring bus.

Cost Summary

The **AC1-069 "Atlanta 69 kV II"** project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$ 0
Direct Connection Network Upgrades	$ 0

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Description	Total Cost
Non Direct Connection Network Upgrades	$ 830,000
Total Costs	**$ 830,000**

In addition, the **AC1-069** project may be responsible for a contribution to the following costs:

Description	Total Cost
New System Upgrades	$ 0
Previously Identified Upgrades (Dayton and AEP systems)	$ 26,140,000
Total Costs	**$ 26,140,000**

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

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

No Direct Connection facilities are required to support this interconnection.

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 Ring Bus Position Installation	$ 630,000
Metering, P&C, RTU Upgrades	$ 200,000
Total Non-Direct Connection Facility Costs	**$ 830,000**

The substation non-direct connection cost estimate for the AC1-069 project is approximately **$830,000**. The scope of work at Dayton's Atlanta Substation involves installing an additional 69kV ring bus position, revenue class 69 kV metering, fiber line relaying, and RTU to interconnect the AC1-069 generation.

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

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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.

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

Overall elapsed time to complete both the required Network Upgrades (AEP and Dayton work) and Non-Direct Connection work (Dayton work only) is approximately **24-36 months**.

Based on the extent of the Dayton primary Non-Direct Connection and Attachment upgrades required to support the AC1-069 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 work can be done concurrently with the Network Upgrades required. 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.

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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 AC1-069 was evaluated as a 49.9 MW (Capacity 34 MW) injection at the Atlanta 69kV substation in the Dayton area. Project AC1-069 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC1-069 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Base Case Used

Summer Peak Analysis – 2020 Case

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Description
762_B2_TOR8072	CONTINGENCY '762_B2_TOR8072' OPEN BRANCH FROM BUS 243453 TO BUS 253110 CKT 1 / 243453 05BEATTY 345 253110 09ADKINS 345 1 END
764_B2_TOR9237	CONTINGENCY '764_B2_TOR9237' OPEN BRANCH FROM BUS 242938 TO BUS 253038 CKT 1 / 242938 05MARQUI 345 253038 09KILLEN 345 1 END
892_B2	CONTINGENCY '892_B2' OPEN BRANCH FROM BUS 253014 TO BUS 253077 CKT 1 / 253014 09CLINTO 345 253077 09STUART 345 1 END

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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)

#	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	Ref
1	N-1	764_B2_TOR9237	DAY - AEP	09ADKINS-05BEATTY 345 kV line	253110	243453	1	DC	112.35	113.87	NR	1233	18.78	1
2	N-1	892_B2	DAY - AEP	09ADKINS-05BEATTY 345 kV line	253110	243453	1	DC	111.73	113.22	NR	1233	18.3	
3	N-1	762_B2_TOR8072	DAY - DAY	09NHOLLN-09ROBINS 69 kV line	253181	253201	1	DC	103.91	108.75	ER	165	7.99	2

Note: Please see Attachment 3 for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper Appendix in the Attachment.

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Steady-State Voltage Requirements

To be provided in the System Impact Study.

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty: None.

Contributions to previously identified circuit breakers found to be over-duty: None.

Stability and Reactive Power Requirement

To be provided in the System Impact Study.

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).

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.

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#	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	Ref
4	N-1	764_B2_T OR9237	DAY - AEP	09ADKINS-05BEATTY 345 kV line	253110	243453	1	DC	105.68	107.92	NR	1233	27.56	
5	N-1	762_B2_T OR8072	DAY - DAY	09NHOLLN-09ROBINS 69 kV line	253181	253201	1	DC	100.38	107.49	ER	165	11.73	

Light Load Analysis – 2020 Case

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

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)*

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost
#3	09NHOLLN-09ROBINS 69 kV line	Replace 1200 A wave trap at Robinson Substation with a new 2000A wave trap. New Rating SN/SE 221/239 MVA. Time to Complete: 4 months	Pending	**$40,000**

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Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost
#1,2	09ADKINS-05BEATTY 345 kV line	Reconductor/rebuild (depending on age and health of the existing structures) 13.0 miles of ACAR 983.1 345 kV conductor. AEP ratings SN/SE 1825/2062 MVA. Time to complete: 24-36 months	Pending	**$26,000,000**
#1,2	09ADKINS-05BEATTY 345 kV line	Replace the Beatty Road Line Riser Section. AEP-end ratings increased to SN/SE 1414/1414 MVA. Time to complete: 12 months	N5136	**$100,000**
			Total New Network Upgrades	**$26,140,000**

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Attachment 1. AC1-069 'Atlanta 69 kV II': One Line Diagram

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Attachment 2: AC1-069 'Atlanta 69 kV II': Site Diagram

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Attachment 3. Flowgate Details

Appendices

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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Appendix 1

(DAY - AEP) The 09ADKINS-05BEATTY 345 kV line (from bus 253110 to bus 243453 ckt 1) loads from 112.35% to 113.87% (**DC power flow**) of its normal rating (1233 MVA) for the single line contingency outage of '764_B2_TOR9237'. This project contributes approximately 18.78 MW to the thermal violation.

CONTINGENCY '764_B2_TOR9237'
OPEN BRANCH FROM BUS 242938 TO BUS 253038 CKT 1 / 242938 05MARQUI 345 253038 09KILLEN 345 1
END

Appendix 1							
Bus Number	Bus Name	Full Contribution	Project Status	Bus Number	Bus Name	Full Contribution	Project Status
253110	09ADKINS	68.24		925921	AC1-068 C	18.78	Active
253077	09STUART	71.33		925931	AC1-069 C	18.78	Active
916411	Z1-097	4.21	IS	925981	AC1-074 C OP	4.15	Active
920662	Z2-029	0.63	IS	926791	AC1-165 C	18.56	Active
922002	AA2-100	0.54	UC	926801	AC1-166 C	18.56	Active
922612	AB1-014 C	4.62	Active	926951	AC1-182	1.55	Active
923522	AB1-169 C OP	175.98	Active				

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Appendix 2

(DAY - DAY) The 09NHOLLN-09ROBINS 69 kV line (from bus 253181 to bus 253201 ckt 1) loads from 103.91% to 108.75% (**DC power flow**) of its emergency rating (165 MVA) for the single line contingency outage of '762_B2_TOR8072'. This project contributes approximately 7.99 MW to the thermal violation.

CONTINGENCY '762_B2_TOR8072'
OPEN BRANCH FROM BUS 243453 TO BUS 253110 CKT 1 / 243453 05BEATTY 345 253110 09ADKINS 345 1
END

Appendix 2							
Bus Number	Bus Name	Full Contribution	Project Status	Bus Number	Bus Name	Full Contribution	Project Status
253110	09ADKINS	9.01		925931	AC1-069 C	7.99	Active
916411	Z1-097	0.56	IS	926791	AC1-165 C	7.9	Active
925921	AC1-068 C	7.99	Active	926801	AC1-166 C	7.9	Active

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