Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AD1-081

Beatty-London 138 kV

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.

General

The Interconnection Customer (IC), has proposed a Solar generating facility located in Madison County, Ohio. The installed facilities will have a capability of 20 MW with 13.2 MW of this output being recognized by PJM as capacity. Note that this project is an increase to the Interconnection Customer's AC1-078 project, which will share the same property and connection point. The AC1-078 project will have a capability of 176 MW with 66 MW being recognized as capacity. The total capability of the combined AC1-078 and AD1-081 projects will be 196 MW with 79.2 MW being recognized by PJM as capacity. The proposed in-service date for the AD1-081 project is December 31, 2021. **This study does not imply an ATSI commitment to this in-service date.**

Point of Interconnection

AD1-081 will interconnect with the ATSI transmission system along the Beatty-London 138kV line.

Cost Summary

The AD1-081 project will be responsible for the following costs:

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

In addition, the AD1-081 project may be responsible for a contribution to the following costs:

Description	Total Cost
New System Upgrades	$ 0
Previously Identified Upgrades	$ 3,816,700
Total Costs	**$ 3,816,700**

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

Attachment Facilities

No Attachment Facilities are required to support this interconnection request.

Direct Connection Cost Estimate

No Direct Connection Facilities are required to support this interconnection request.

Non-Direct Connection Cost Estimate

No Non-Direct Connection Facilities are required to support this interconnection request.

Transmission Owner Scope of Work

The proposed AD1-081 project is an increase to the AC1-078 project by 20 MWs. No additional direct connection facilities will be required, in addition to those already specified as part of AC1-078.

Interconnection Customer Requirements

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 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.

3. The Interconnection Customer seeking to interconnect a wind generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per item 5.iv. of Schedule H to the Interconnection Service Agreement.

4. The original portion of the IC's facility (AC1-078) shall retain its existing ability to maintain a power factor of at least 0.95 leading (absorbing VARs) to 0.95 lagging (supplying VARs) measured at the generator's terminals. The increase of 20 MW to the IC's facility proposed for project AD1-081 shall be designed with the ability to maintain a power factor of at least 0.95 leading to 0.95 lagging measured at the high side of the facility substation transformers.

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.

ATSI Requirements

The Interconnection Customer will be required to comply with all FE Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "FirstEnergy Requirements for Transmission Connected Facilities" document located at the following links:

http://www.firstenergycorp.com/feconnect
http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx

Network Impacts

The Queue Project AD1-081 was evaluated as a 20.0 MW (Capacity 13.2 MW) uprate to the AC1-078 Queue Project which is tapping the Beatty to London 138kV line in the AEP area. Project AD1-081 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD1-081 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2021

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Description
AEP_P7-1_#468	CONTINGENCY 'AEP_P7-1_#468' OPEN BRANCH FROM BUS 239133 TO BUS 243458 CKT 1 / 239133 02TANGY 345 243458 05HYATT 345 1 OPEN BRANCH FROM BUS 239133 TO BUS 242939 CKT 1 / 239133 02TANGY 345 242939 05MARYSV 345 1 END
ATSI-P7-1-OES-345-68T	CONTINGENCY 'ATSI-P7-1-OES-345-68T' /* TANGY-HYATT & TANGY-MARYSVILLE COMMON TOWER DISCONNECT BRANCH FROM BUS 239133 TO BUS 243458 CKT 1 /* 02TANGY 345 05HYATT 345 DISCONNECT BRANCH FROM BUS 239133 TO BUS 242939 CKT 1 /* 02TANGY 345 05MARYSV 345 DISCONNECT BRANCH FROM BUS 239133 TO BUS 239134 CKT 3 /* 02TANGY 345 02TANGY 138 DISCONNECT BRANCH FROM BUS 239133 TO BUS 239134 CKT 4 /* 02TANGY 345 02TANGY 138 DISCONNECT BRANCH FROM BUS 239133 TO BUS 239134 CKT 5 /* 02TANGY 345 02TANGY 138 DISCONNECT BUS 239133 /* 02TANGY 345 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)

	Contingency		Affected		Bus			Power	Loading %		Rating		MW	
#	Type	Name	Area	Facility Description	From	To	Circuit	Flow	Initial	Final	Type	MVA	Contribution	Ref
1	DCTL	ATSI-P7-1-OES-345-68T	AEP - FE	AC1-078 TAP-02LONDON 138 kV line	926010	238908	1	DC	104.21	107.26	ER	242	7.38	1
2	DCTL	AEP_P7-1_#468	AEP - FE	AC1-078 TAP-02LONDON 138 kV line	926010	238908	1	DC	104.21	107.26	ER	242	7.38	

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

Short Circuit

(Summary of impacted circuit breakers)

None.

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.

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).

Duke, Progress & TVA Impacts:

Duke Carolina, Progress, & TVA Impacts to be determined during later study phases (as applicable).

OVEC Impacts:

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

Light Load Analysis - 2021

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
#1, 2	AC1-078 TAP-02LONDON 138 kV line	In order to mitigate the overloads of facilities above, the following reinforcements are required: • AEP: No mitigation is required • ATSI: The PJM and FE analysis for the AD1-081 project identified line overloading on the FE / ATSI Beatty - London #1 138 kV Line. The proposed network upgrade is to reconductor approximately 8 miles of transmission line from AD1-081 point of interconnection to the London substation, which will cost $3,816,700. The upgrade work is expected to take a minimum of thirteen (13) months from the date of a fully executed Interconnection Construction Service Agreement to complete the installation. PJM is responsible for determining the cost allocation of the network upgrades.	TBD	**$ 3,816,700**
			Total New Network Upgrades	**$ 3,816,700**

Attachment 1. 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.

Appendix 1

(AEP - FE) The AC1-078 TAP-02LONDON 138 kV line (from bus 926010 to bus 238908 ckt 1) loads from 104.21% to 107.26% (**DC power flow**) of its emergency rating (242 MVA) for the tower line contingency outage of 'ATSI-P7-1-OES-345-68T'. This project contributes approximately 7.38 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
934561	AD1-081 C	4.87
934562	AD1-081 E	2.51
935043	AD1-140 BAT	4.83

Bus Number	Bus Name	Full Contribution
926011	AC1-078 C	24.35
926012	AC1-078 E	40.59