Generation Interconnection

System Impact Study Report

for

Queue Project AE2-204

BOLIVAR 34.5 KV

9.3 MW Capacity / 19.3 MW Energy

February 2020

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1 Preface

The intent of the System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

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. Cost allocation rules for network upgrades can be found in PJM Manual 14A, Attachment B. 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 System Impact 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.

The Interconnection Customer seeking to interconnect a wind or solar generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement and Section 8 of Manual 14D.

An Interconnection Customer 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 General

The Interconnection Customer (IC), has proposed a Solar generating facility located in Stark County, Ohio. The installed facilities will have a total capability of 19.3 MW with 9.3 MW of this output being recognized by PJM as Capacity.

The proposed in-service date for this project is 5/31/2021. This study does not imply a TO commitment to this in-service date.

From the transmission perspective, no network impacts were identified, as detailed in the "Network Impacts" section below. However, the analysis performed in a Feasibility Study does not include evaluation by Protection and Control Engineering to determine whether the existing protection schemes will provide acceptable performance. A preliminary review may take place during the System Impact Study stage, but final evaluation usually occurs during the Facilities Study. Additional protection equipment may be required to provide adequate protection system performance.

Queue Number	**AE2-204**
Project Name	BOLIVAR 34.5 KV
Interconnection Customer	Bolivar PV I, LLC
State	Ohio
County	Stark
Transmission Owner	AEP
MFO	19.3
MWE	19.3
MWC	9.3
Fuel	Solar
Basecase Study Year	2022

2.1 Point of Interconnection

AE2-204 will interconnect with the AEP-Ohio distribution system on the Bolivar 34.5kV circuit.

2.2 Cost Summary

The AE2-204 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$TBD*
Direct Connection Network Upgrade	$TBD*
Non Direct Connection Network Upgrades	$800,000
Total Costs	$TBD*

*The Attachment, Direct, and Non-Direct connection network upgrades will be evaluated by AEP-Ohio once the Interconnection Customer submits a request to interconnect under the state jurisdictional Interconnection process.

Final attachment facilities and local upgrades (if required) along with terms and conditions to interconnect AE2-204 will be specified in a separate two party Interconnection Agreement (IA) between AEP-Ohio and the Interconnection Customer as this project is considered FERC non-jurisdictional per the PJM Open Access Transmission Tariff (OATT).

The estimates provided in this report are preliminary in nature, as they were determined without the benefit of detailed engineering studies. Final estimates will require an on-site review and coordination to determine final construction requirements. In addition, Stability analysis (if required) will be completed during the Facilities Study stage. It is possible that a need for additional upgrades could be identified by these studies.

3 Transmission Owner Scope of Work

4 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.

To be determined in the AEP Distribution Impact Study

5 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.

To be determined in the AEP Distribution Impact Study

6 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
Replace the 138 kV MOAB/ground switch system for the Bolivar 138/34.5 transformer with one (1) 138 kV CB and associated relays and controls.	$800,000
Total Costs	$800,000

7 Interconnection Customer Requirements

It is understood that Bolivar PV I, LLC is responsible for all costs associated with this interconnection. The costs above are reimbursable to AEP. The cost of Bolivar PV I's generating plant and the costs for the line connecting the generating plant to the AEP-Ohio Bolivar 34.5 kV feeder are not included in this report; these are assumed to be Bolivar PV I's responsibility.

The Generation Interconnection Agreement does not in or by itself establish a requirement for American Electric Power to provide power for consumption at the developer's facilities. A separate agreement may be reached with the local utility that provides service in the area to ensure that infrastructure is in place to meet this demand and proper metering equipment is installed. It is the responsibility of the developer to contact the local service provider to determine if a local service agreement is required.

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 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.

8 Revenue Metering and SCADA Requirements

8.1 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 Section 8 of Attachment O.

8.2 AEP Requirements

The Interconnection Customer will be required to comply with all AEP Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "Requirements for Connection of New Facilities or Changes to Existing Facilities Connected to the AEP Transmission System" document located at the following link:

http://www.pjm.com/~/media/planning/plan-standards/private-aep/aep-interconnection-requirements.ashx

9 Network Impacts

The Queue Project AE2-204 was evaluated as a 19.3 MW (Capacity 9.3 MW) injection into the Bolivar 138 kV substation in the AEP area. Project AE2-204 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-204 was studied with a commercial probability of 1.00. Potential network impacts were as follows:

Summer Peak Load Flow

10 Generation Deliverability

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

None

11 Multiple Facility Contingency

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

None

12 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

13 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

14 Light Load Analysis

Not required

15 Steady-State Voltage Requirements

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

Not required

16 Stability and Reactive Power Requirements for Low Voltage Ride Through

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

Not required

17 System Reinforcements

None

Affected Systems

18 Affected Systems

18.1 LG&E

None

18.2 MISO

MISO Impacts to be determined during the Facilities Study.

18.3 TVA

None

18.4 Duke Energy Progress

None

18.5 NYISO

None

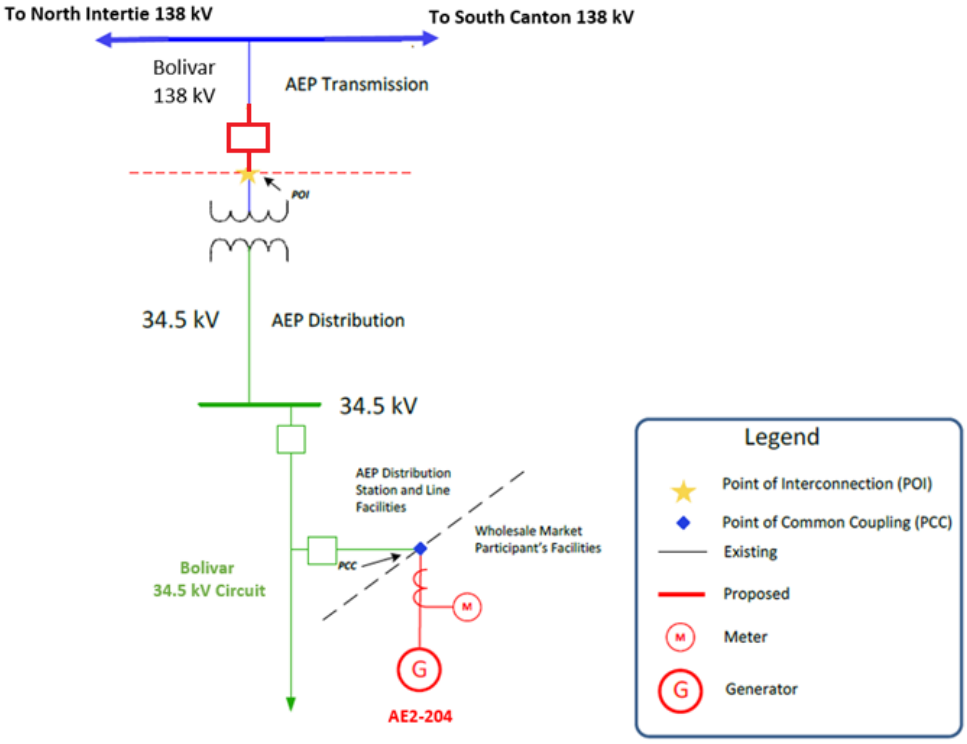
Short Circuit

19 Short Circuit

The following Breakers are overduty

None

20 Attachment 1: One Line Diagram



*Distribution facilities not completely shown. Information on the one-line is provided without any input from distribution.

21 Attachment 2: Point of Interconnection