Generation Interconnection
System Impact Study Report

For

PJM Generation Interconnection Request
Queue Position AB2-103

Seaman 138kV

February 2018

General

Community Energy Solar Development, LLC (Community Energy) proposes to install PJM Project #AB2-103, a 40.0 MW (27.2 MW Capacity) solar generating facility in Adams County, Ohio (see Figure 2). The generating facility will consist of eighteen (18) 2.2 MW inverters. The point of interconnection is at the Seaman 138 kV substation (see Figure 1).

The requested Backfeed date is September 30, 2017.

The requested in service date is October 31, 2017.

The objective of this System Impact Study is to determine budgetary cost estimates and approximate construction timelines for identified transmission facilities required to connect the proposed generating facilities to the AEP transmission system. These reinforcements include the Attachment Facilities, Local Upgrades, and Network Upgrades required to maintain the reliability of the AEP transmission system. Stability analysis is included as part of this study.

Attachment Facilities

Point of Interconnection (Seaman 138 kV Substation)

To accommodate the interconnection at the Seaman 138 kV substation, the substation will have to be expanded requiring the installation of a new 138 kV circuit breaker, extending the two 138 kV buses, and starting a new string, associated protection and control equipment, SCADA, and 138 kV revenue metering.

Direct Connection to the Seaman 138 kV Substation Work and Cost:

- Install one new 138 kV circuit breaker (see Figure 1). Installation of associated protection and control equipment, SCADA, and 138 kV revenue metering will also be required.
- **Estimated Station Cost: $300,000**
- **Estimated 138 kV Revenue Metering Cost: $150,000**

Protection and Relay Work and Cost:

- Install line protection and controls at the Seaman 138 kV substation.
- **Estimated Cost: $200,000**

It is understood that Community Energy is responsible for all costs associated with this interconnection. The cost of Community Energy's generating plant and the costs for the line connecting the generating plant to Community Energy's switching station are not included in this report; these are assumed to be Community Energy'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.

Additional Interconnection Customer Responsibilities:

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.

Local and Network Impacts for the Point of Interconnection

The impact of the proposed generating facility on the AEP System was assessed for adherence with applicable reliability criteria. AEP planning criteria require that the transmission system meet performance parameters prescribed in the AEP FERC Form 715[1] and Connection Requirements for AEP Transmission System[2]. Therefore, these criteria were used to assess the impact of the proposed facility on the AEP System. The Queue Project AB2-103 was evaluated as a 40.0 MW (Capacity 27.2 MW) injection into the Seaman 138 kV substation in the AEP area. Project AB2-103 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB2-103 was studied with a commercial probability of 100%. Potential network impacts were as follows:

Generator Deliverability

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

None

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1 https://www.aep.com/about/codeofconduct/OASIS/TransmissionStudies/GuideLines/AEP_East_FERC_715_2016_Final_Part_4.pdf

2 https://www.aep.com/about/codeofconduct/OASIS/TransmissionStudies/Requirements/AEP_Interconnection_Requirements_rev1.pdf

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

Stability Analysis

For prior outage of Adams – Wareroad 138 kV circuit, fault at Seaman 138 kV on the Highland circuit (MA.3N04) causes voltage oscillation at the Seaman and Adams 138 kV bus. Pelec and Qelec of AB2-103 and AB2-085 were also oscillatory. It is recommended that AB2-103 be tripped for this scenario. No other mitigations were found to be required.

Voltage Variations

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.

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

Additional Limitations of Concern

None

Light Load Analysis

Not required

New System Reinforcements

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

None

Schedule

It is anticipated that the time between receipt of executed agreements and Commercial Operation may range from 12 to 18 months if no line work is required. If line work is required, construction time would be between 24 to 36 months after signing an interconnection agreement.

Note: The time provided between anticipated normal completion of System Impact, Facilities Studies, subsequent execution of ISA and ICSA documents, and the proposed Backfeed Date is shorter than usual and may be difficult to achieve.

Conclusion

Based upon the results of this System Impact Study, the construction of the 40.0 MW (27.2 MW Capacity) solar generating facility of Community Energy (PJM Project #AB2-103) will require the following additional interconnection charges. This plan of service will interconnect the proposed solar generating facility in a manner that will provide operational reliability and flexibility to both the AEP system and the Community Energy solar generating facility.

Cost Breakdown for Point of Interconnection (Seaman 138 kV Substation)			
Type of Network Upgrade	**Network Upgrade Number**	**Description**	**Cost**
Direct Connection	**n5424**	Expand Seaman 138 kV Substation	**$300,000**
Non-Direct Connection	**n5424**	138 kV Revenue Metering	**$150,000**
	n5425	Install line protection and controls at the Seaman 138 kV substation	**$200,000**
		Total Estimated Cost for Project AB2-103	**$650,000**

The estimates 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.

Figure 1: Point of Interconnection (Seaman 138 kV Substation)

Single-Line Diagram

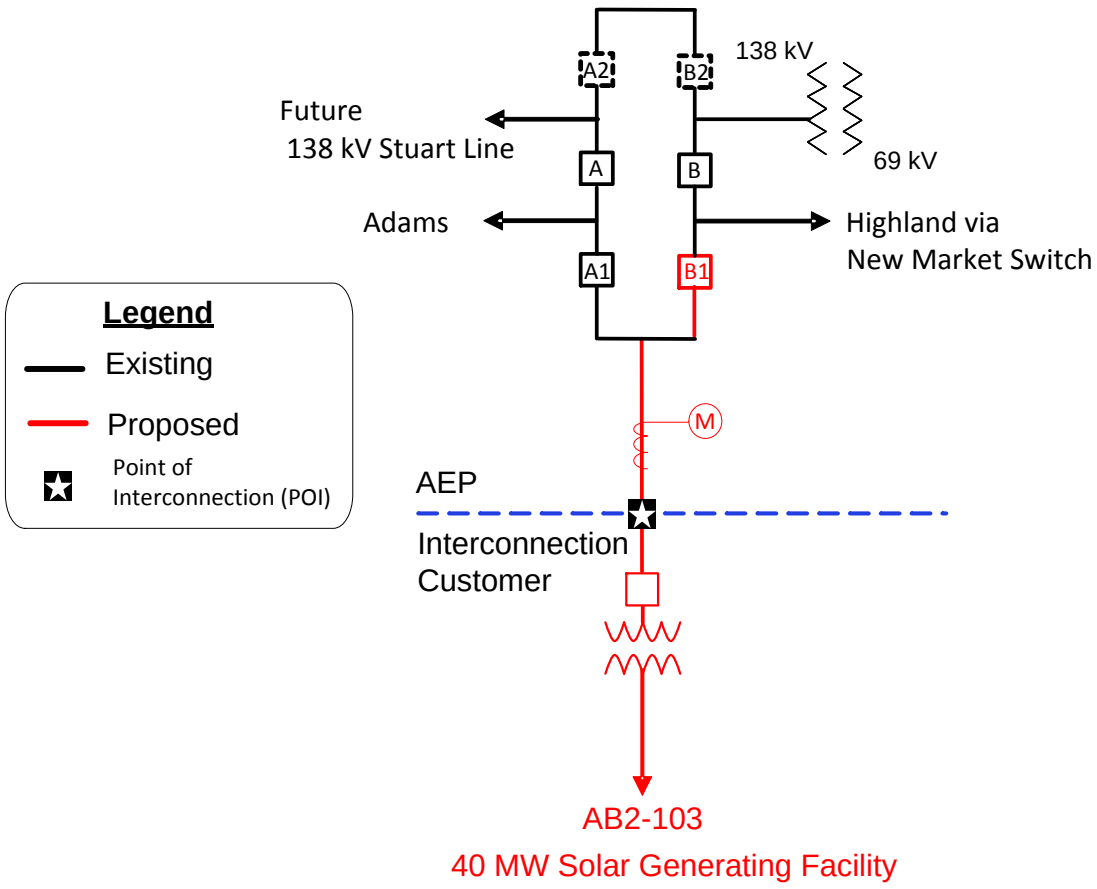

Figure 2: Point of Interconnection (Seaman 138 kV Substation)