# *PJM Generator Interconnection Request*
# *Queue AB1-174*
# *Thornville12 kV*
# *Feasibility/Impact Study Report*

**February 2016**

# Preface

The intent of the Feasibility/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 an Interconnection Customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, 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 Feasibility/System Impact Study is performed.

The Feasibility/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.

This report is divided into two sections:

**Part I – AEP Distribution Planning Analysis and Results**
**Part II – Transmission Planning Analysis and Results**

## Part I - AEP Distribution Planning Analysis and Results

# Interconnection Feasibility/Impact Study AB1 – 174

### Request

The customer has proposed a 10 MW Solar generating facility. The proposed service point is located 220 feet west of the Shoreline Drive and Honeycreek Road intersection on the south side of Honeycreek Road, Thornville, Ohio. See Figure 1 for approximate location.

### Disclaimer

The contents of this feasibility study apply only to the facility described in the feasibility study agreement. All modeling is based on the Distributed Generation (DG) service point location at Latitude: 39° 54'58.06''N, Longitude: 82° 25'15.33''W.

### Modeling and Assumptions

The Solar Access Development Group LLC solar power project will be served from AEP distribution system via 12.47 kV LL, 7.2 kV LG Thornville Station, Thornville circuit (400801). Circuit 400801 is a radial configuration, three-phase multi-grounded four wire system. The customer service Point of Common Coupling (PCC) is located near Latitude: 39° 54'58.06''N, Longitude: 82° 25'15.33''W, just south of AEP Ohio Pole number 40820674C30008. (Note: In the original documentation, the point of interconnection was specified near Latitude: 39° 54'44.07''N, Longitude: 82° 27'32.93''W, just south of AEP Ohio Pole number 40820673000107, which is not in AEP Ohio service territory. Following discussions on 12/10/2015 it was agreed that the point of interconnection could be moved to a location in AEP Ohio service territory, the identified PCC described above.)

The specs for the Generator and transformer were obtained from an applicant email dated January 21, 2016. A site electrical one line will need to be provided for detailed engineering and design should the customer enter into a Wholesale Market Participation Agreement (WMPA).

CymDist Version 7.2 revision 4 was utilized to model the Generator's effect on the Distribution System. A high level analysis was performed to determine if there are any apparent steady state loading issues or excess fault current issues.

### AEP Fault Values and Thevenin Impedances

The following are AEP symmetrical fault values and AEP Thevenin impedances calculated at the Generator's assumed PCC (without the generator connected). The nominal voltage can vary +/- 5%.

**Thornville Circuit**

- LLL = 2827 A LG = 2636 A
- Z1 = Z2 = 0.7965 + j 2.4213 ohms @ 12.47 kV
- Z0 = 0.765 + j 3.0186 ohms @ 12.47/7.2 kVs

***Distribution Study Conclusion***

The high level study revealed steady state loading issues due to possible backflow into the 69 kV system. The high level study did not reveal any issues due to the additional fault current contribution of the generators. This does not mean that more issues will not be discovered during the detailed distribution engineering and design phase.

***Conceptual Distribution Costs for Interconnection***

The presumption based upon the documents submitted is that the developer will be extending a line to AEP's circuit and AEP will provide a metering structure and the associated facilities required for interconnection to the AEP distribution system. AEP will also need to upgrade 2,000 ft. of distribution three phase primary line facilities. There is the possibility of 6 MVA of backflow into the 69 kV system during DG operation which may require mitigation.

The installation of 12 kV metering at the interconnection point with the facility will cost approximately **$50,000**. The cost of the SCADA communication connection will cost approximately **$40,000**.

The 2,000 ft. upgrade of three phase primary line facilities will cost approximately **$75,000.**

The backflow into the 69 kV system mitigation will cost approximately **$80,000.**

A detailed engineering study will be required to determine the final costs for interconnection to the AEP distribution system. The estimated cost of this study is **$5,000**. The engineering study may also identify additional mitigations required to ensure reliability of the AEP distribution system during DG operation.

***Conclusion***

The total estimated cost is **$250,000**. The required engineering study will be will be completed before the Interconnection Agreement (IA) referenced under Milestone 3.1.4 in the Wholesale Market Participation Agreement (WMPA) is executed. The Engineering study will be used as the basis for creating the IA between Solar Access Development Group LLC and AEP.

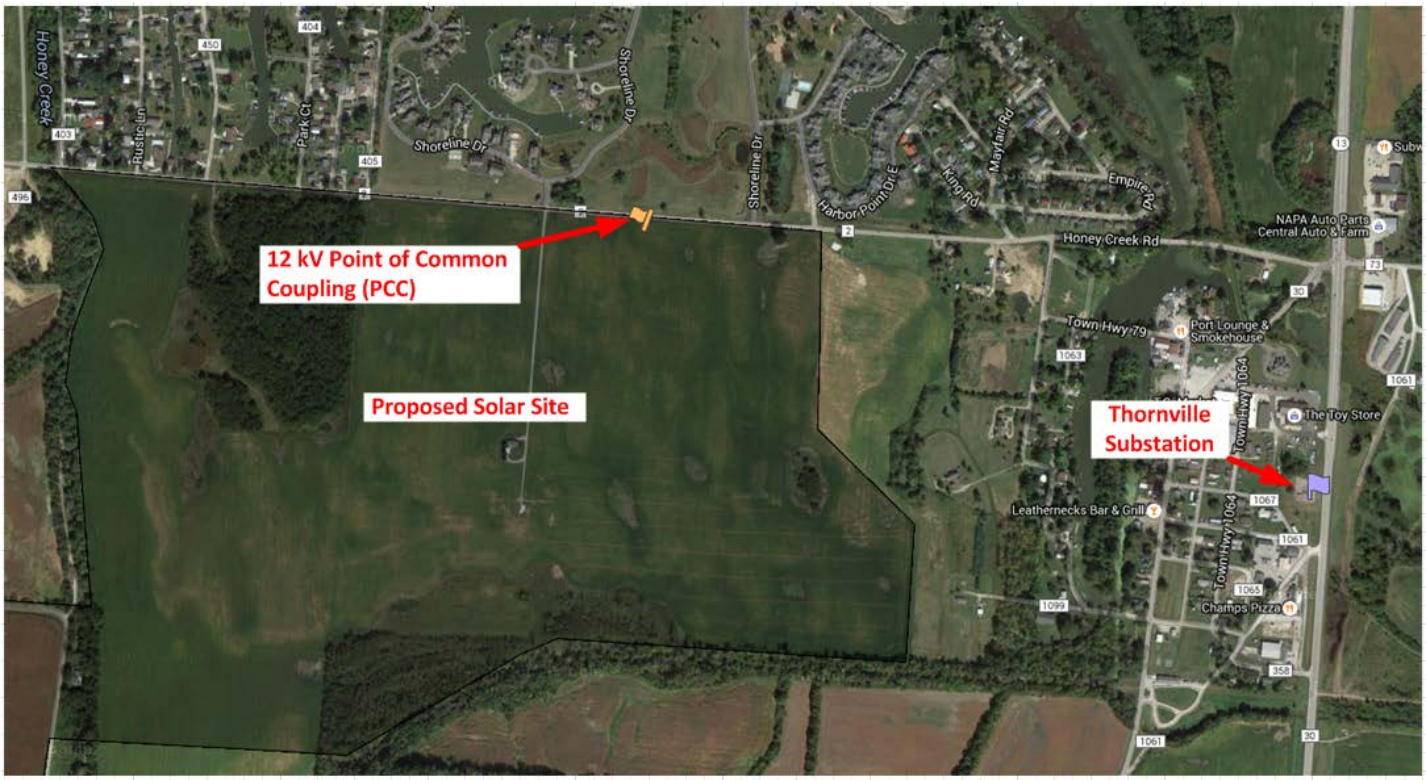


**Figure 1 – Proposed Solar Site**

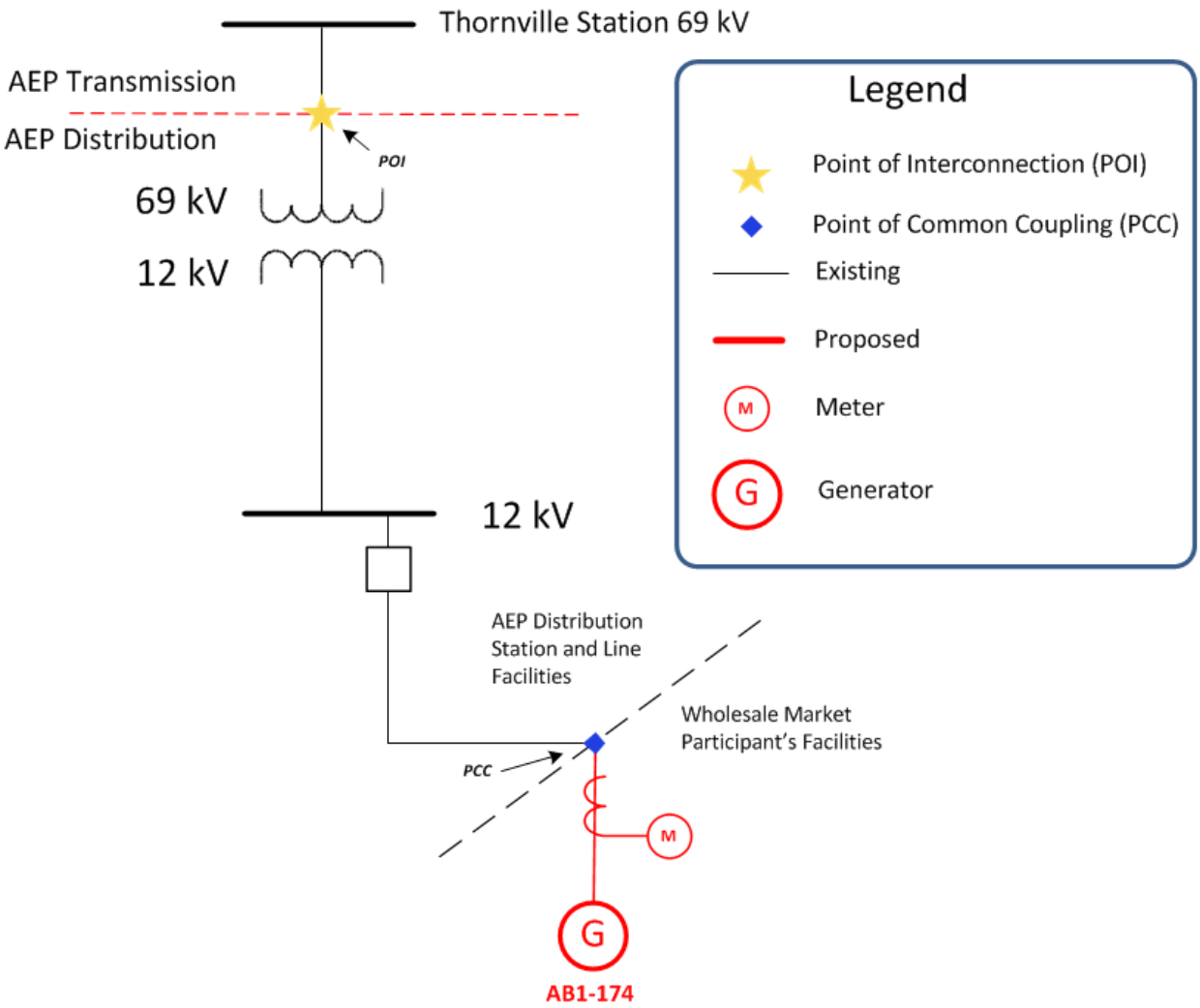


**Figure 2 – Single Line Diagram**

# Part II – Transmission Planning Analysis and Results

## Network Impacts

The Queue Project AB1-174 was studied as a 10 MW (Capacity 6.6 MW) injection at the Thornville 69 kV substation in the AEP area. Project AB1-174 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB1-174 was studied with a commercial probability of 100%. Potential network impacts were as follows:

## Summer Peak Analysis - 2019

**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

**Steady-State Voltage Requirements**
*(Results of the steady-state voltage studies should be inserted here)*

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

# Light Load Analysis - 2018

Not required

# System Reinforcements

**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)*
*(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)*

None

**Short Circuit**
*(Summary form of Cost allocation for breakers will be inserted here if any)*

None

**Stability and Reactive Power Requirement**
*(Results of the dynamic studies should be inserted here)*

Not required