

***PJM Generator Interconnection Request  
Queue #Z2-036  
Rokeby 12 kV  
Feasibility Study Report***

**August 2014**

## 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,

## **Interconnection Feasibility Study Z2 – 036**

### **Request**

The applicant has proposed a 4.3 MW (2-2.39 MVA unit) Non-Fuel, Run-of River Hydropower (Water) generating facility to be located at Rokeby Lock & Dam at river mile 57, on the Muskingum River, in Morgan County, OH.

### **Disclaimer**

The contents of this feasibility study apply only to the facility described in the attached Distributed Generation (DG) Interconnection Request application. All modeling is based on the DG location at Latitude: 39° 43'57"N, Longitude: 81° 54'32"W.

### **Modeling and Assumptions**

The Rokeby Lock & Dam water power project will be served from AEP distribution system via 12.47 kV LLL, 7.2 kV LG McConnesville circuit (7421602) originating from North McConnesville station. McConnesville circuit is a radial configuration, three-phase multi-grounded four wire system. The customer service Point of Common Coupling (PCC) is assumed to be near location 40820879B40018. See Attachment 1.

The specs for the Generator and transformer were obtained from the most recent customer, one-line diagram. The proposed generator indicates 2- 2390 kVA 720 RPM, 4.16 kV, 90% PF. The customer owned transformer specification were 3750 KVA 12.5/4.16 kV, Z=5.75 %, and assumed X/R ratio of 8, was used to model the study. The information submitted on other documents is in conflict in various ways with the customer one-line diagram and will need to be resolved if this project moves forward to an impact study.

Should the customer installed equipment vary from the equipment described in the customer application and model used for the impact study, the customer must notify AEP immediately for analysis of whether the equipment variation will affect the impact study results.

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. The nominal voltage can vary +/- 5%.

#### **McConnesville Circuit**

- LLL = 1063 A      LG = 794A
- $Z1 = Z2 = 4.3104 + j 5.6535$  ohms @ 12.47 kV
- $Z0 = 7.0882 + j12.5683$  ohms @ 12.47/7.2 kV

## **Distribution Study Conclusion**

Cymedist Version 5.02 revision 10 was utilized to model the Generator's effect on the Distribution System.

The high level study at steady state peak loading and generators at full output, the study reveals a regulator and recloser that would need to be replaced due exceeding and or approaching its continuous current ratings. The cost for the replacement of the recloser and regulator will be included in the costs section.

## **Conceptual Costs for Interconnection**

The presumption based upon the documents submitted is that the developer will be extending a line to AEP's circuit and we will only need to provide a metering structure and the related facilities to permit interconnection.

1. Remove 100 VR32 phase B regulator with 3 phase 219 A 3 phase regulator located at grid #40820903000008. The approximate cost of this improvement is **\$ 40,000**.
2. Replace existing 3-100 A V4H reclosers, located at grid #40820903000007 with a 560 A VWE Recloser. Project design group will have to re coordinate and provide new recloser settings. The approximate cost of this improvement is **\$ 35,000**.
3. The installation of 12 kV meter at the facility will cost approximately **\$50,000**.
4. Installation of SCADA communication approximately **\$25,000**.

Total estimated cost is **\$150,000** based on our high level analysis. When detailed engineering is performed the costs could be determined to be higher or lower. Also, an impact study may reveal additional work that might need to be done to AEP facilities in order to permit interconnection.

## **Timetable for Construction**

Total time to complete this project is 12 months from the time that all required signed agreements are received. This time estimate is based upon the known work that is required as a result of this study. Additional work that might be indicated by an impact study would likely alter the required time.

## **Network Impacts**

The Queue Project Z2-036 was studied as a 4.3 MW (Capacity 4.3 MW) injection at the North McConnellsville 69 kV substation in the AEP area. Project Z2-036 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project Z2-036 was studied with a commercial probability of 100%. Potential network impacts were as follows:

## **Summer Peak Analysis - 2018**

### **Generator Deliverability**

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

None

### **Multiple Facility Contingency**

*(Double Circuit Tower Line, Failed 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)*

To be determined

### **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.

Not Applicable

## **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)*

To be determined by AEP Distribution System Planning during the Impact Study.

## **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 gauge 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.

None