Generation Interconnection System Impact Study Report

For

PJM Generation Interconnection Request Queue Position AD2-189

Kammer-Vassell 765kV

September 2019

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 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 System 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.

General

Guernsey Power Station LLC proposes to increase the generation of its previous PJM Projects #AB2-067 and AC1-044, a combined 1650 MW natural gas generating facility in Guernsey County, Ohio by 186 MW (see Figure 2). The point of interconnection is to the proposed Guernsey 765kV substation connecting to AEP's Kammer – Vassell 765kV circuit (see Figure 1). The AD2-189 uprate request is due to additional machine capability and does not reflect any electrical or mechanical changes to the plant. The output of the generating plant is summarized below:

	AB2-067	**AC1-044**	**AD2-189**
Plant Configuration	2 - 1 x 1 CC	1 x 1 CC	increased capability of previous queue positions
Maximum Facility Output (MW)	1,100	550	225
Capacity (MW)	1,100	550	186
Planned Backfeed	September 1, 2019	N/A	N/A
Planned In-Service	September 1, 2020	September 1, 2020	June 1, 2021

Table 1

Point of Interconnection (Guernsey 765kV)

AD2-189 (uprate project) will be interconnected with the AEP transmission system at the proposed Guernsey 765kV switching station to be constructed by PJM Project # AB2-067 & AC1-044.

Note: It is assume that the 765 kV revenue metering and gen lead to be constructed for #AB2-067 will be adequate for the additional generation.

Cost Summary

The AD2-189 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
Allocation for New System Upgrades	$ 0
Contribution for Previously Identified Upgrades	$ 0
Total Costs	**$ 0**

Attachment Facilities

There are no Attachment Facilities are required to support this interconnection.

Direct Connection Cost Estimate

There are no Direct Connection Facilities are required to support this interconnection.

Non-Direct Connection Cost Estimate

There are no Non-Direct Connection Facilities are required to support this interconnection.

Interconnection Customer Requirements

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.

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.

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

Network Impacts

The queue project AD2-189 was evaluated as a 186 MW (Capacity 186 MW) Summer Peak incremental injection at the proposed Guernsey 765 kV station in the AEP area, and was also was evaluated as a 225 MW (Capacity 186 MW) Winter Peak incremental injection at the proposed Guernsey 765 kV station in the AEP area. Project AD2-189 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD2-189 was studied with a commercial probability of 100%. Potential network impacts were as follows:

Base Case Used

Summer Peak Analysis – 2021 Case

Generator Deliverability

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

None.

Multiple Facility Contingency

(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)

None.

Short Circuit

(Summary of impacted circuit breakers)

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

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

None.

Stability and Reactive Power Requirement for Low Voltage Ride Through

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

None.

New System Reinforcements

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

None.

Affected System Analysis & Mitigation

LGEE Impacts:

None

MISO Impacts:

None

Duke, Progress & TVA Impacts:

None

OVEC Impacts:

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)

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.

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 In-Service Date is shorter than usual and may be difficult to achieve.

Conclusion

Based upon the results of this Feasibility Study, the increase of 186 MW Summer Peak and 225.0 MW Winter Peak for PJM Project #AD2-189 natural gas generation to Guernsey Power Station's previous requests (PJM Project #AB2-067 and AC1-044) will not require additional interconnection charges.

Cost Breakdown for Point of Interconnection (Kammer-Vassell 765 kV)		
Attachment Cost	PJM Project AB2-067 will pay for the necessary direct connection work required. Project AC1-044 and AD2-189 will share the same Generator lead to the new 765 kV interconnection switching station being constructed for Project AB2-067.	**PJM Project #AB2-067 to pay for Attachment Facilities**

Table 2

Figure 1: Point of Interconnection (Proposed Guernsey 765 kV Switching Station)

Single-Line Diagram

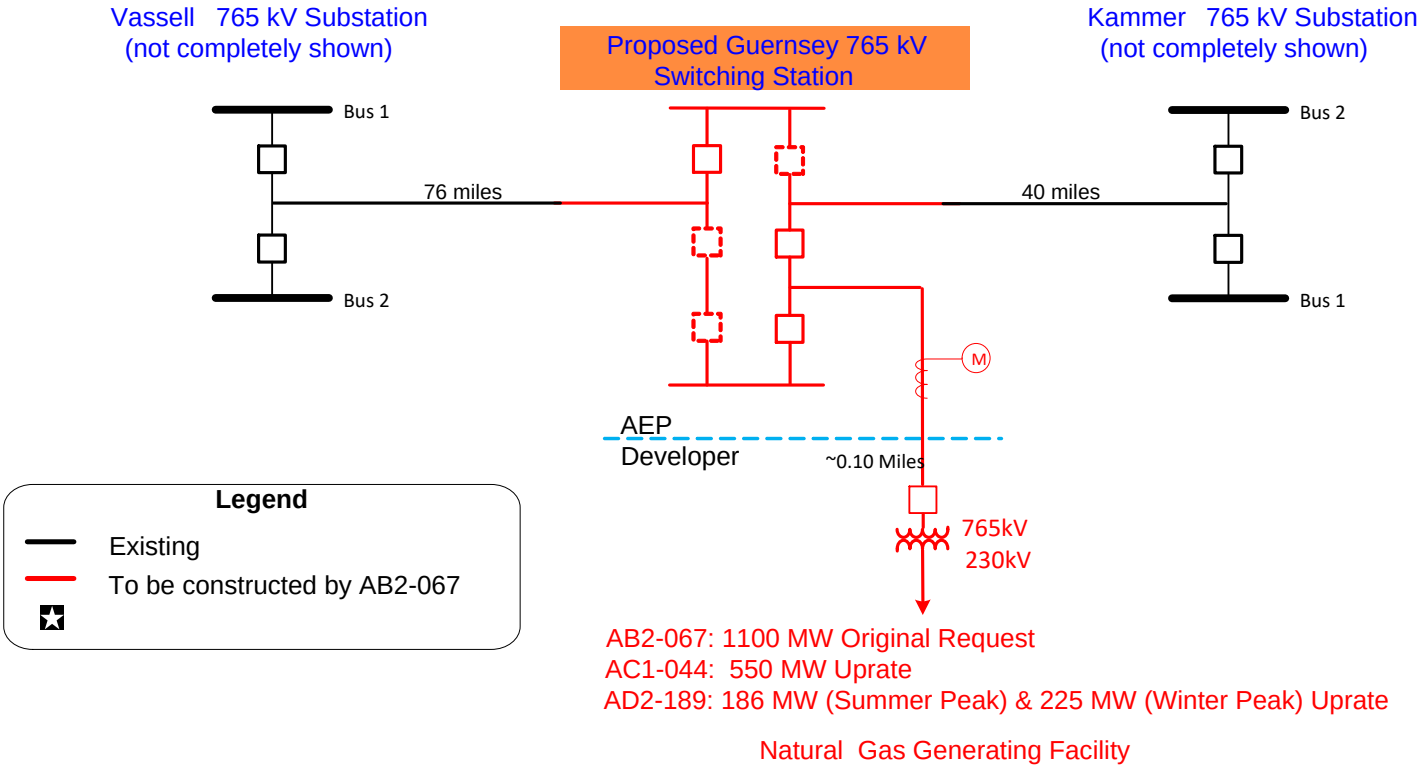

Figure 2: Point of Interconnection
(Proposed Guernsey 765 kV Switching Station)

Attachment 3: Dynamic Simulation Analysis
Executive Summary

Generator Interconnection Request AD2-189 is for a 75.0 MW uprate of the existing thermal generation plants AB2-067 and AC1-044. The uprate increases the Maximum Facility Output (MFO) of the facility from 1800.0 MW to 1875.0 MW due to additional machine capability and does not reflect any electrical or mechanical changes to the plant. AD2-189 consists of 3 × 635 MW single shaft 1x1 combined cycle generators with a Point of Interconnection (POI) on the Kammer – Vassell 765 kV line in the American Electric Power (AEP) transmission system, Guernsey County, Ohio.

This report describes a dynamic simulation analysis of AD2-189 as part of the overall system impact study.

The load flow scenario for the analysis was based on the RTEP 2021 light load case, modified to include applicable queue projects. AD2-189 has been dispatched online at maximum power output, with 0.95 p.u. voltage at the generator bus.

AD2-189 was tested for compliance with NERC, PJM, Transmission Owner and other applicable criteria. Steady-state condition and 26 contingencies were studied, each with a 20 second simulation time period. Studied faults included:

a) Steady state operation;

b) Three phase faults with normal clearing time;

c) Single phase faults with stuck breaker.

No relevant bus faults, tower faults or high-speed reclosing (HSR) contingencies were identified for this study.

There are no delayed (Zone 2) clearing faults as dual pilot protection is employed in the AEP's 765 kV network.

The three phase faults with normal clearing time will be performed under network intact conditions and with prior outage of:

a) AD2-189 POI – Kammer 765 kV circuit,

b) Vassell – Maliszewski 765 kV circuit.

For all simulations, the queue project under study along with the rest of the PJM system were required to maintain synchronism and with all states returning to an acceptable new condition following the disturbance.

For all of the fault contingencies tested on the 2021 light load case:

a) AD2-189 was able to ride through the faults (except for faults where protective action trips a generator(s)),

b) Post-contingency oscillations were positively damped with a damping margin of at least 3%.

c) Following fault clearing, all bus voltages recovered to a minimum of 0.7 per unit after 2.5 seconds (except where protective action isolates that bus).

d) No transmission element tripped, other than those either directly connected or designed to trip as a consequence of that fault.

The active and reactive power capability of Mitchell unit 1 and 2 were updated as listed in Table 5 per the latest model information. The PGEN was set to avoid governor limit errors.

The reactive power capability of AD2-189 meets the leading and lagging PF requirements.

Multiple network non-convergence instances outside of the fault period are observed for contingencies which lead to the loss of the entire AD2-189 facility. These non-convergences are observed at multiple machines around the network. There is no observed impact on the study results due to this non-convergences in the 20 second simulation timeframe.

No mitigations were found to be required.