Generation Interconnection Combined Feasibility and System Impact Study Report

For

PJM Generation Interconnection Request Queue Position AD1-136

South Bethel-Brown 69 kV

January 2018

Preface

The intent of the Combined Feasibility and 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, if any, is included in the System Impact Study.

The Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. Interconnection Customer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs associated with them will be addressed when seeking an Interconnection Agreement as outlined below. Interconnection Customer will also be responsible for providing and installing metering equipment in compliance with applicable PJM and Transmission Owner standards.

General

Lendlease Energy Development, LLC ("Interconnection Customer") has proposed an uprate to an active solar project (Queue Position AC2-088) in the Duke Energy Ohio zone. The new requested increase of 10 MW Energy and 5.4 MW Capacity will result in a total Maximum Facility Output (MFO) of 80 MWs and new Capacity Interconnection Rights (CIR) of 43.8 MWs. The following is a summary of the MW values for both Queue Requests:

- AC2-088 requested capability of 70 MW Energy and 38.4 MW CIR;
- AD1-136 requested incremental increase of 10 MW Energy and 5.4 MW CIR;
- Both projects combined, AC2-088 and AD1-136, will have capability of 80 MW Energy (MFO) and 43.8 MW CIR.

The proposed in-service date for both projects (AC2-088 and AD1-136) is May 31, 2019. **This study does not imply a Duke Energy commitment to this in-service date.**

Point of Interconnection ("POI")

The facility location is near Leonard Road, Brown County, Ohio. Interconnection Customer will build a new substation to tap the South Bethel – Brown 69 kV transmission line. The Point of Interconnection will be located at the new substation's exist side to solar plant. Please refer to Appendix 2 for more details.

Costs Summary and Transmission Owner Scope of Work

In addition to proposed attachment facilities and network upgrades for Queue Project AC2-088, the following upgrades are required to support AD1-136:

(a) Attachment Facilities: None.

(b) Direct Connection Network Upgrades: None.

(c) Non-Direct Network Upgrades:

(c1) Replace in-line switch and mounting structure near Brown substation with new structure and higher capacity switch.
PJM Network Upgrade Number: to be determined during Facilities Study phase.
Estimated cost: .....**$ 200,000**

(d) Direct Connection Local Upgrades: None.

(e) Non-Direct Connection Local Upgrades: None.

(f) Option to Build Upgrades: None.

Estimated Total Costs (a) to (f): .....$ 200,00

NOTE: The above shown Estimated Total Costs do not include Contribution in Aid of Construction (CIAC) Federal Income Tax Gross Up charge. The total tax amount may or may not be charged to this project depending upon whether this project meets the eligibility requirements of the latest IRS Safe Harbor provisions for non-taxable status.

Interconnection Customer Requirements

Interconnection Customer will be responsible for meeting all criteria as specified in the applicable sections of the Duke Energy "Requirements for Connection of Facilities to the Duke Energy MIDWEST Transmission System" document, Version 6, effective January 31, 2014, which can be found under this link:

http://www.pjm.com/~/media/planning/plan-standards/deok/deok-facility-connection-requirements.ashx.

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 Interconnection Customer's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Sections 24.1 and 24.2.

Duke Energy Requirements

The Interconnection Customer will be required to comply with all Duke Energy revenue metering requirements for generation interconnection customers. The revenue metering requirements may be found within the "Requirements for Connection of Facilities to the Duke Energy MIDWEST Transmission System" document, Version 6, effective January 31, 2014.

Schedule

Because both queue projects (AC1-088 and AD1-136) will receive one Facilities Study Report, the schedule associated with constructing any AD1-136 attachment facilities and network upgrades will be included in such report.

Network Impacts

The Queue Project AD1-136 was evaluated as a 10.0 MW (Capacity 5.4 MW) uprate to Queue Project AC2-088 in the DEOK area. Project AD1-136 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD1-136 was studied with a commercial probability of 100%. Potential network impacts were as follows:

Summer Peak Analysis - 2021

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

Duke Energy Load Flow Analysis

A Summer Peak 2021 load flow study was performed by Duke Energy evaluating AD1-136 for compliance with applicable reliability planning criteria (NERC, NERC Regional Reliability Council, and Transmission Owner). AD1-136 was studied combined with AC2-088 as an 80 MW injection at a 69 kV tap bus between South Bethel and Brown substations. The load flow study showed that the feeder between the tap bus and Brown overloads to 102.7% in the case where the connecting breaker at South Bethel is opened for any of four failed breaker contingencies.

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

None

Short Circuit

None

Affected System Analysis & Mitigation

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 - 2021

Not required.

System Reinforcements

Short Circuit

None

Stability and Reactive Power Requirement

To be determined during the Facilities Study phase (With queue project AC1-088.)

Summer Peak Load Flow Analysis Reinforcements

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

As identified by Duke Energy, an in-line switch near Brown substation is the limiting element. The overload is alleviated with the switch replaced. Duke Energy will replace the switch with a higher capacity switch and a new mounting structure near Brown substation. Estimated Cost: $200,000.

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

Light Load Load Flow Analysis Reinforcements

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

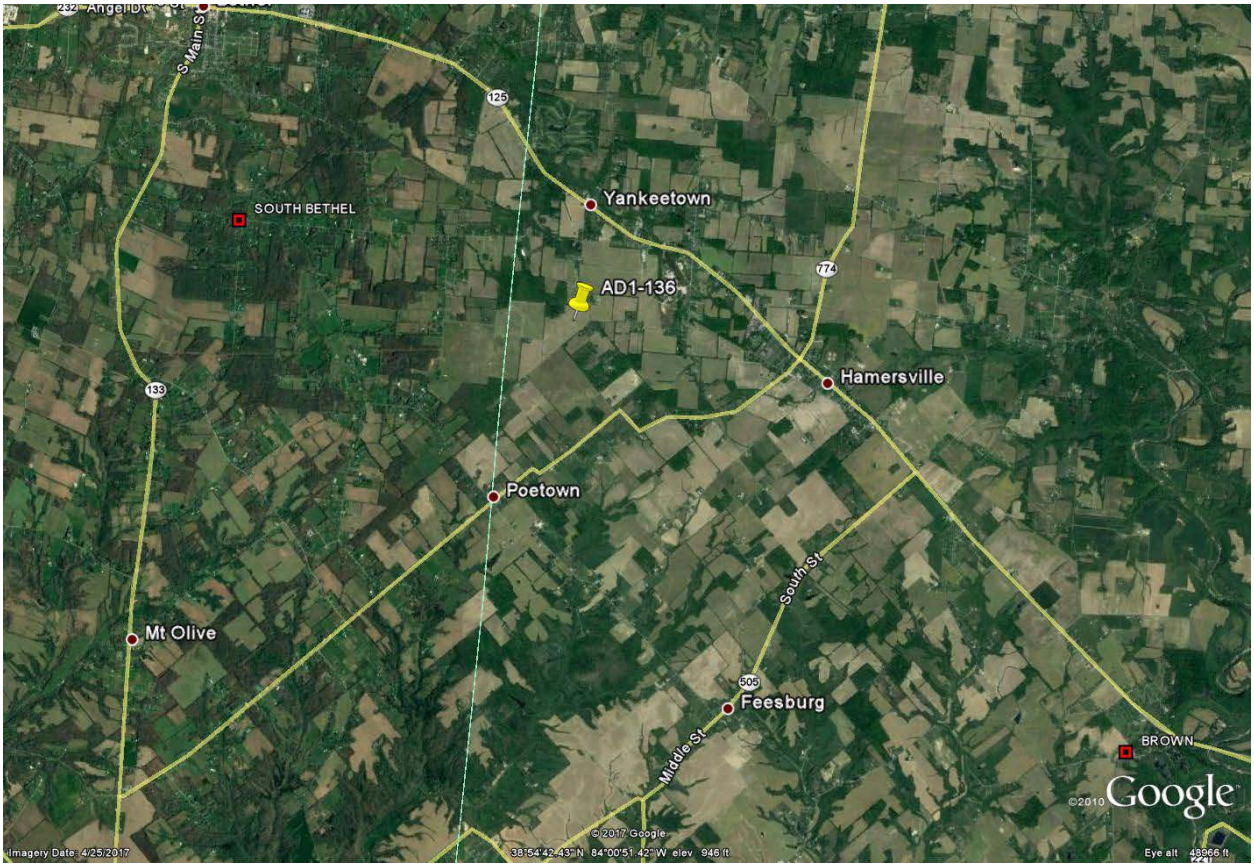
None

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)

None

Appendix 1

Facility Location
PJM Queue Position: AD1-136



Appendix 2

Interconnection One-Line Diagram
PJM Queue Position: AD1-136