Generation Interconnection

Feasibility Study Report

for

Queue Project AF1-045

CEDARVILLE-FORD 138 KV

31.3 MW Capacity / 52.2 MW Energy

January, 2020

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1 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. Cost allocation rules for network upgrades can be found in PJM Manual 14A, Attachment B. 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, the costs may be included in the study.

2 General

Project AF1-045 is a request that proposes a 52.2 MW MFO increase using battery storage to PJM queue project AE2-318, which is a solar farm to be built near Hawley Road, Clermont County, Ohio; please refer to the facilities location map in Appendix 1 (Please note this POI is not official). The proposed in-service date for this project is December 01, 2023. This study does not imply a Duke Energy commitment to this in-service date.

Queue Number	AF1-045
Project Name	CEDARVILLE-FORD 138 KV
State	Ohio
County	Clermont
Transmission Owner	DEOK
MFO	152.2
MWE	52.2
MWC	31.3
Fuel	Storage
Basecase Study Year	2023

2.1 Point of Interconnection

AF1-045 will interconnect with the Duke Energy transmission system by direct injection into a new 138 kV substation bus located on the feeder between the AF1-315 and Cedarville substations. The new substation will have a three-breaker ring bus configuration. The Point of Interconnection is located where Duke Energy's overhead line from the new substation terminates to the Interconnection Customer's pole mounted switch, approximately 25 feet outside the new substation fence; please refer to the single-line diagram in Appendix 2. Please note that since AF1-045 is an increase in MFO from AE2-318, the three-breaker ring bus station mentioned above is constructed in project AE2-318. Should AE2-318 drop from the PJM queue, AF1-045 would be responsible for construction of this three-breaker ring bus.

2.2 Cost Summary

The AF1-045 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$0
Direct Connection Network Upgrade	$0
Non Direct Connection Network Upgrades	$0
Total Costs	$0

In addition, the AF1-045 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	$12,722,939

Cost allocations for these upgrades will be provided in the System Impact Study Report.

3 Transmission Owner Scope of Work

4 Attachment Facilities

None as the attachment facilities are being constructed in PJM queue project AE2-318.

5 Direct Connection Cost Estimate

None as the attachment facilities are being constructed in PJM queue project AE2-318..

6 Non-Direct Connection Cost Estimate

None.

Duke Energy facilities and network upgrades costs required to support the AF1-045 project are listed below. Please note this is a class 5 estimate, with a band range of (-50% to +100 %). It is also assumed there will be no issues obtaining Transmission Line easement for station power.

(a) Attachment Facilities: $ 0 (None)

(b) Direct Connection Network Upgrades: $ 0 (None)

(c) Non-Direct Connection Network Upgrades: $ 0 (None)

(d) Direct Connection Local Upgrades: $ 0 (None)

(e) Non-Direct Connection Local Upgrades: $ 0 (None)

(f) Option to Build Upgrades: $ 0 (None)

Estimated Total Costs (a) to (f): .....$ 0 (None)

NOTE: CIAC Tax Gross Up charges will be charged to the project if it does not meet the eligibility requirements of IRS Notice 88-129.

7 Schedule

The estimated time to complete this work is approximately 29 months from a signed ISA and CSA. This assumes no issues getting a PJM outage on the line or adjacent line on tower and no major interruptions for weather.

8 Transmission Owner Analysis

A Summer Peak 2023 load flow study was performed evaluating AF1-045 for compliance with applicable reliability planning criteria (NERC, NERC Regional Reliability Council, and Transmission Owner). AF1-045 was studied as a 53 MW injection onto the 138 kV line between the AF1-315 POI and Cedarville. Previous queued generation and other AF1 queued generation within the DEOK footprint only were modeled as well. An impact was found on the system caused by the combination of this generation interconnection and AF1-315. The impact was that the line from the AE2-318/AF1-045 POI to Cedarville becomes overloaded for contingencies elsewhere on the DEOK system. The scope and cost estimate are given above in the Non-Direct Connection Network Upgrades section.

9 Interconnection Customer Requirements

Interconnection Customer will be required to procure and provide land for the new substation. The land will be ceded to Duke Energy prior to construction of the new substation. The land must be near the Ford Batavia - Cedarville 138 kV feeder path and have direct access to publicly maintained roadway. The land shall be environmentally permitted, graded and ready for construction. Final size and location is to be approved by Duke Energy.

Interconnection Customer will be required to engineer, procure, and construct the connecting circuit from the Interconnection Customer's substation to the Point of Interconnection. This includes, but is not limited to, a pole and switch to be installed approximately 25 feet outside the new substation fence.

Interconnection Customer will be responsible for meeting all criteria as specified in the applicable sections of the "Duke Energy Midwest transmission systems Facility Connection Requirements" document, Version 7, effective October 31, 2018, which can be found under this link:

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

10 Revenue Metering and SCADA Requirements

10.1 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 Section 8 of Attachment O.

10.2 DEOK 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 "Duke Energy Midwest transmission systems Facility Connection Requirements" document, Version 7, effective October 31, 2018.

11 Network Impacts

The Queue Project AF1-045 was evaluated as a 52.2 MW energy (Capacity 31.3 MW) injection as an uprate to AE2-318 tapping the Ford to Cedarville 138 kV line in the DEOK area. Project AF1-045 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-045 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

Summer Peak Load Flow

12 Generation Deliverability

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

None

13 Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

None

14 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

15 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.

Note: Only the most severely overloaded conditions are listed below. 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 shall study all overload conditions associated with the overloaded element(s) identified.

None

16 System Reinforcements

None

Affected Systems

17 Affected Systems

17.1 LG&E

LG&E Impacts to be determined during later study phases (as applicable).

17.2 MISO

MISO Impacts to be determined during later study phases (as applicable).

17.3 TVA

TVA Impacts to be determined during later study phases (as applicable).

17.4 Duke Energy Progress

Duke Energy Progress Impacts to be determined during later study phases (as applicable).

17.5 NYISO

NYISO Impacts to be determined during later study phases (as applicable).

Short Circuit

18 Short Circuit

The following Breakers are overduty

None