



Generation Interconnection

Feasibility Study Report

for

Queue Project AF1-249

Nickel 12.47 KV

14 MW Capacity / 19.92 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.

The Interconnection Customer seeking to interconnect a wind or solar generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement and Section 8 of Manual 14D.

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 AF1-249 is a request by CZ Solar Warren LLC (Interconnection Customer) that proposes a 19.92 MW solar generator to be built near the Duke Energy Owned Nickel Station, Warren County, Ohio; please refer to the facilities location map in Appendix 1 (Please note this POI location is not official). The proposed in-service date for this project is June 01, 2021. **This study does not imply a Duke Energy commitment to this in-service date.**

Queue Number	AF1-249
Project Name	UNION ROAD 12.47 KV
State	Ohio
County	Warren
Transmission Owner	DEOK
MFO	19.9
MWE	19.92
MWC	14
Fuel	Solar
Basecase Study Year	2023

2.1 Point of Interconnection

AF1-249 will interconnect with the Duke Energy transmission system by direct injection into the Nickel 12.47 kV bus. There will be two connections on the 12.47 kV bus at Nickel to the interconnection customer via Duke Energy Owned (Transmission Owner) series breakers (Please see Interconnection Single-Line Diagram 1 in Appendix 2). The Points of Interconnection (hereinafter referred to as POIs) are located where Duke Energy's overhead lines from the Nickel 12.47 kV substation terminate to the Interconnection Customer's pole mounted switches, approximately 25-30 feet outside the Nickel substation fence; please refer to the Interconnection Single-Line Diagram 2 in Appendix 2.

2.2 Cost Summary

The AF1-249 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$1,073,083
Direct Connection Network Upgrade	\$ 0
Non Direct Connection Network Upgrades	\$ 685,476
Total Costs	\$1,758,559

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.

In addition, the AF1-249 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	\$0

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

3 Transmission Owner Scope of Work

4 Attachment Facilities

Duke Energy will move a distribution feeder from 12 kV bus 1 to 12 kV bus 2 at Nickel and use that existing breaker for the first interconnection point. Along with re-using this existing breaker, Duke Energy will add poles, metering, a recloser, equipment for direct transfer trip, and overhead conductors to complete this first interconnection point. Duke Energy will also install a 15.5 kV breaker on the Nickel 12 kV bus 2 with associated disconnects and bus work, poles, metering, a recloser, equipment for direct transfer trip, and overhead conductors for the second interconnection point.

The total preliminary cost estimate for the Attachment work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Attachment Facilities	\$1,073,083
Total Attachment Facility Costs	\$1,073,083

5 Direct Connection Cost Estimate

The total preliminary cost estimate for the Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

None.

6 Non-Direct Connection Cost Estimate

The total preliminary cost estimate for the Non-Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Non-Direct Connection Local Upgrades	\$685,476
Total Non-Direct Connection Facility Costs	\$685,476

7 Schedule

The estimated time to complete this work is approximately 18 months from a signed ISA and CSA. This assumes no issues getting right of way, 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 AF1-249 for compliance with applicable reliability planning criteria (NERC, NERC Regional Reliability Council, and Transmission Owner). AF1-249 was studied as a 20 MW injection into the existing Nickel 138 kV bus. In the model, the 12.47 kV system at Nickel is equivalized which is why the 20 MW was injected into the Nickel 138 kV bus. No adverse impacts were found at this time.

9 Interconnection Customer Requirements

Interconnection Customer will be required to procure and provide land for the POI structures and the line right of way for the lines from the Nickel 12.47 kV substation to the POI structures. The land will be ceded to Duke Energy prior to construction of the lines and POI structures. Final location is to be approved by Duke Energy.

Interconnection Customer will be required to engineer, procure, and construct the connecting circuits from the Interconnection Customer's substation to the POIs. This includes, but is not limited to, two poles for the two interconnections with associated disconnect switches to be installed approximately 25-30 feet outside the Nickel substation fence at the POIs.

The Interconnection Customer will be required to evenly split the generation among the two interconnection points. Each interconnection point will carry 9.96 MW. The customer will not be allowed to place all the 19.92 MW of solar generation on one single interconnection point as the interconnection equipment is not rated for that much generation.

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 AF1-249 was evaluated as a 19.9 MW (Capacity 13.5 MW) injection at the Union Road 12.47 kV substation in the DEOK area. Project AF1-249 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-249 was studied with a commercial probability of 1.00. 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).

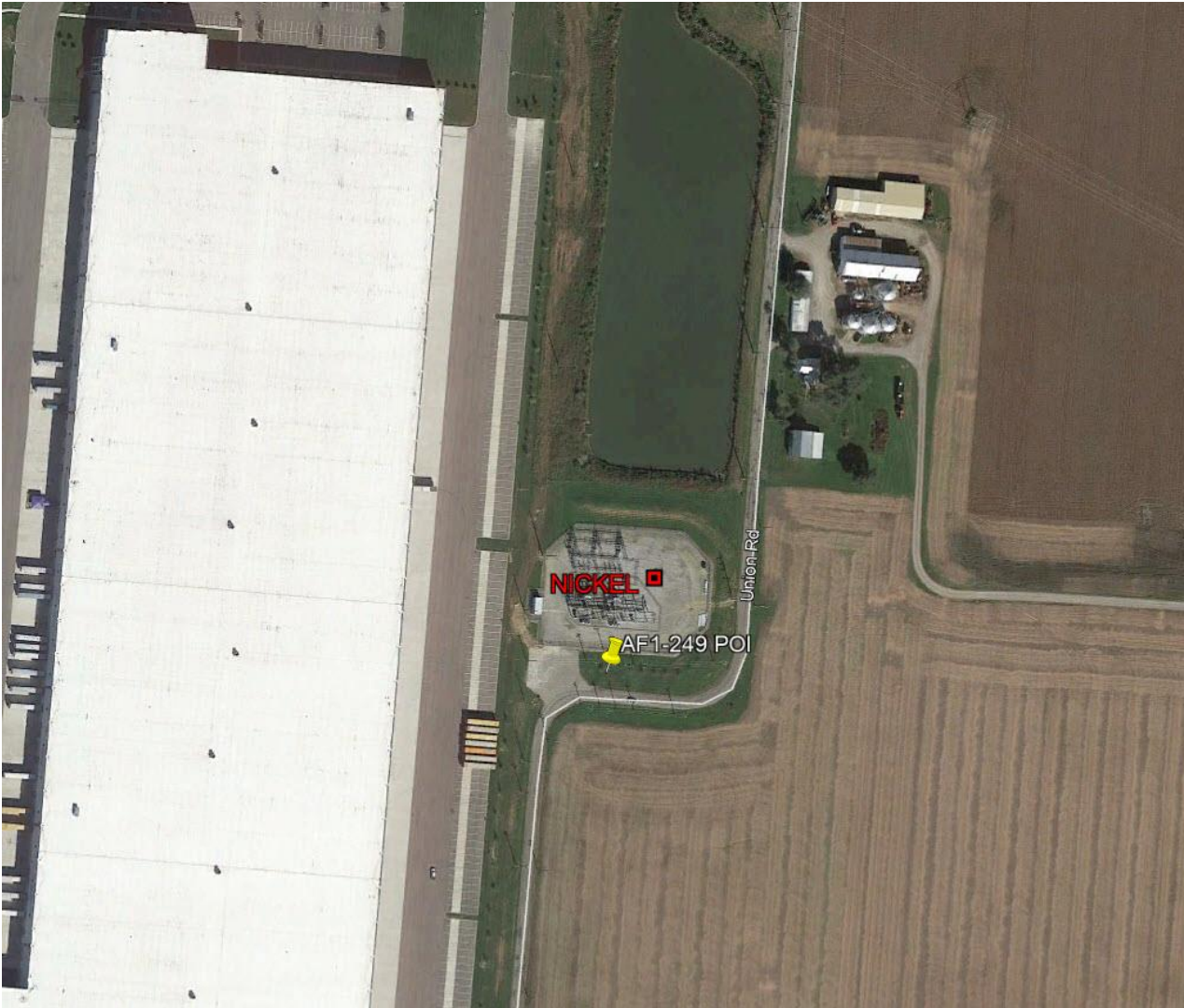
18 Short Circuit

No Breakers are identified as overdutied

19 Appendix 1

Facility Location

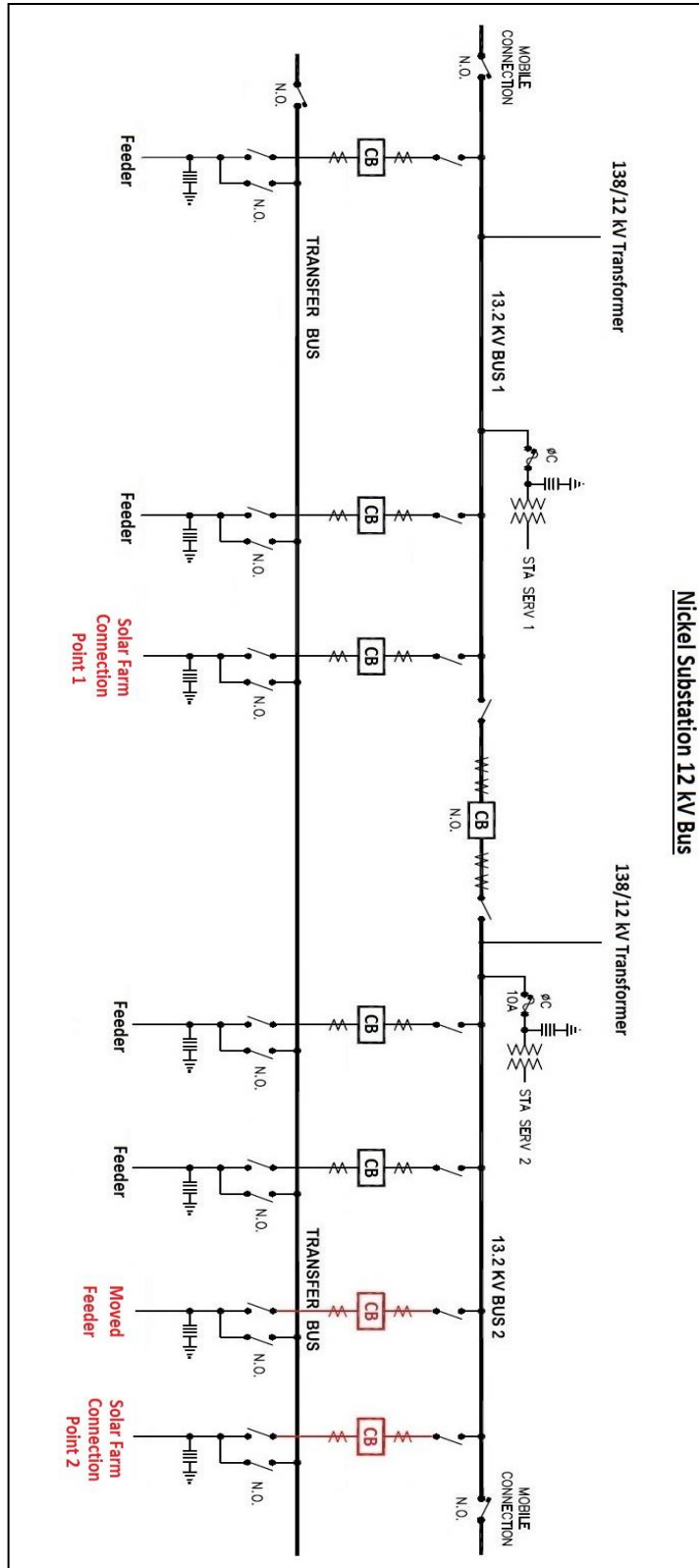
PJM Queue Position: AF1-249 (Please note this POI location is not official)



20 Appendix 2

Interconnection Single-Line Diagram 1
PJM Queue

Position: AF1-249



Interconnection Single-Line Diagram 2

PJM Queue Position: AF1-249

Only one connection is shown; however it is the same for both connections

