Generation Interconnection

Combined Feasibility/System Impact Study Report

for

Queue Project AF1-061

FAYETTEVILLE 12.47 KV

1.2 MW Capacity / 4 MW Energy

January 2020

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1 Introduction

This Combined Feasibility/System Impact Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 36.2, as well as the Feasibility Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is West Penn Power (APS – WPP zone).

2 Preface

The intent of the Combined Feasibility/System Impact study is to determine a plan, with approximate 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 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.

3 General

The Interconnection Customer (IC), has proposed a Solar generating facility located in Franklin County, Pennsylvania. The installed facilities will have a total capability of 4 MW with 1.2 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is 12/10/2021. This study does not imply a TO commitment to this in-service date.

Final attachment facilities and local upgrades (if required) along with terms and conditions to interconnect AF1-061 will be specified in a separate two party Interconnection Agreement (IA) between WPP and the Interconnection Customer as this project is considered FERC non-jurisdictional per the PJM Open Access Transmission Tariff (OATT).

From the transmission perspective, no network impacts or system reinforcements were identified as detailed in the "Network Impacts" section below.

Queue Number	AF1-061
Project Name	FAYETTEVILLE 12.47 KV
State	Pennsylvania
County	Franklin
Transmission Owner	APS
MFO	4
MWE	4
MWC	1.2
Fuel	Solar
Basecase Study Year	2023

3.1 Point of Interconnection

The interconnection of the AF1-061 project will be accomplished by constructing a new dedicated 12.47 kV distribution feeder, substation position with G&W viper recloser, and underground substation exit from Fayetteville Substation. The point of interconnection will be in the area of existing pole 22431-WP41 and is approximately 3.8 miles from Fayetteville Substation. The new substation position will be located on the Fayetteville No. 2 – 12 kV distribution bus, fed from the Fayetteville TR62 138/12.47 kV transformer. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection 12.47 kV distribution feeder, substation position, and the associated attachment facilities.

Attachment 1 shows a one-line diagram of the proposed primary Direct Connection facilities for the AF1-061 generation project to connect to the West Penn Power ("WPP") Distribution system. Typical configuration and requirements of 300kw or greater interconnection facilities to FirstEnergy's distribution system can be found at: https://www.firstenergycorp.com/content/dam/feconnect/files/retail/Customer-Interconnection-Guide-Three-Phase.pdf.

The IC will be responsible for constructing the facilities on its side of the POI.

3.2 Cost Summary

Total estimated cost for the required Interconnection Facilities is **$1,677,000**. This cost excludes a Federal Income Tax Gross Up charges. This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 88-129. If at a future date it is determined that the Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

From the transmission perspective, no network impacts or system reinforcements were identified as detailed in the "Network Impacts" section below.

4 Transmission Owner Scope of Work

There will be no work required on any transmission voltages for the scope of this project. The interconnection will be to the 12.47 kV distribution system. The interconnection of the AF1-061 project will be accomplished by constructing a new dedicated 12.47 kV distribution feeder, substation position with G&W viper recloser, and underground substation exit from Fayetteville Substation. The point of interconnection will be in the area of existing pole 22431-WP41 and is approximately 3.8 miles from Fayetteville Substation. The new substation position will be located on the Fayetteville No. 2 – 12 kV distribution bus, fed from the Fayetteville TR62 138/12.47 kV transformer. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection 12.47 kV distribution feeder, substation position, and the associated attachment facilities.

Description	Total Cost
Line Work	$1,520,000
Substation Work	$147,000
Meter Package	$10,000
Total Estimated Connection Facility Costs	**$1,677,000**

5 Schedule

Based on the scope of work for the Attachment Facilities and the Direct and/or Non-Direct Connection Facilities, it is expected to take a minimum of **12 months** after signing of an Interconnection Construction Service Agreement to complete the installation. This includes the requirement for the IC to make a preliminary payment that compensated WPP for the first three months of the engineering design work that is related to the Attachment Facility work. Full initial deposit is required for the Non-Direct Connection work. This assumes there will be no environmental issues with any of the new properties associated with this project, there will be no delays in acquiring the necessity permits for implementing the defined interconnection work, and that all transmission and distribution system outages will be allowed when requested.

6 Transmission Owner Analysis

WPP performed an analysis of its 12.47 kV distribution system. The AF1-061 project was modeled at 4MW using Eaton's Cyme Program – CYMEDIST 7.2r11. During the study it was determined that a direct feeder with new substation position on the Fayetteville #2 12kVt was required for the AF1-061 interconnection.

WPP did not study its underlying transmission system <100kV or 138 kV system as no load was flowing through the Fayetteville TR62 138/12.47 kV transformer.

7 Interconnection Customer Requirements

7.1 System Protection

The IC must design its Customer Facilities in accordance with all applicable standards, including the standards in FE's "Interconnection of Customer Owned Generation to the FirstEnergy Distribution System" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx.

Preliminary Protection requirements will be provided as part of the Facilities Study with FirstEnergy. Detailed Protection Requirements will be provided once the project enters the construction phase. Please note that a breaker or recloser is required at the point of interconnection as outlined in FirstEnergy's "Customer Guide for Retail Interconnection of Electric Power Producing and Storage Facilities Commercial/Industrial – Three Phase Inverter Based" located at: https://www.firstenergycorp.com/content/dam/feconnect/files/retail/Customer-Interconnection-Guide-Three-Phase.pdf

The IC's GSU transformers shall be designed with a grounded wye winding on the high (utility) side. Transformer with other configurations must be studied by FE to determine if they would be acceptable for installation on the FE distribution system. Furthermore, other transformer winding configurations may result in additional upgrades to the transmission system.

7.2 Compliance Issues and Interconnection Customer Requirements

The proposed Customer Facilities must be designed in accordance with FE's "Interconnection of Customer Owned Generation to the FirstEnergy Distribution System" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx.

The IC will also be required to meet all PJM, ReliabilityFirst, and NERC reliability criteria and operating procedures for standards compliance. For example, the IC will need to properly locate and report the over and under voltage and over and under frequency system protection elements for its units as well as the submission of the generator model and protection data required to satisfy the PJM and ReliabilityFirst audits. Failure to comply with these requirements may result in a disconnection of service if the violation is found to compromise the reliability of the FE system.

7.3 Power Factor Requirements

The IC shall design its non-synchronous Customer Facility with the ability to maintain a power factor of at least 0.95 leading (absorbing VARs) to 0.95 lagging (supplying VARs) measured at the point of interconnection or at the point of common coupling as determined by FirstEnergy.

8 Revenue Metering and SCADA Requirements

8.1 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.

8.1.1 Meteorological Data Reporting Requirement

The solar generation facility shall provide the Transmission Provider with site-specific meteorological data including:

- Temperature (degrees Fahrenheit)
- Atmospheric pressure (hectopascals)
- Irradiance
- Forced outage data

8.2 APS - West Penn Power Requirements

The IC will be required to comply with all FE revenue metering requirements for generation interconnection customers which can be found in FE's "Generator Interconnection Technical Requirements for Distribution Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx

9 Network Impacts

The Queue Project AF1-061 was evaluated as a 4.0 MW (Capacity 1.2 MW) injection near pole 22431-WP41 utilizing a new 12.47 distribution feeder from Fayetteville Substation in the West Penn Power area. Project AF1-061 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-061 was studied with a commercial probability of 100%. Potential network impacts were as follows:

Summer Peak Load Flow

10 Generation Deliverability

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

None

11 Multiple Facility Contingency

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

None

12 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

13 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

14 System Reinforcements

None.

Affected Systems

15 Affected Systems

None.

Short Circuit

16 Short Circuit

The following Breakers are overduty:

None.

Stability

17 Stability

Not required for this project.

18 Attachment 1 – One Line