



**Generation Interconnection
Feasibility Study Report
for
Queue Project AF1-153
MOTION-RIDGEWAY 46 KV
12 MW Capacity / 20 MW Energy**

January, 2020

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1 Introduction

This Feasibility 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 (WPP – APS).

2 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 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.

PJM utilizes manufacturer models to ensure the performance of turbines is properly captured during the simulations performed for stability verification and, where applicable, for compliance with low voltage ride through requirements. Turbine manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is contained in Attachment B of Manual 14G. Manufacturer models may be updated from time to time, for various reasons such as to reflect changes to the control systems or to more accurately represent the capabilities turbines and controls which are currently available in the field. Additionally, as new turbine models are developed, turbine manufacturers provide such new models which must be used in the conduct of these studies. PJM needs adequate time to evaluate the new models in order to reduce delays to the System Impact Study process timeline for the Interconnection Customer as well as other Interconnection Customers in the study group. Therefore, PJM will require that any Interconnection Customer with a new manufacturer model must supply that model to PJM, along with a \$10,000 fully refundable deposit, no later than three (3) months prior to the starting date of the System

Impact Study (See Section 4.3 for starting dates) for the Interconnection Request which shall specify the use of the new model. The Interconnection Customer will be required to submit a completed dynamic model study request form (Attachment B-1 of Manual 14G) in order to document the request for the study.

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.

3 General

The Interconnection Customer (IC), has proposed a Solar generating facility located in Elk County, Pennsylvania. The installed facilities will have a total capability of 20 MW with 12 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is May 1, 2022. 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 AF1-153 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).

Queue Number	AF1-153
Project Name	MOTION-RIDGEWAY 46 KV
State	Pennsylvania
County	Elk
Transmission Owner	APS – West Penn Power
MFO	20
MWE	20
MWC	12
Fuel	Solar
Basecase Study Year	2023

4 Point of Interconnection

4.1 Primary POI

The interconnection of the project onto the FirstEnergy system will be accomplished by tapping the Motion Control (Ridgway) 46 kV line and constructing a one span tap. The transmission line tap will be located approximately 0.1 miles from Ridgway substation. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection line tap and the associated attachment facilities. The project will also require non-direct connection upgrades at Ridgway substation.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AF1-153 generation project to connect to the FirstEnergy (“FE”) transmission system. IC will be responsible for constructing all of the facilities on its side of the POI, including the Attachment facilities which connect the generator to the FE transmission system.

4.2 Secondary POI

The interconnection of the project at the Secondary POI can be accomplished by installing a new 46 kV terminal position at Ridgway substation. A full scope of work or estimated cost is not provided for the proposed Secondary POI. Analysis results can be found in the “Network Impacts – Secondary POI” section of this report.

5 Cost Summary

Total estimated cost for the required Interconnection Facilities is **\$210,200**. 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.

Final attachment facilities and local upgrades (if required) along with terms and conditions to interconnect AF1-153 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).

6 Transmission Owner Scope of Work

The interconnection of the project onto the FirstEnergy system will be accomplished by tapping the Motion-Control (Ridgway) 46 kV line and constructing a one span tap. The transmission line tap will be located approximately 0.1 miles from Ridgway substation. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection line tap and the associated attachment facilities. The project will also require non-direct connection upgrades at Ridgway substation.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AF1-153 generation project to connect to the FirstEnergy (“FE”) transmission system. IC will be responsible for constructing all of the facilities on its side of the POI, including the Attachment facilities which connect the generator to the FE transmission system.

Description	Total Cost
Install one 46 kV tap switch and construct single span tap to customer’s substation. Install 46 kV metering in customer’s substation.	\$36,100
Construct 46 kV tap with two 46 kV line switches.	\$72,200
Update relay settings at Ridgway	\$38,700
Review drawings and provide nameplates for customer substation.	\$63,200
Total Estimated Connection Facility Costs	\$ 210,200

7 Schedule

Based on the scope of work for the connection facilities, it is expected to take a minimum of **12 months** after the signing of an Interconnection Agreement to complete the installation. This assumes that there will be no environmental issues with any of the new properties associated with this project, that there will be no delays in acquiring the necessary permits for implementing the connection and that any distribution system outages will be allowed when requested.

8 Transmission Owner Analysis

FE performed an analysis of its underlying transmission <100 kV system. The AF1-153 project did not contribute to any overloads on the FE transmission <100 kV system.

9 Interconnection Customer Requirements

9.1 System Protection

The IC must design its Customer Facilities in accordance with all applicable standards, including the standards in FE's "Requirements for Transmission Connected Facilities" 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. Detailed Protection Requirements will be provided once the project enters the construction phase.

The IC has requested a non-standard GSU transformer winding configuration. This transformer is in violation of section 14.2.6 of FE's "Requirements for Transmission Connected Facilities" document and will not be accepted. The GSU transformer must have a delta or ungrounded wye connection on the high (utility) side.

9.2 Compliance Issues and Interconnection Customer Requirements

The proposed Customer Facilities must be designed in accordance with FE's "Requirements for Transmission Connected Facilities" document located at: <http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx>. In particular, the IC is responsible for the following:

1. The purchase and installation of a fully rated 34.5 kV circuit breaker to protect the AF1-153 generator lead line. A single circuit breaker must be used to protect this line; if the project has several GSU transformers, the individual GSU transformer breakers cannot be used to protect this line.
2. The purchase and installation of the minimum required FE generation interconnection relaying and control facilities. This includes over/under voltage protection, over/under frequency protection, and zero sequence voltage protection relays.
3. The purchase and installation of supervisory control and data acquisition ("SCADA") equipment to provide information in a compatible format to the FE Transmission System Control Center.
4. Compliance with the FE and PJM generator power factor and voltage control requirements.
5. The execution of a back-up service agreement to serve the customer load supplied from the AF1-153 generation project metering point when the units are out-of-service. This assumes the intent of the IC is to net the generation with the load.

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.

9.3 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 high-side of the facility substation transformer(s) connected to the FE transmission system.

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.

10.1.1 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

10.2 FirstEnergy 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 "Requirements for Transmission Connected Facilities" document located at: <http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx>

11 Network Impacts – Primary POI

The Queue Project AF1-153 was evaluated as a 20.0 MW (Capacity 12.0 MW) injection tapping the Ridgeway to Motion Control 46 kV line in the APS area. Project AF1-153 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-153 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

11.1 Generation Deliverability

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

None

11.2 Multiple Facility Contingency

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

None

11.3 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

11.4 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

11.5 System Reinforcements

None

Affected Systems

11.6 Affected Systems

11.6.1 LG&E

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

11.6.2 MISO

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

11.6.3 TVA

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

11.6.4 Duke Energy Progress

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

11.6.5 NYISO

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

Short Circuit

11.7 Short Circuit

The following Breakers are overduty

None

12 Network Impacts – Secondary POI

The Queue Project AF1-153 was evaluated as a 20.0 MW (Capacity 12.0 MW) injection at the Ridgeway 46 kV substation in the APS area. Project AF1-153 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-153 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

12.1 Generation Deliverability

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

None

12.2 Multiple Facility Contingency

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

None

12.3 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

12.4 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

Affected Systems

12.5 Affected Systems

12.5.1 LG&E

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

12.5.2 MISO

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

12.5.3 TVA

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

12.5.4 Duke Energy Progress

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

12.5.5 NYISO

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

Short Circuit

12.6 Short Circuit

The following Breakers are overduty:

None

13 Attachment One: One Line Diagram