



**Generation Interconnection
Combined Feasibility & System Impact Study
Report for
Queue Project AF1-182
SHAWVILLE 4 230 KV
4 MW Capacity / 4 MW Energy**

January 2020

Table of Contents

1	Introduction.....	3
2	Preface.....	3
3	General.....	5
3.1	Point of Interconnection	5
3.2	Cost Summary.....	5
4	Transmission Owner Scope of Work.....	6
5	Attachment Facilities	6
6	Direct Connection Cost Estimate.....	6
7	Non-Direct Connection Cost Estimate.....	6
8	Schedule.....	6
9	Transmission Owner Analysis.....	6
9.1	Power Flow Analysis	6
10	Interconnection Customer Requirements.....	7
11	Revenue Metering and SCADA Requirements	9
11.1	PJM Requirements.....	9
11.2	PENELEC Requirements.....	9
12	Network Impacts.....	10
12.1	Generation Deliverability	12
12.2	Multiple Facility Contingency	12
12.3	Contribution to Previously Identified Overloads.....	12
12.4	Potential Congestion due to Local Energy Deliverability.....	12
13	Short Circuit.....	14
14	Affected Systems	16
14.1	LG&E.....	16
14.2	MISO	16
14.3	TVA.....	16
14.4	Duke Energy Progress.....	16
14.5	NYISO	16
15	Attachment 1 – One Line.....	17
16	Attachment 2 – Project Location	18

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 Pennsylvania Electric Company (PENELEC).

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.

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 an uprate to an existing Natural Gas generating facility located in Adams County, Shawville, Pennsylvania. Note that this project is an increase to the Interconnection Customer's AB1-144 project, which will share the same property and connection point. This projects requests an increase to the installed capability of Shawville Unit 4 of 4 MW with 4 MW of this output being recognized by PJM as Capacity. The installed facilities will have a total capability of 175 MW with 175 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is October 03, 2019. This study does not imply a TO commitment to this in-service date.

Queue Number	AF1-182
Project Name	SHAWVILLE 4 230 KV
State	Pennsylvania
County	Adams
Transmission Owner	MAIT
MFO	175
MWE	4
MWC	4
Fuel	Natural Gas
Basecase Study Year	2023

3.1 Point of Interconnection

The interconnection customer is proposing to increase the net energy output by 4 MW (summer) and 4 MW (winter) behind the existing meter point for the AB1-144 Shawville Unit 4 project. The net energy output increase will change the capacity of the combined Unit 4 projects from 171 MW to 175 MW. The MFO of the combined projects will change from 171 MW to 175 MW. No modification of the FE connection facilities are required to accommodate this capacity increase.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AB1-144 and AF1-182 Unit 4 generation projects to connect to the FirstEnergy ("FE") transmission system. Attachment 2 provides the proposed location for the point of interconnection. IC will be responsible for constructing the facilities on its side of the POI, including the attachment facilities which connect the generator to the FE transmission system's direct connection facilities.

3.2 Cost Summary

There are no direct or non-direct connection facility upgrades to accommodate the net energy output increase.

In addition, the AF1-182 project may be responsible for a contribution to the following costs:

None.

4 Transmission Owner Scope of Work

The interconnection customer is proposing to increase the net energy output by 4 MW (summer) and 4 MW (winter) behind the existing meter point for the AB1-144 Shawville Unit 4 project. The net energy output increase will change the capacity of the combined Unit 4 projects from 171 MW to 175 MW. The MFO of the combined projects will change from 171 MW to 175 MW. No modification of the FE connection facilities are required to accommodate this capacity increase.

5 Attachment Facilities

There is no Attachment Facility scope of work required.

6 Direct Connection Cost Estimate

There is no Direct Connection scope of work required.

7 Non-Direct Connection Cost Estimate

There is no Non-Direct Connection scope of work required.

8 Schedule

The schedule for the required Network Impact Reinforcements will be more clearly identified in future study phases. The estimate elapsed time to complete each of the required reinforcements is identified in the “System Reinforcements” section of the report.

9 Transmission Owner Analysis

9.1 Power Flow Analysis

FE performed an analysis of its underlying transmission <100 kV system. The AF1-182 project did not contribute to any overloads on the FE transmission <100 kV system.

10 Interconnection Customer Requirements

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.

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 230 kV circuit breaker to protect the AF1-182 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 AF1-182 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.

Power Factor Requirements

The existing 171 MW portion of the Customer Unit 4 Facility shall retain its existing ability to maintain a power factor of at least 0.95 leading (absorbing VARs) to 0.90 lagging (supplying VARs) measured at the generator's terminals. The increase of 4 MW to the Customer Facilities associated with the AF1-182 project shall be designed with the ability to maintain a Power Factor of at least 1.0 (unity) to 0.90 lagging (supplying VARs) measured at the Point of Interconnection.

11 Revenue Metering and SCADA Requirements

11.1 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.

11.2 PENELEC 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>.

12 Network Impacts

The Queue Project AF1-182 is an update to previous queue project AB1-144 Shawville Unit 4 and was evaluated as a 4.0 MW (Capacity 4.0 MW) injection at Shawville 230 kV in the PENELEC area. Project AF1-182 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-182 was studied with a commercial probability of 100%. 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

Short Circuit

13 Short Circuit

The following Breakers are overdutied:

None.

Affected Systems

14 Affected Systems

14.1 LG&E

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

14.2 MISO

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

14.3 TVA

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

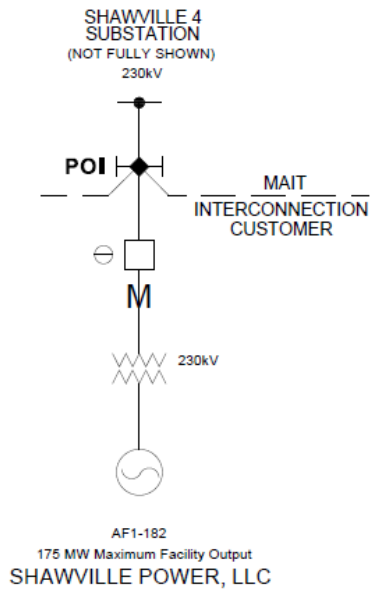
14.4 Duke Energy Progress

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

14.5 NYISO

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

15 Attachment 1 – One Line



◆ = POI (POINT OF INTERCONNECTION) IS AT THE MAIT OWNED SUBSTATION DEAD-END STRUCTURE, WHERE INTERCONNECTION CUSTOMER'S TRANSMISSION LINE TERMINATES

M = REVENUE METERING FOR INTERCONNECTION CUSTOMER IS OWNED, OPERATED, AND MAINTAINED BY INTERCONNECTION CUSTOMER

		TITLE SHAWVILLE POWER, LLC INTERCONNECTION TO THE MAIT OWNED SHAWVILLE 4, 230KV SUBSTATION	
DATE: 02/06/2020	ISSUE: PRELIMINARY	AGREEMENT:	ID. NO.: PO1-MAIT-PN-AF1-182
REV: 1	REV: 1	REV: 1	REV: 1

16 Attachment 2 – Project Location

