



Generation Interconnection

Feasibility Study Report

for

Queue Project AF2-004

BEAVER 345 KV

33 MW Capacity / 33 MW Energy

July 2020

Table of Contents

1	Introduction.....	3
2	Preface.....	3
3	General.....	4
4	Point of Interconnection.....	5
5	Cost Summary.....	5
6	Transmission Owner Scope of Work.....	6
7	Schedule.....	6
8	Transmission Owner Analysis.....	6
9	Interconnection Customer Requirements.....	6
9.1	System Protection.....	6
9.2	Compliance Issues and Interconnection Customer Requirements.....	6
9.3	Power Factor Requirements.....	7
10	Revenue Metering and SCADA Requirements.....	7
10.1	PJM Requirements.....	7
10.2	Meteorological Data Reporting Requirements.....	8
10.3	Interconnected Transmission Owner Requirements.....	8
11	Summer Peak - Load Flow Analysis.....	9
11.1	Generation Deliverability.....	9
11.2	Multiple Facility Contingency.....	9
11.3	Contribution to Previously Identified Overloads.....	9
11.4	Potential Congestion due to Local Energy Deliverability.....	9
11.5	System Reinforcements.....	10
11.6	Flow Gate Details.....	10
11.7	Queue Dependencies.....	10
11.8	Contingency Descriptions.....	10
12	Short Circuit Analysis.....	11
13	Affected Systems.....	11
	NYISO.....	11
	MISO.....	11
14	Attachment 1: One Line Diagram.....	12

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 ATSI.

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.

An Interconnection Customer with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

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 a planned/existing Natural Gas generating facility located in Lorain, Ohio. This project is an increase to the Interconnection Customer's AF2-004 project, which will share the same point of interconnection. The AF2-004 queue position is a 33 MW uprate (33 MW Capacity uprate) to the previous project. The total installed facilities will have a capability of 378.2 MW with 339.3 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this uprate project is November 01, 2020. This study does not imply a TO commitment to this in-service date.

Queue Number	AF2-004
Project Name	BEAVER 345 KV
State	Ohio
County	Lorain
Transmission Owner	ATSI
MFO	378.2
MWE	33
MWC	33
Fuel	Natural Gas
Basecase Study Year	2023

Any new service customers who can feasibly be commercially operable prior to June 1st of the basecase study year are required to request interim deliverability analysis.

4 Point of Interconnection

AF2-004 will interconnect with the ATSI transmission system as an uprate to the existing West Lorain, Units 2-5 at the Beaver 345 kV substation.

Attachment 1 shows a one-line diagram of the existing primary Direct Connection facilities for the AF2-004 generation project to connect to the FirstEnergy (“FE”) Transmission System. The IC will be responsible for constructing the facilities on its side of the POI.

5 Cost Summary

The AF2-004 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	\$0
Total System Network Upgrade Costs	\$0
Total Costs	\$0

6 Transmission Owner Scope of Work

There is no new interconnection switching station and associated facilities to construct or Non-Direct Connection upgrades for the project.

The total physical interconnection costs is given in the table below:

Description	Total Cost
Total Physical Interconnection Costs	\$0

7 Schedule

There is no scope of work for the interconnection facilities. The schedule for the required Network Impact Reinforcements will be more clearly identified in future study phases.

8 Transmission Owner Analysis

FE performed an analysis of its underlying transmission <100 kV system. The AF2-004 project did not contribute to any overloads on the FE Transmission 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.

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 345 kV circuit breaker to protect the AF2-004 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 AF2-004 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 Transmission System.

9.3 Power Factor Requirements

The existing 345.2 MW portion of the Customer 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 33 MW to the Customer Facilities associated with the AF2-004 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 generator’s terminals.

For synchronous generators with multiple units and the power factor is measured at the generator’s terminals. Each unit must generally meet the PF requirements independently. That is, one unit with a reactive power surplus cannot be used to supplement a unit that has a reactive power deficiency unless the IC guarantees that the units will always be online together.

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 Meteorological Data Reporting Requirements

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

- Back Panel temperature (Fahrenheit)
- Irradiance (Watts/meter²)
- Ambient air temperature (Fahrenheit) – (Accepted, not required)
- Wind speed (meters/second) – (Accepted, not required)
- Wind direction (decimal degrees from true north) – (Accepted, not required)

10.3 Interconnected Transmission Owner Requirements

The IC will be required to comply with all Interconnected Transmission Owner's revenue metering requirements for generation interconnection customers located at the following link:

<https://pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx>

11 Summer Peak - Load Flow Analysis

The Queue Project AF2-004 was evaluated as a 33.0 MW (Capacity 33.0 MW) uprate to the existing West Lorain, Units 2-5 at the Beaver 345 kV substation in the ATSI area. Project AF2-004 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-004 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

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

11.6 Flow Gate Details

The following indices contain additional information about each facility presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. The intent of the indices is to provide more details on which projects/generators have contributions to the flowgate in question. All New Service Queue Requests, through the end of the Queue under study, that are contributors to a flowgate will be listed in the indices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the indices. Although this information is not used "as is" for cost allocation purposes, it can be used to gage the impact of other projects/generators. It should be noted the project/generator MW contributions presented in the body of the report are Full MW Impact contributions which are also noted in the indices column named "Full MW Impact", whereas the loading percentages reported in the body of the report, take into consideration the PJM Generator Deliverability Test rules such as commercial probability of each project as well as the ramping impact of "Adder" contributions. The MW Impact found and used in the analysis is shown in the indices column named "Gendeliv MW Impact".

None

11.7 Queue Dependencies

The Queue Projects below are listed in one or more indices for the overloads identified in your report. These projects contribute to the loading of the overloaded facilities identified in your report. The percent overload of a facility and cost allocation you may have towards a particular reinforcement could vary depending on the action of these earlier projects. The status of each project at the time of the analysis is presented in the table. This list may change as earlier projects withdraw or modify their requests.

None

11.8 Contingency Descriptions

None

12 Short Circuit Analysis

To be performed in the System Impact phase.

13 Affected Systems

NYISO

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

MISO

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

14 Attachment 1: One Line Diagram