Generation Interconnection

Combined Feasibility / System Impact Study Report

for

Queue Project AF2-097

FAIRVIEW EAST 34.5 KV II

3 MW Capacity / 5 MW Energy

July 2020

Table of Contents

1 Introduction

This System Impact Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 205, as well as the System Impact Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Mid-Atlantic Interstate Transmission, LLC (MAIT) (PENELEC zone).

2 Preface

The intent of the System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

In some instances an Interconnection Customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, may also contribute to the need for the same network reinforcement. 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 System Impact Study is performed.

The System Impact 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.

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.

3 General

The Interconnection Customer (IC) has proposed an uprate to a planned Solar generating facility located in Erie, Pennsylvania. This project is an increase to the Interconnection Customer's AF1-006 project, which will share the same point of interconnection. The AF2-097 queue position is a 5 MW uprate (3 MW Capacity uprate) to the previous project. The total installed facilities will have a capability of 25 MW with 15.8 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this uprate project is December 31, 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 AF2-097 will be specified in a separate two party Interconnection Agreement (IA) between the ITO 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	**AF2-097**
Project Name	FAIRVIEW EAST 34.5 KV II
State	Pennsylvania
County	Erie
Transmission Owner	PENELEC
MFO	25
MWE	5
MWC	3
Fuel	Solar
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

AF2-097 will interconnect with the PENELEC on distribution system as an uprate to AF1-006 at the Fairview 34.5 kV substation. The point of interconnection will be near pole FN-41234 on Penelec's Erie West Circuit (00266-34) Fairview East substation at 34.5kV.

5 Cost Summary

The AF2-097 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$31,400
Local System Network Upgrade Costs	$825,000
Total Costs	$856,400

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 AF2-097 will be specified in a separate two party Interconnection Agreement (IA) between the ITO and the Interconnection Customer as this project is considered FERC non-jurisdictional per the PJM Open Access Transmission Tariff (OATT).

Note 1: PJM Open Access Transmission Tariff (OATT) section 217.3A outline cost allocation rules. The rules are further clarified in PJM Manual 14A Attachment B. The allocation of costs for a network upgrade will start with the first Queue project to cause the need for the upgrade. Later queue projects will receive cost allocation contingent on their contribution to the violation and are allocated to the queues that have not closed less than 5 years following the execution of the first Interconnection Service Agreement which identifies the need for this upgrade.

Note 2: For customers with System Reinforcements listed: If your present cost allocation to a System Reinforcement indicates $0, then please be aware that as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, the cost responsibilities can change and a cost allocation may be assigned to your project. In addition, although your present cost allocation to a System Reinforcement is presently $0, your project may need this system reinforcement completed to be deliverable to the PJM system. If your project comes into service prior to completion of the system reinforcement, an interim deliverability study for your project will be required.

6 Transmission Owner Scope of Work

AF2-097 will interconnect with the PENELEC on distribution system as an uprate to AF1-006 at the Fairview 34.5 kV substation. The point of interconnection will be near pole FN-41234 on Penelec's Erie West Circuit (00266-34) Fairview East substation at 34.5kV.

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

Description	Total Cost
Fairview East 34.5kV SS. Adjust Remote Relay and Metering Settings.	$ 15,700
Lake City 34.5kV SS. Adjust Remote Relay and Metering Settings.	$ 15,700
Total Physical Interconnection Costs	$31,400

7 Schedule

Based on the scope of work (including the reconductoring of the mainline circuit identified in Section 8 below), it is expected to take a minimum of **18 months** after the signing of an Interconnection Agreement and construction kickoff call 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 defined direct connection and that any distribution system outages will be allowed when requested.

8 Transmission Owner Analysis

Penelec performed an analysis of its distribution system. The AF1-006 project did not contribute to any overloads on the distribution system, however, when AF2-097 was implemented as an incremental increase for the existing project overloads were noted. Mainline conductor 1/0 CU from FV-33734 to FV-40834 is shown as overloaded. This is approximately 17,593ft or 3.3miles of 1/0 CU Rated at 360Amps. The study showed this conductor overload to reach 112% of the conductor rating. The cost for this reconductor will be approximately $825,000.

Description	Total Cost
Remove and Replace 1/0Cu with 336.4 ACSR or Company Standard Specified Conductor at time of construction	$ 825,000
Total Local System Upgrade Costs	$ 825,000

9 Interconnection Customer Requirements

The Relays at the remote ends of the circuit require setting adjustments due to the addition of the 5MW.

An analysis was conducted to assess the impact of the Fairview East 34.5 kV (AF2-097) Project on the system protection requirements in the area. The results of this review show that the following relay additions will be required:

Proposed single line diagrams show Erie Solar, LLC (Developer) constructing a generation facility they call “Erie” tapping Penelec’s Fairview East - 34.5kV Erie West circuit at pole FV-40834. (AF1-006), Protection upgrades will be provided by AF1-006.

The 34.5kV interconnection proposal will require Developer to meet applicable "Technical Requirements" as outlined in First Energy's document titled “Technical Requirements for the Interconnection of Customer-Owned Generation to the FirstEnergy Distribution System". Anti-islanding system shall meet IEEE 1547 and UL 1741. Therefore, no Direct Transfer Trip (DTT) will be required.

Protection requirements are included in the "Technical Requirements" document.

General Concerns

It is to be understood, for abnormal operation of the Penelec system, which could cause Developer's generation facility to be electrically isolated from the Penelec system synchronous source via the tripping of a interconnecting primary voltage line or device, Developer will, via Penelec's direction, be required to disconnect the generation from Penelec's system and remain disconnected (units are required to be OFF LINE), until the Penelec system normal circuitry is restored. These abnormal conditions will be reviewed by Penelec system operators as to the need for the generation facility to be disconnected.

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)

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:

http://www.pjm.com/planning/design-engineering/to-tech-standards/

Metering and Scada Requirements will be provided by AF1-006. The Relays at the remote ends of the circuit require setting adjustments due to the addition of the 5MW.

11 Summer Peak Analysis

The Queue Project AF2-097 was evaluated as a 5.0 MW (Capacity 3.0 MW) uprate to AF1-006 at the Fairview 34.5 kV substation in the PENELEC area. Project AF2-097 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-097 was studied with a commercial probability of 100.0 %. 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 Steady-State Voltage Requirements

None

11.5 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

11.6 System Reinforcements

None

11.7 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

11.8 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

11.9 Contingency Descriptions

None

12 Light Load Analysis

Not required for this project.

13 Short Circuit Analysis

The following Breakers are overdutied:

None

14 Stability and Reactive Power

(Summary of the VAR requirements based upon the results of the dynamic studies)

No impacts.

15 Affected Systems

15.1 NYISO

None

16 Attachment 1: One Line Diagram