



## **Generation Interconnection**

# **Combined Feasibility / System Impact Study Report**

**for**

**Queue Project AF2-265**

**SOUTH TROY-ATHENS 34.5 KV**

**8.6 MW Capacity / 15 MW Energy**

July 2020

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## 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 a Solar generating facility located in Bradford County, Pennsylvania. The installed facilities will have a total capability of 15 MW with 8.6 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is November 30, 2021. This study does not imply a TO commitment to this in-service date.

<b>Queue Number</b>	<b>AF2-265</b>
<b>Project Name</b>	<b>SOUTH TROY-ATHENS 34.5 KV</b>
<b>State</b>	Pennsylvania
<b>County</b>	Bradford
<b>Transmission Owner</b>	PENELEC
<b>MFO</b>	15
<b>MWE</b>	15
<b>MWC</b>	8.6
<b>Fuel</b>	Solar
<b>Basecase Study Year</b>	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

AF2-265 will interconnect with the PENELEC distribution system via a tap on the South Troy Substation 34.5 kV Athens circuit #00517-63 at pole # STS-17961 (Attachment 1). The IC's proposed generating unit site is located at GPC: 41.853200, -76.726553.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AF2-265 generation project to connect to the Penelec distribution system. IC will be responsible for constructing all the facilities on its side of the POI, including the attachment facilities which connect the generator to the Penelec distribution system's direct connection facilities.

## 5 Cost Summary

The AF2-265 project will be responsible for the following costs:

Description	Total Cost
<b>Total Physical Interconnection Costs</b>	\$113,400
<b>Allocation towards System Network Upgrade Costs</b>	\$0
<b>Total Costs</b>	\$113,400

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.

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

AF2-265 will interconnect with the PENELEC distribution system via a tap on the South Troy Substation 34.5 kV Athens circuit #00517-63 at pole # STS-17961 (Attachment 1). The IC's proposed generating unit site is located at GPC: 41.853200, -76.726553.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AF2-265 generation project to connect to the Penelec distribution system. Attachment 2 provides the proposed location for the point of interconnection. IC will be responsible for constructing all the facilities on its side of the POI, including the attachment facilities which connect the generator to the Penelec distribution system's direct connection facilities.

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

Description	Total Cost
Tap the existing South Troy 34.5kV Athens line at an existing pole or interspersed pole on Penelec's existing distribution circuit (00517-63) near pole STS-17961, new SCADA recloser tap to interconnect queue project AF2-265. Install 34.5 kV metering in customer's facilities. The customer will have to provide Penelec with permanent access/roadway to this off-road location/equipment. The customer is responsible to build their own line from their site to Penelec's existing facilities.	\$100,000
South Troy 34.5kV SS. Adjust Remote Relay and Metering Settings.	\$13,400
<b>Total Physical Interconnection Costs</b>	<b>\$113,400</b>

## 7 Schedule

Based on the scope of work for the interconnection facilities, it is expected to take a minimum of **6 months** after the signing of an Interconnection Construction Service 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 AF2-265 project did not contribute to any overloads on the distribution system.

## 9 Interconnection Customer Requirements

### 9.1 System Protection

An analysis was conducted to assess the impact of the South Troy 34.5kV (AF2-265) 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 the IC constructing a generation facility tapping Penelec's South Troy Substation 34.5 kV Athens circuit #00517-63 at pole # STS-17961.

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".

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

### 9.2 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.

### 9.3 Requirements for Owner's/Developer's generation IPP Facility

The proposed interconnection Owner's/Developer's facilities must be designed in accordance with the document titled *FirstEnergy Distribution Engineering Practices Interconnection of Customer-Owned Generation to the FirstEnergy Distribution System* dated 11/17/14 located at the following link:

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

The document is referred to as engineering practice EP (# 02-280) with section 4, part C specifically referencing the "interconnection technical requirements". Certain protection requirements are shown.

Additionally, Owner/Developer is responsible to provide adequate protection (for their equipment) under any distribution system operating condition' - which includes 'Separation from supply' (i.e. tripping of F.E. circuit breakers) and 'resynchronizing the generation after electric restoration of the supply' (i.e. reclosing of F.E. circuit breakers).

Owner's/Developer's protection must be designed to coordinate with the reclosing practices of FirstEnergy line protective devices. The generator must cease to energize the FirstEnergy circuit to which it is connected prior to reclosing of any (FE) automatic reclosing devices.

Owners/Developer's electrical protection and control schematics shall be provided to FE for consideration. FE may request modifications, if required, to meet the technical requirements.

### 9.4 Compliance Issues

IC will be responsible for meeting a power factor between 0.90 lagging (producing MVARs) to 0.95 leading (absorbing MVARs) and assure that voltage deviation will be less than 1.0 volt as measured at the POI under all Solar Gen operating conditions due to the inherent dynamic reactive power capability of this solar facility.

Generators with no inherent VAR (reactive power) control capability, or those that have a restricted VAR capability less than the defined requirements, must provide dynamic supplementary reactive support located at the generation facility with electrical characteristics equivalent to that provided by a similar sized synchronous generator. A Dynamic Reactive Compensation (either Static VAR Compensator (SVC) or STATCOM) or other method be applied in order to maintain the required specifications at the POI. IC is responsible for the installation of equipment on its side of the POI in order to adhere to the criteria stated above by FirstEnergy.

## 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/meter<sup>2</sup>)
- 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 Penelec Requirements

IC will be required to comply with all FE Revenue Metering Requirements for Generation Interconnection Customers. These FE requirements are the following:

The FE operating company (Penelec) shall provide, own, operate, test, and maintain the revenue metering equipment at the Interconnection Customer's (IC) expense. The revenue metering equipment includes, but is not limited to, current transformers, voltage transformers, secondary wires, meter socket, bidirectional revenue meter, and associated devices. The IC shall mount the instrument transformers unless otherwise agreed to by Penelec. The instrument transformers and meter socket shall be installed in a location that is readily accessible to authorized Penelec representatives. Penelec will provide the IC access to bidirectional kWh and kVARh pulses from the Penelec meter at the IC's expense if requested. The IC shall, at its expense, install, own, operate, test, and maintain any metering and telemetry equipment that may be required to provide real-time meter data to FE or PJM.

## 11 Summer Peak Analysis

The Queue Project AF2-265 was evaluated as a 15.0 MW (Capacity 8.6 MW) injection at the South Troy 34.5 kV substation in the PENELEC area. Project AF2-265 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-265 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.

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CON T NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPAC T
101240812	200674	26TOWANDA	115.0	PENELEC	200677	26NO MESH	115.0	PENELEC	1	PN-P1-2-PN-230-013A	operation	202.0	205.79	207.0	AC	2.66

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CON T NAME	Type	Ratin g MVA	PRE PROJEC T LOADIN G %	POST PROJEC T LOADIN G %	AC D C	MW IMPAC T
101241056	200885	26EVERT DR	115.0	PENELE C	200929	26MAINESBURG	115.0	PENELE C	1	PN-P1-2-PN-345-104T	operatio n	245.0	59.98	62.39	AC	5.8

## 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

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## 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

Contingency Name	Contingency Definition
<b>PN-P1-2-PN-345-104T</b>	CONTINGENCY 'PN-P1-2-PN-345-104T' /* MAINESBURG - WATERCURE ROAD (NYSEG) 345KV LINE DISCONNECT BRANCH FROM BUS 200930 TO BUS 130757 CKT 1 /* 26MAINESBURG345 WATRC345 345 END
<b>PN-P1-2-PN-230-013A</b>	CONTINGENCY 'PN-P1-2-PN-230-013A' /* EAST TOWANDA - NORTH MESHOPPEN 230KV DISCONNECT BRANCH FROM BUS 200675 TO BUS 200924 CKT 1 /* 26E.TWANDA 230 26CANYON 230 DISCONNECT BRANCH FROM BUS 200924 TO BUS 200706 CKT 1 /* 26CANYON 230 26N.MESHPN 230 END

## 12 Light Load Analysis

Not required for this project.

## 13 Short Circuit Analysis

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

