



Generation Interconnection

Feasibility Study Report

for

Queue Project AF2-241

ATHENS-MILAN 34.5 KV

11.3 MW Capacity / 20 MW Energy

July 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 Mid-Atlantic Interstate Transmission, LLC (MAIT) (PENELEC Zone).

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.

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 Bradford County, Pennsylvania. The installed facilities will have a total capability of 20 MW with 11.3 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.

| | |
|----------------------------|----------------------|
| Queue Number | AF2-241 |
| Project Name | ATHENS-MILAN 34.5 KV |
| State | Pennsylvania |
| County | Bradford |
| Transmission Owner | PENELEC (MAIT) |
| MFO | 20 |
| MWE | 20 |
| MWC | 11.3 |
| 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

AF2-241 will interconnect with the PENELEC distribution system via a tap on the Athens Substation 34.5 kV Milan circuit #00511-61 at pole # STS-25861 (Attachment 1). The IC's proposed generating unit site is located at GPC: 41.863729, -76.654049

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 AF2-241 project will be responsible for the following costs:

| Description | Total Cost |
|---|--------------------------|
| Total Physical Interconnection Costs | \$1,258,200 |
| Total System Network Upgrade Costs | \$\$855,960 ¹ |
| Total Costs | \$1,258,200 |

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.

Cost allocations for any System Upgrades will be provided in the System Impact Study Report.

¹ This project currently contributes to overloads of the Transmission System (see Summer Peak Load Flow Analysis section below) and therefore has potential to have cost allocation for the system reinforcements listed in the report. This will be re-evaluated in the System Impact phase. The results may vary with queue customers withdrawing from the queue and other generators deactivating over time. If a customer is the first to cause the need for a project (causes loading to exceed 100% of rating), then the customer is responsible. If a customer's MW contribution to a facility that is already overloaded by a prior queue is less than 5 MW, then they will not receive cost allocation.

6 Transmission Owner Scope of Work

AF2-241 will interconnect with the PENELEC distribution system via a tap on the Athens Substation 34.5 kV Milan circuit #00511-61 at pole # STS-25861 (Attachment 1). The IC's proposed generating unit site is located at GPC: 41.863729, -76.654049

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

| Description | Total Cost |
|---|--------------------|
| Tap the existing Athens 34.5kV Milan line at an existing pole or interspersed pole on Penelec' s existing distribution circuit (00511-61) near pole STS-25861, new SCADA recloser tap to interconnect queue project AF2-241. 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 |
| Replace 20300' 4/0 ACSR with 336.4 ACSR between STS-38161 and STS-46961 due to overloaded condition | \$1,000,000 |
| Replace 560A recloser @ pole 233313-163648 with 800A due to overloaded condition. | \$100,000 |
| Athens 34.5kV SS. Adjust Remote Relay and Metering Settings. | \$33,000 |
| Review customer drawings, create nameplates and update CD drawing. | \$25,200 |
| Total Physical Interconnection Costs | \$1,258,200 |

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 work and that any system outages will be allowed when requested.

8 Transmission Owner Analysis

Penelec performed an analysis of its distribution system. The AF2-241 project contributed to the following overloads on the distribution system.

Facility: 20300' 4/0 ACSR with 336.4 ACSR between STS-38161 and STS-46961

Reinforcement Project: Mitigation is to replace 34.5 kV overloaded conductor from between STS-38161 and STS-46961

Facility: Recloser @ pole 233313-163648

Reinforcement Project: Mitigation is to replace 560A recloser @ pole 233313-163648 with 800A due to overloaded condition.

9 Interconnection Customer Requirements

An analysis was conducted to assess the impact of the Athens 34.5 kV (AF2-241) 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 Athens Substation 34.5 kV Milan circuit #00511-61 at pole # STS-25861.

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.

9.1 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.

9.2 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.

9.3 Compliance Issues

The 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. The 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/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:

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

The 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 - Load Flow Analysis

The Queue Project AF2-241 was evaluated as a 20.0 MW (Capacity 11.3 MW) injection at the East Sayre 34.5 kV substation in the PENELEC area. Project AF2-241 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-241 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)

| ID | FROM BUS# | FROM BUS | kV | FROM BUS AREA | TO BUS# | TO BUS | kV | TO BUS AREA | CK T ID | CONT NAME | Type | Rating MVA | PRE PROJECT LOADIN G % | POST PROJECT LOADIN G % | AC D C | MW IMPACT |
|-----------|-----------|-------------|-------|---------------|---------|----------|-------|-------------|---------|---------------------|---------|------------|------------------------|-------------------------|--------|-----------|
| 99428845 | 130807 | WESTOVER115 | 115.0 | NYISO | 200680 | 26LAUREL | 115.0 | PENELEC | 1 | PN-P2-3-PN-115-46G | breaker | 128.0 | 130.1 | 130.74 | DC | 1.8 |
| 99429106 | 200676 | 26E.SAYRE | 115.0 | PENELEC | 130836 | N.WAV115 | 115.0 | NYISO | 1 | PN-P1-2-PN-230-101T | single | 128.0 | 119.41 | 124.44 | DC | 6.44 |
| 101208390 | 200680 | 26LAUREL | 115.0 | PENELEC | 200679 | 26TIFFAN | 115.0 | PENELEC | 1 | PN-P2-3-PN-115-46G | breaker | 151.0 | 106.38 | 106.92 | DC | 1.8 |

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.

| ID | FROM BUS# | FROM BUS | kV | FROM BUS AREA | TO BUS# | TO BUS | kV | TO BUS AREA | CK T ID | CONT NAME | Type | Rating MVA | PRE PROJECT LOADIN G % | POST PROJECT LOADIN G % | AC D C | MW IMPACT |
|----|-----------|----------|----|---------------|---------|--------|----|-------------|---------|-----------|------|------------|------------------------|-------------------------|--------|-----------|
|----|-----------|----------|----|---------------|---------|--------|----|-------------|---------|-----------|------|------------|------------------------|-------------------------|--------|-----------|

| ID | FROM BUS# | FROM BUS | kV | FROM BUS AREA | TO BUS# | TO BUS | kV | TO BUS AREA | CK T ID | CONT NAME | Type | Rating MVA | PRE PROJECT LOADING % | POST PROJECT LOADING % | AC DC | MW IMPACT |
|-----------|-----------|-----------|-------|---------------|---------|-----------|-------|-------------|---------|---------------------|-----------|------------|-----------------------|------------------------|-------|-----------|
| 101208560 | 200674 | 26TOWANDA | 115.0 | PENELEC | 200677 | 26NOMESHO | 115.0 | PENELEC | 1 | PN-P1-2-PN-230-013A | operation | 202.0 | 208.79 | 210.47 | DC | 3.5 |
| 99429105 | 200676 | 26E.SAYRE | 115.0 | PENELEC | 130836 | N.WAV115 | 115.0 | NYISO | 1 | PN-P1-2-PN-230-101T | operation | 128.0 | 146.98 | 155.88 | DC | 11.4 |

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

| ID | Idx | Facility | Upgrade Description | Cost |
|-----------|-----|---|---|------------------------------|
| 99429106 | 2 | 26E.SAYRE 115.0 kV - N.WAV115 115.0 kV Ckt 1 | <p>PENELEC PN-AF2-F-0007A (1703) : Replace relay at East Sayre on North Waverly terminal Note: PJM to coordinate with NYSEG on miscellaneous relay replacement Project Type : FAC Cost : \$427,980 Time Estimate : 12.0 Months</p> <p>PN-AF2-F-0007C (1705) : Replace line relaying at East Sayre. Project Type : FAC Cost : \$427,980 Time Estimate : 12.0 Months</p> <p>Note: It should be noted that some of the contingencies taken in the analysis may not be valid due to system condition changes that were not captured in the model. This will be re-evaluated for validity in the System Impact phase.</p> | \$855,960 |
| 99428845 | 1 | WESTOVER115 115.0 kV - 26LAUREL L 115.0 kV Ckt 1 | <p>Note: It should be noted that some of the contingencies taken in the analysis may not be valid due to system condition changes that were not captured in the model. This will be re-evaluated for validity in the System Impact phase.</p> | \$0 |
| 101208390 | 3 | 26LAUREL L 115.0 kV - 26TIFFANY 115.0 kV Ckt 1 | <p>Note: It should be noted that some of the contingencies taken in the analysis may not be valid due to system condition changes that were not captured in the model. This will be re-evaluated for validity in the System Impact phase.</p> | \$0 |
| | | | TOTAL COST | \$855,960¹ |

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".

11.6.1 Index 1

| ID | FROM BUS# | FROM BUS | FROM BUS AREA | TO BUS# | TO BUS | TO BUS AREA | CKT ID | CONT NAME | Type | Rating MVA | PRE PROJECT LOADING % | POST PROJECT LOADING % | AC DC | MW IMPACT |
|----------|-----------|-------------|---------------|---------|------------|-------------|--------|--------------------|---------|------------|-----------------------|------------------------|-------|-----------|
| 99428845 | 130807 | WESTOVER115 | NYISO | 200680 | 26LAUREL L | PENELEC | 1 | PN-P2-3-PN-115-46G | breaker | 128.0 | 130.1 | 130.74 | DC | 1.8 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|--------|------------------------|--------------------|---------------|----------------|
| 200823 | 26MHP_X3-003 | -3.0484 | Adder | -3.59 |
| 200894 | 26K02 | 2.4800 | Adder | 2.92 |
| 200898 | 26AA1-106 | 1.0415 | Adder | 1.23 |
| 203999 | P-047 E | 4.9800 | Adder | 5.86 |
| 916202 | Z1-069 E | 2.9669 | Adder | 3.49 |
| 918682 | AA1-082 E | 3.2306 | Adder | 3.8 |
| 919201 | AA1-144 OP | 9.0459 | Adder | 10.64 |
| 922932 | AB1-082 OP (Suspended) | 0.8474 | Adder | 1.0 |
| 923443 | AB1-160 E | 0.8477 | Adder | 1.0 |
| 940861 | AE2-074 C | 0.6435 | Adder | 0.76 |
| 940862 | AE2-074 E | 0.8470 | Adder | 1.0 |
| 941421 | AE2-139 C | 3.1383 | Adder | 3.69 |
| 941422 | AE2-139 E | 2.0922 | Adder | 2.46 |
| 944411 | AF1-106 O1 | 1.5310 | Adder | 1.8 |
| 945331 | AF1-198 | 0.1454 | Adder | 0.17 |
| 946211 | AF1-286 C O1 | 0.6201 | Adder | 0.73 |
| 946212 | AF1-286 E O1 | 0.4210 | Adder | 0.5 |
| 959061 | AF2-197 C O1 | 1.2255 | Adder | 2.72 |
| 959062 | AF2-197 E O1 | 1.8383 | Adder | 4.08 |
| 959471 | AF2-238 C | 0.3781 | Adder | 0.84 |
| 959472 | AF2-238 E | 0.2521 | Adder | 0.56 |
| 959481 | AF2-239 C | 0.2825 | Adder | 0.63 |
| 959482 | AF2-239 E | 0.2265 | Adder | 0.5 |
| 959491 | AF2-240 C | 0.4382 | Adder | 0.97 |
| 959492 | AF2-240 E | 0.3733 | Adder | 0.83 |
| 959501 | AF2-241 C | 0.4585 | Adder | 1.02 |
| 959502 | AF2-241 E | 0.3530 | Adder | 0.78 |
| 959741 | AF2-265 C | 0.2710 | Adder | 0.6 |
| 959742 | AF2-265 E | 0.2017 | Adder | 0.45 |
| 960271 | AF2-318 C | 0.3054 | Adder | 0.68 |
| 960272 | AF2-318 E | 0.2036 | Adder | 0.45 |
| 961141 | AF2-405 | 0.4057 | Adder | 0.9 |
| 961151 | AF2-406 | 3.0429 | Adder | 6.75 |
| 961201 | AF2-411 O1 | 11.2080 | Adder | 24.88 |
| 961211 | AF2-412 O1 | 4.4041 | Adder | 9.78 |
| WEC | WEC | 0.1358 | Confirmed LTF | 0.1358 |
| LGEE | LGEE | 0.2379 | Confirmed LTF | 0.2379 |
| CPL | CPL | 0.1680 | Confirmed LTF | 0.1680 |
| CBM-W2 | CBM-W2 | 3.2350 | Confirmed LTF | 3.2350 |
| CBM-W1 | CBM-W1 | 5.6170 | Confirmed LTF | 5.6170 |
| TVA | TVA | 0.5194 | Confirmed LTF | 0.5194 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---------------|------------|---------------------------|---------------|-----------------------|
| O-066 | O-066 | 8.8435 | Confirmed LTF | 8.8435 |
| CBM-S2 | CBM-S2 | 1.6704 | Confirmed LTF | 1.6704 |
| CBM-S1 | CBM-S1 | 3.2291 | Confirmed LTF | 3.2291 |
| G-007 | G-007 | 1.2688 | Confirmed LTF | 1.2688 |
| MEC | MEC | 0.6626 | Confirmed LTF | 0.6626 |

11.6.2 Index 2

| ID | FROM BUS# | FROM BUS | FROM BUS AREA | TO BUS# | TO BUS | TO BUS AREA | CKT ID | CONT NAME | Type | Rating MVA | PRE PROJECT LOADING % | POST PROJECT LOADING % | AC DC | MW IMPACT |
|----------|-----------|-----------|---------------|---------|----------|-------------|--------|---------------------|--------|------------|-----------------------|------------------------|-------|-----------|
| 99429106 | 200676 | 26E.SAYRE | PENELEC | 130836 | N.WAV115 | NYISO | 1 | PN-P1-2-PN-230-101T | single | 128.0 | 119.41 | 124.44 | DC | 6.44 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|------------|--------------|--------------------|---------------|----------------|
| 200851 | 26MEHOOP3 | 0.7270 | 80/20 | 0.7270 |
| 200898 | 26AA1-106 | 1.2716 | 80/20 | 1.2716 |
| 200917 | 26MTNTP_P28 | 0.3696 | 80/20 | 0.3696 |
| 200949 | 26X1-109 | 14.2910 | 80/20 | 14.2910 |
| 203283 | 26MANOR_T86 | 0.0340 | 80/20 | 0.0340 |
| 203347 | 26NME_Y1-047 | 0.2452 | 80/20 | 0.2452 |
| 203350 | 26MILZ1-092 | 1.9559 | 80/20 | 1.9559 |
| 203351 | 26GROZ1-110 | 0.2193 | 80/20 | 0.2193 |
| 203352 | 26CANZ2-011 | 0.2193 | 80/20 | 0.2193 |
| 203907 | 26Y2-042 | 1.1253 | 80/20 | 1.1253 |
| 203909 | 26Z1-038 | 1.6097 | 80/20 | 1.6097 |
| 917631 | Z2-104 | 0.0170 | 80/20 | 0.0170 |
| 919201 | AA1-144 OP | 17.2861 | 80/20 | 17.2861 |
| 920351 | AA2-133 | 0.4137 | 80/20 | 0.4137 |
| 934801 | AD1-108 | 0.0165 | 80/20 | 0.0165 |
| 934811 | AD1-109 | 0.0121 | 80/20 | 0.0121 |
| 934821 | AD1-110 | 0.0185 | 80/20 | 0.0185 |
| 935061 | AD1-142 | 0.1081 | 80/20 | 0.1081 |
| 941421 | AE2-139 C | 5.7219 | 80/20 | 5.7219 |
| 944411 | AF1-106 O1 | 11.3960 | 80/20 | 11.3960 |
| 946211 | AF1-286 C O1 | 4.6154 | 80/20 | 4.6154 |
| 959061 | AF2-197 C O1 | 6.2835 | 80/20 | 6.2835 |
| 959481 | AF2-239 C | 1.6834 | 80/20 | 1.6834 |
| 959491 | AF2-240 C | 6.1538 | 80/20 | 6.1538 |
| 959501 | AF2-241 C | 6.4387 | 80/20 | 6.4387 |
| 960271 | AF2-318 C | 1.8199 | 80/20 | 1.8199 |
| 961141 | AF2-405 | 5.6980 | 80/20 | 5.6980 |
| 961151 | AF2-406 | 42.7350 | 80/20 | 42.7350 |
| 961451 | AF2-436 | 0.1808 | 80/20 | 0.1808 |
| 961461 | AF2-437 | 0.0922 | 80/20 | 0.0922 |
| NEWTON | NEWTON | 0.4459 | Confirmed LTF | 0.4459 |
| FARMERCITY | FARMERCITY | 0.0230 | Confirmed LTF | 0.0230 |
| G-007A | G-007A | 2.1122 | Confirmed LTF | 2.1122 |
| VFT | VFT | 5.9856 | Confirmed LTF | 5.9856 |
| CALDERWOOD | CALDERWOOD | 0.1784 | Confirmed LTF | 0.1784 |
| NY | NY | 1.8620 | Confirmed LTF | 1.8620 |
| PRAIRIE | PRAIRIE | 1.0513 | Confirmed LTF | 1.0513 |
| CHEOAH | CHEOAH | 0.1787 | Confirmed LTF | 0.1787 |
| EDWARDS | EDWARDS | 0.1488 | Confirmed LTF | 0.1488 |
| TILTON | TILTON | 0.2671 | Confirmed LTF | 0.2671 |
| MADISON | MADISON | 0.0222 | Confirmed LTF | 0.0222 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|----------------|------------|---------------------------|---------------|-----------------------|
| GIBSON | GIBSON | 0.2277 | Confirmed LTF | 0.2277 |
| BLUEG | BLUEG | 0.7222 | Confirmed LTF | 0.7222 |
| TRIMBLE | TRIMBLE | 0.2315 | Confirmed LTF | 0.2315 |
| CATAWBA | CATAWBA | 0.1092 | Confirmed LTF | 0.1092 |

11.6.3 Index 3

| ID | FROM BUS# | FROM BUS | FROM BUS AREA | TO BUS# | TO BUS | TO BUS AREA | CKT ID | CONT NAME | Type | Rating MVA | PRE PROJECT LOADING % | POST PROJECT LOADING % | AC DC | MW IMPACT |
|-----------|-----------|------------|---------------|---------|-----------|-------------|--------|--------------------|---------|------------|-----------------------|------------------------|-------|-----------|
| 101208390 | 200680 | 26LAUREL L | PENELEC | 200679 | 26TIFFANY | PENELEC | 1 | PN-P2-3-PN-115-46G | breaker | 151.0 | 106.38 | 106.92 | DC | 1.8 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|--------|------------------------|--------------------|---------------|----------------|
| 200823 | 26MHP_X3-003 | -3.0484 | Adder | -3.59 |
| 200894 | 26K02 | 2.4800 | Adder | 2.92 |
| 200898 | 26AA1-106 | 1.0415 | Adder | 1.23 |
| 203999 | P-047 E | 4.9800 | Adder | 5.86 |
| 916202 | Z1-069 E | 2.9669 | Adder | 3.49 |
| 918682 | AA1-082 E | 3.2306 | Adder | 3.8 |
| 919201 | AA1-144 OP | 9.0459 | Adder | 10.64 |
| 922932 | AB1-082 OP (Suspended) | 0.8474 | Adder | 1.0 |
| 923443 | AB1-160 E | 0.8477 | Adder | 1.0 |
| 940861 | AE2-074 C | 0.6435 | Adder | 0.76 |
| 940862 | AE2-074 E | 0.8470 | Adder | 1.0 |
| 941421 | AE2-139 C | 3.1383 | Adder | 3.69 |
| 941422 | AE2-139 E | 2.0922 | Adder | 2.46 |
| 944411 | AF1-106 O1 | 1.5310 | Adder | 1.8 |
| 945331 | AF1-198 | 0.1454 | Adder | 0.17 |
| 946211 | AF1-286 C O1 | 0.6201 | Adder | 0.73 |
| 946212 | AF1-286 E O1 | 0.4210 | Adder | 0.5 |
| 959061 | AF2-197 C O1 | 1.2255 | Adder | 2.72 |
| 959062 | AF2-197 E O1 | 1.8383 | Adder | 4.08 |
| 959471 | AF2-238 C | 0.3781 | Adder | 0.84 |
| 959472 | AF2-238 E | 0.2521 | Adder | 0.56 |
| 959481 | AF2-239 C | 0.2825 | Adder | 0.63 |
| 959482 | AF2-239 E | 0.2265 | Adder | 0.5 |
| 959491 | AF2-240 C | 0.4382 | Adder | 0.97 |
| 959492 | AF2-240 E | 0.3733 | Adder | 0.83 |
| 959501 | AF2-241 C | 0.4585 | Adder | 1.02 |
| 959502 | AF2-241 E | 0.3530 | Adder | 0.78 |
| 959741 | AF2-265 C | 0.2710 | Adder | 0.6 |
| 959742 | AF2-265 E | 0.2017 | Adder | 0.45 |
| 960271 | AF2-318 C | 0.3054 | Adder | 0.68 |
| 960272 | AF2-318 E | 0.2036 | Adder | 0.45 |
| 961141 | AF2-405 | 0.4057 | Adder | 0.9 |
| 961151 | AF2-406 | 3.0429 | Adder | 6.75 |
| 961201 | AF2-411 O1 | 11.2080 | Adder | 24.88 |
| 961211 | AF2-412 O1 | 4.4041 | Adder | 9.78 |
| WEC | WEC | 0.1358 | Confirmed LTF | 0.1358 |
| LGEE | LGEE | 0.2379 | Confirmed LTF | 0.2379 |
| CPL | CPL | 0.1680 | Confirmed LTF | 0.1680 |
| CBM-W2 | CBM-W2 | 3.2350 | Confirmed LTF | 3.2350 |
| CBM-W1 | CBM-W1 | 5.6170 | Confirmed LTF | 5.6170 |
| TVA | TVA | 0.5194 | Confirmed LTF | 0.5194 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---------------|------------|---------------------------|---------------|-----------------------|
| O-066 | O-066 | 8.8435 | Confirmed LTF | 8.8435 |
| CBM-S2 | CBM-S2 | 1.6704 | Confirmed LTF | 1.6704 |
| CBM-S1 | CBM-S1 | 3.2291 | Confirmed LTF | 3.2291 |
| G-007 | G-007 | 1.2688 | Confirmed LTF | 1.2688 |
| MEC | MEC | 0.6626 | Confirmed LTF | 0.6626 |

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.

| Queue Number | Project Name | Status |
|--------------|----------------------------------|---|
| AA1-082 | E. Towanda 230kV | In Service |
| AA1-106 | Grover II 34.5kV | Withdrawn |
| AA1-144 | East Towanda-Grover 230kV | Engineering and Procurement |
| AA2-133 | Wyalusing 34.5kV | In Service |
| AB1-082 | Potter 46kV | Suspended |
| AB1-160 | Gold-Sabinsville 115kV | In Service |
| AD1-108 | Grover 34 kV | In Service |
| AD1-109 | Canton 34.5 kV | In Service |
| AD1-110 | North Meshoppen 34.5 kV | In Service |
| AD1-142 | Milan 34.5 kV | In Service |
| AE2-074 | Potter 46 kV | Active |
| AE2-139 | East Towanda-Grover 230 kV | Active |
| AF1-106 | East Sayre 34.5 kV | Active |
| AF1-198 | Blossburg #1 CT 34.5 kV | Partially in Service - Under Construction |
| AF1-286 | East Sayre 34.5 kV II | Active |
| AF2-197 | East Towanda 115 kV | Active |
| AF2-238 | Mansfield-South Troy 34.5 kV | Active |
| AF2-239 | Wyalusing-Hollenback WRC 34.5 kV | Active |
| AF2-240 | North Orwell 12.47 kV | Active |
| AF2-241 | Athens-Milan 34.5 kV | Active |
| AF2-265 | South Troy-Athens 34.5 kV | Active |
| AF2-318 | East Towanda-New Albany 34.5 kV | Active |
| AF2-405 | East Sayre 34.5 kV III | Active |
| AF2-406 | Sayre 115 kV | Active |
| AF2-411 | Mainesburg 345 kV | Active |
| AF2-412 | Mainesburg 115 kV | Active |
| AF2-436 | Wyalusing 34.5 kV II | Active |
| AF2-437 | Oxbow 34.5 kV III | Active |
| X1-109 | E. Towanda 230kV | In Service |
| X3-003 | Mehoopany II 115 kV | In Service |
| Y1-047 | North Meshoppen 34.5kV | In Service |
| Y2-042 | Oxbow 25kV | In Service |
| Z1-038 | Florey Knob 34.5kV | Withdrawn |
| Z1-069 | Gold-Sabinsville 115kV | In Service |
| Z1-092 | Milan 34kV | In Service |
| Z1-110 | Grover 34kV | In Service |
| Z2-011 | Canton 34.5kV | In Service |
| Z2-104 | Oxbow 25kV II | In Service |

11.8 Contingency Descriptions

| Contingency Name | Contingency Definition |
|----------------------------|---|
| PN-P2-3-PN-115-46G | CONTINGENCY 'PN-P2-3-PN-115-46G' /* 672 DISCONNECT BRANCH FROM BUS 200677 TO BUS 200698 CKT 2 /* 26NO MESHO 115 26MEHOOPNY 115 DISCONNECT BRANCH FROM BUS 200674 TO BUS 200677 CKT 1 /* 26TOWANDA 115 26NO MESHO 115 DISCONNECT BRANCH FROM BUS 200677 TO BUS 200687 CKT 2 /* 26NO MESHO 115 26N MESH2 35 DISCONNECT BRANCH FROM BUS 200675 TO BUS 200924 CKT 1 /* 26E.TWANDA 230 26CANYON 230 DISCONNECT BRANCH FROM BUS 200706 TO BUS 200924 CKT 1 /* 26N.MESHPN 230 26CANYON 230 DISCONNECT BRANCH FROM BUS 200677 TO BUS 200706 CKT 4 /* 26NO MESHO 115 26N.MESHPN 230 END |
| PN-P1-2-PN-230-101T | CONTINGENCY 'PN-P1-2-PN-230-101T' /* EAST TOWANDA - HILLSIDE 230KV DISCONNECT BRANCH FROM BUS 200675 TO BUS 130763 CKT 1 /* 26E.TWANDA 230 HILSD230 230 END |
| PN-P1-2-PN-230-013A | 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 Short Circuit Analysis

The Short Circuit Analysis will be completed during the System Impact Study phase.

13 Affected Systems

13.1 NYISO

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