# Generation Interconnection

# Feasibility Study Report

# for

# Queue Project AG1-301

# MILLER REC-WARRIOR RIDGE 46 KV

# 12 MW Capacity / 20 MW Energy

January 2021

# Table of Contents


1 Introduction ..... 4
2 Preface ..... 4
3 General ..... 5
4 Point of Interconnection ..... 6
5 Cost Summary ..... 6
6 Transmission Owner Scope of Work ..... 7
7 Schedule ..... 8
8 Transmission Owner Analysis ..... 8
8.1 Power Flow Analysis ..... 8
9 Interconnection Customer Requirements ..... 8
9.1 System Protection ..... 8
9.2 Compliance Issues and Interconnection Customer Requirements ..... 8
9.3 Power Factor Requirements ..... 9
10 Revenue Metering and SCADA Requirements ..... 9
10.1 PJM Requirements ..... 9
10.2 Meteorological Data Reporting Requirements ..... 9
10.3 Interconnected Transmission Owner Requirements ..... 10
11 Summer Peak - Load Flow Analysis ..... 11
11.1 Generation Deliverability ..... 12
11.2 Multiple Facility Contingency ..... 12
11.3 Contribution to Previously Identified Overloads ..... 12
11.4 Potential Congestion due to Local Energy Deliverability ..... 12
11.5 System Reinforcements - Summer Peak Load Flow - Primary POI ..... 14
11.6 Flow Gate Details ..... 16
11.6.1 Index 1 ..... 17
11.6.2 Index 2 ..... 21
11.7 Queue Dependencies ..... 25
11.8 Contingency Descriptions ..... 27
12 Short Circuit Analysis ..... 28
12.1 System Reinforcements - Short Circuit ..... 28
13 Affected Systems ..... 29

13.1 NYISO ..... 29
13.2 MISO ..... 29
14 Attachment 1: One Line Diagram ..... 30

# 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 Huntingdon County, Pennsylvania. The installed facilities will have a total capability of 20 MW with 12 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is January 15, 2023. This study does not imply a TO commitment to this in-service date.

| Queue Number | AG1-301 |
|---|---|
| Project Name | MILLER REC-WARRIOR RIDGE 46 KV |
| State | Pennsylvania |
| County | Huntingdon |
| Transmission Owner | MAIT (PENELEC zone) |
| MFO | 20 |
| MWE | 20 |
| MWC | 12 |
| Fuel | Solar |
| Basecase Study Year | 2024 |

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

The interconnection of the project will be accomplished by tapping the Miller REC (Warrior Ridge) 46 kV line and constructing a one span tap. The transmission line tap will be located approximately 6.5 miles from Warrior Ridge Substation. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection line tap and the associated interconnection facilities. The project will also require upgrades at Warrior Substation.

Attachment 1 shows a one-line diagram of the proposed primary interconnection facilities for the AG1-301 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, including the Attachment Facilities which connect the generator to the FE Transmission System's interconnection facilities.

## 5 Cost Summary

The AG1-301 project will be responsible for the following costs:

| Description | Total Cost |
|---|---|
| **Total Physical Interconnection Costs** | $ 1,494,000 |
| **Total System Network Upgrade Costs** | $38,750,000[1] |
| **Total Costs** | **$40,244,000** |

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 2016-36, 2016-25 I.R.B. (6/20/2016). 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 contributes to a facility that is already overloaded by a prior queue, then they may receive cost allocation.

## 6 Transmission Owner Scope of Work

The interconnection of the project will be accomplished by tapping the Miller REC (Warrior Ridge) 46 kV line and constructing a one span tap. The transmission line tap will be located approximately 6.5 miles from Warrior Ridge Substation. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection line tap and the associated interconnection facilities. The project will also require upgrades at Warrior Substation.

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

| **Description** | **Total Cost** |
|---|---|
| Construct a one span tap and install 2-46 kV switches on the Miller REC (Warrior Ridge) 46 kV line. | $ 914,000 |
| Install 46 kV metering in the customer's substation. | $ 95,000 |
| Upgrade relaying at Warrior Ridge substation. | $ 485,000 |
| **Total Physical Interconnection Costs** | $1,494,000 |

# 7 Schedule

Based on the scope of work for the interconnection facilities, it is expected to take a minimum of **24 months** after the signing of an Interconnection Construction Service Agreement 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 interconnection facilities and network upgrades, and that all transmission system outages will be allowed when requested.

If the customer is ultimately responsible for network upgrades, then the schedule for those upgrades will be refined in future study phases. The customer would need to wait for those upgrades to be completed prior to commercial operation unless determined deliverable by an interim deliverability study. The elapsed time to complete any network upgrades is provided in the System Reinforcements table of this report.[1]

# 8 Transmission Owner Analysis

## 8.1 Power Flow Analysis

FE performed an analysis of its underlying transmission <100 kV system. The AG1-301 project did not contribute to any overloads on the FE transmission <100 kV 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.

The IC has requested a non-standard GSU transformer winding configuration. This transformer is in violation of section 14.2.6 of FE's "Requirements for Transmission Connected Facilities" document and will not be accepted. The GSU transformer must have a delta connection on the high (utility) side.

## 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 46 kV circuit breaker to protect the AG1-301 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 AG1-301 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 IC shall design its non-synchronous Customer Facility with the ability to maintain a power factor of at least 0.95 leading (absorbing VARs) to 0.95 lagging (supplying VARs) measured at the high-side of the facility substation transformer(s) connected to the FE Transmission System.

## 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) - (Required for plants with Maximum Facility Output of 3 MW or higher)

- Irradiance (Watts/meter2) - (Required for plants with Maximum Facility Output of 3 MW or higher)
- 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/

## 11 Summer Peak - Load Flow Analysis

The Queue Project AG1-301 was evaluated as a 20.0 MW (Capacity 12.0 MW) injection tapping the Miller REC to Warrior Ridge 46 kV line in the PENELEC area. Project AG1-301 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-301 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 | CKT ID | CONT NAME | Type | Rating MVA | PRE PROJECT LOADING % | POST PROJECT LOADING % | AC\|DC | MW IMPACT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **165777924** | 200522 | 26SHADE GP | 115.0 | PENELEC | 938380 | AE1-071-POI | 115.0 | PENELEC | 1 | PL:10:P24:100548 | bus | 160.0 | 201.54 | 202.86 | DC | 2.11 |
| **165975953** | 200522 | 26SHADE GP | 115.0 | PENELEC | 938380 | AE1-071-POI | 115.0 | PENELEC | 1 | PL:10:P45:102437 | breaker | 160.0 | 201.54 | 202.86 | DC | 2.11 |
| **165975954** | 200522 | 26SHADE GP | 115.0 | PENELEC | 938380 | AE1-071-POI | 115.0 | PENELEC | 1 | PN-P2_3-PN-230-0347-16-DRT-029 | breaker | 160.0 | 196.58 | 197.89 | DC | 2.11 |
| **165777919** | 938380 | AE1-071-POI | 115.0 | PENELEC | 200520 | 26ROXBURY | 115.0 | PENELEC | 1 | PL:10:P24:100548 | bus | 160.0 | 234.4 | 235.72 | DC | 2.11 |
| **165975943** | 938380 | AE1-071-POI | 115.0 | PENELEC | 200520 | 26ROXBURY | 115.0 | PENELEC | 1 | PN-P2_3-PN-230-0347-16-DRT-029 | breaker | 160.0 | 236.71 | 238.02 | DC | 2.11 |
| **165975944** | 938380 | AE1-071-POI | 115.0 | PENELEC | 200520 | 26ROXBURY | 115.0 | PENELEC | 1 | PL:10:P45:102437 | breaker | 160.0 | 234.4 | 235.72 | DC | 2.11 |

## 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 | CKT ID | CONT NAME | Type | Rating MVA | PRE PROJECT LOADING % | POST PROJECT LOADING % | AC\|DC | MW IMPACT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **167665934** | 200513 | 26LEWISTWN | 230.0 | PENELEC | 208005 | JUNI BU2 | 230.0 | PPL | 1 | Base Case | operation | 493.0 | 186.44 | 187.6 | DC | 5.74 |
| **167665935** | 200513 | 26LEWISTWN | 230.0 | PENELEC | 208005 | JUNI BU2 | 230.0 | PPL | 1 | PN-P1-2-PN-115-094_NON | operation | 618.0 | 163.46 | 164.49 | DC | 6.33 |

| ID | FROM BUS# | FROM BUS | kV | FROM BUS AREA | TO BUS# | TO BUS | kV | TO BUS AREA | CKT ID | CONT NAME | Type | Rating MVA | PRE PROJECT LOADING % | POST PROJECT LOADING % | AC\|DC | MW IMPACT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **166212743** | 200522 | 26SHADE GP | 115.0 | PENELEC | 938380 | AE1-071-POI | 115.0 | PENELEC | 1 | PL:10:P13:100618 | operation | 160.0 | 196.03 | 197.34 | DC | 2.11 |
| **166212731** | 938380 | AE1-071-POI | 115.0 | PENELEC | 200520 | 26ROXBURY | 115.0 | PENELEC | 1 | PL:10:P13:100618 | operation | 160.0 | 232.36 | 233.68 | DC | 2.11 |

## 11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

| ID | Idx | Facility | Upgrade Description | Cost |
|---|---|---|---|---|
| 165975954,165777924,165975953 | 1 | 26SHADE GP 115.0 kV - AE1-071 TAP 115.0 kV Ckt 1 | **PENELEC**<br>**PN-AF2-F-0015A (1424) : Reconductor 6.4 miles of line.**<br>**Project Type : FAC**<br>**Cost : $19,600,000**<br>**Time Estimate : 30.0 Months**<br><br>**PN-AF2-F-0015B (1425) : Replace line trap at Shade Gap**<br>**Project Type : FAC**<br>**Cost : $200,000**<br>**Time Estimate : 12.0 Months**<br><br>**PN-AF2-F-0015C (1426) : Replace transmission line drop at Shade Gap**<br>**Project Type : FAC**<br>**Cost : $200,000**<br>**Time Estimate : 12.0 Months**<br><br>**PN-AF2-F-0015D (1427) : Replace adjust CTs at Shade Gap**<br>**Project Type : FAC**<br>**Cost : $800,000**<br>**Time Estimate : 12.0 Months**<br><br>**PN-AF2-F-0015E (1428) : Replace substation conductor (bus taps) at Shade Gap**<br>**Project Type : FAC**<br>**Cost : $200,000**<br>**Time Estimate : 12.0 Months**<br><br>**PN-AG1-F-0016F (1429) : Replace breaker at Shade Gap**<br>**Project Type : FAC**<br>**Cost : $900,000**<br>**Time Estimate : 12.0 Months**<br><br>**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, though the worst case contingency driving the reinforcements listed above is valid.** | $21,900,000 |

| ID | Idx | Facility | Upgrade Description | Cost |
|---|---|---|---|---|
| 165975944,165777919,165975943 | 2 | AE1-071 TAP 115.0 kV - 26ROXBURY 115.0 kV Ckt 1 | **PENELEC**<br>**PN-AF2-F-0014A (1435) : Reconductor 6.4 miles of line.**<br>**Project Type : FAC**<br>**Cost : $15,700,000**<br>**Time Estimate : 36.0 Months**<br><br>**PN-AF2-F-0014B (1436) : Replace substation conductor (including bus, risers, line trap leads, and breaker leads) at Roxbury**<br>**Project Type : FAC**<br>**Cost : $175,000**<br>**Time Estimate : 12.0 Months**<br><br>**PN-AF2-F-0014C (1437) : Replace transmission line drop at Roxbury**<br>**Project Type : FAC**<br>**Cost : $175,000**<br>**Time Estimate : 12.0 Months**<br><br>**PN-AF2-F-0014D (1438) : Replace circuit breaker and CTs at Roxbury**<br>**Project Type : FAC**<br>**Cost : $800,000**<br>**Time Estimate : 12.0 Months**<br><br>**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.** | $16,850,000 |
| | | | **TOTAL COST** | **$38,750,000**[1] |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **165975953** | 200522 | 26SHADE GP | PENELEC | 938380 | AE1-071-POI | PENELEC | 1 | PL:10:P45:102437 | breaker | 160.0 | 201.54 | 202.86 | DC | 2.11 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **200812** | 26ALY HYDR | 0.4042 | 50/50 | 0.4042 |
| **200852** | 26WARR RDG | 0.2636 | 50/50 | 0.2636 |
| **200883** | Q-053 E | 2.1510 | Adder | 2.53 |
| **235003** | AC1-025 E | 0.1866 | 50/50 | 0.1866 |
| **236828** | 01GRAYMONT | 0.4801 | 50/50 | 0.4801 |
| **290086** | Q-036 E | 2.3338 | Adder | 2.75 |
| **293301** | N-039 E | 3.6448 | Adder | 4.29 |
| **294515** | O38_P22 | 3.1892 | Adder | 3.75 |
| **921642** | AA2-000 | 25.8759 | Adder | 30.44 |
| **930511** | AB2-092 | 0.9501 | Adder | 1.12 |
| **936421** | AD2-055 | 1.9561 | Adder | 2.3 |
| **936991** | AD2-133 C | 1.0502 | Adder | 1.24 |
| **936992** | AD2-133 E | 4.8035 | Adder | 5.65 |
| **939171** | AE1-147 C | 1.4321 | 50/50 | 1.4321 |
| **939172** | AE1-147 E | 0.9547 | 50/50 | 0.9547 |
| **939591** | AE1-188 C | -0.6881 | Adder | -0.81 |
| **940201** | AE2-001 C | 1.4368 | 50/50 | 1.4368 |
| **940202** | AE2-001 E | 0.9578 | 50/50 | 0.9578 |
| **940681** | **AE2-055 C (Suspended)** | **1.5077** | **50/50** | **1.5077** |
| **940682** | **AE2-055 E (Suspended)** | **1.0051** | **50/50** | **1.0051** |
| **941191** | AE2-113 C | 2.6637 | Adder | 3.13 |
| **941192** | AE2-113 E | 2.8679 | Adder | 3.37 |
| **941231** | AE2-117 C | 1.2276 | 50/50 | 1.2276 |
| **941232** | AE2-117 E | 0.8184 | 50/50 | 0.8184 |
| **941241** | AE2-118 C | 0.9922 | Adder | 1.17 |
| **941242** | AE2-118 E | 0.6614 | Adder | 0.78 |
| **941261** | AE2-120 C | 1.4393 | 50/50 | 1.4393 |
| **941262** | AE2-120 E | 0.9595 | 50/50 | 0.9595 |
| **941271** | AE2-121 C | 0.7571 | 50/50 | 0.7571 |
| **941272** | AE2-121 E | 0.5055 | 50/50 | 0.5055 |
| **941321** | AE2-126 C | 0.6973 | Adder | 0.82 |
| **941322** | AE2-126 E | 0.4648 | Adder | 0.55 |
| **941331** | AE2-129 C | 0.7311 | Adder | 0.86 |
| **941332** | AE2-129 E | 0.4874 | Adder | 0.57 |
| **941351** | **AE2-131 C (Suspended)** | **0.7311** | **Adder** | **0.86** |
| **941352** | **AE2-131 E (Suspended)** | **0.4874** | **Adder** | **0.57** |
| **942121** | AE2-224 C | 2.9733 | Adder | 3.5 |
| **942122** | AE2-224 E | 1.9822 | Adder | 2.33 |
| **942351** | AE2-248 C | 1.1824 | 50/50 | 1.1824 |
| **942352** | AE2-248 E | 0.7883 | 50/50 | 0.7883 |
| **942491** | AE2-262 C | 4.2394 | Adder | 4.99 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| 942492 | AE2-262 E | 2.8489 | Adder | 3.35 |
| 942501 | AE2-263 C | 3.9850 | Adder | 4.69 |
| 942502 | AE2-263 E | 2.6606 | Adder | 3.13 |
| 942511 | AE2-264 C | 5.1197 | 50/50 | 5.1197 |
| 942512 | AE2-264 E | 3.4131 | 50/50 | 3.4131 |
| 942961 | AE2-316 C | 1.7575 | Adder | 2.07 |
| 942962 | AE2-316 E | 2.5061 | Adder | 2.95 |
| 943751 | AF1-043 | 5.8682 | Adder | 6.9 |
| 944001 | AF1-068 C O1 (Withdrawn : 12/15/2020) | 1.5860 | 50/50 | 1.5860 |
| 944002 | AF1-068 E O1 (Withdrawn : 12/15/2020) | 0.8922 | 50/50 | 0.8922 |
| 944311 | AF1-099 C | 6.4354 | Adder | 7.57 |
| 944312 | AF1-099 E | 4.2902 | Adder | 5.05 |
| 944321 | AF1-100 C | 10.9204 | Adder | 12.85 |
| 944322 | AF1-100 E | 7.2802 | Adder | 8.56 |
| 944471 | AF1-112 C | 1.4704 | 50/50 | 1.4704 |
| 944472 | AF1-112 E | 0.9802 | 50/50 | 0.9802 |
| 944671 | AF1-132 C O1 (Withdrawn : 12/15/2020) | 1.4920 | 50/50 | 1.4920 |
| 944672 | AF1-132 E O1 (Withdrawn : 12/15/2020) | 0.9946 | 50/50 | 0.9946 |
| 944691 | AF1-134 C | 0.5955 | Adder | 0.7 |
| 944692 | AF1-134 E | 0.3970 | Adder | 0.47 |
| 944771 | AF1-142 C | 10.2966 | Adder | 12.11 |
| 944772 | AF1-142 E | 6.8644 | Adder | 8.08 |
| 944881 | AF1-153 C O1 | 0.6625 | Adder | 0.78 |
| 944882 | AF1-153 E O1 | 0.4417 | Adder | 0.52 |
| 944901 | AF1-155 C | 0.6586 | Adder | 0.77 |
| 944902 | AF1-155 E | 0.4391 | Adder | 0.52 |
| 945011 | AF1-166 C | -0.5622 | Adder | -0.66 |
| 945491 | AF1-214 C (Withdrawn : 12/03/2020) | 1.4392 | 50/50 | 1.4392 |
| 945492 | AF1-214 E (Withdrawn : 12/03/2020) | 0.9594 | 50/50 | 0.9594 |
| 945591 | AF1-224 C | -0.4314 | Adder | -0.51 |
| 946381 | AF1-302 C | 0.7674 | Adder | 0.9 |
| 946382 | AF1-302 E | 1.0233 | Adder | 1.2 |
| 946421 | AF1-306 C | 2.8738 | Adder | 3.38 |
| 946422 | AF1-306 E | 11.4954 | Adder | 13.52 |
| 957451 | AF2-039 C | 0.5188 | Adder | 0.61 |
| 957452 | AF2-039 E | 0.3459 | Adder | 0.41 |
| 957561 | AF2-050 C | 1.4867 | Adder | 1.75 |
| 957562 | AF2-050 E | 0.9911 | Adder | 1.17 |
| 957931 | AF2-087 C (Suspended) | 0.1915 | Adder | 0.23 |
| 957932 | AF2-087 E (Suspended) | 0.2638 | Adder | 0.31 |
| 957941 | AF2-088 C | 0.2498 | Adder | 0.29 |
| 957942 | AF2-088 E | 0.1665 | Adder | 0.2 |
| 958071 | AF2-101 C | -0.0937 | Adder | -0.11 |
| 958271 | AF2-121 C | 0.7311 | Adder | 0.86 |
| 958272 | AF2-121 E | 0.4874 | Adder | 0.57 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **958551** | AF2-146 C | 5.3006 | 50/50 | 5.3006 |
| **958552** | AF2-146 E | 3.5338 | 50/50 | 3.5338 |
| **958571** | AF2-148 C | 4.3049 | 50/50 | 4.3049 |
| **958572** | AF2-148 E | 2.8699 | 50/50 | 2.8699 |
| **958601** | AF2-151 C | -0.0925 | Adder | -0.11 |
| **959241** | AF2-215 C | -0.1576 | Adder | -0.19 |
| **959802** | AF2-271 E | 0.2368 | Adder | 0.28 |
| **959843** | AF2-275 BAT | 0.1034 | Merchant Transmission | 0.1034 |
| **959853** | AF2-276 BAT | 0.1034 | Merchant Transmission | 0.1034 |
| **960022** | AF2-293 E | 0.1389 | 50/50 | 0.1389 |
| **960041** | AF2-295 C | 0.6586 | Adder | 0.77 |
| **960042** | AF2-295 E | 0.4391 | Adder | 0.52 |
| **960051** | AF2-296 C | 0.5955 | Adder | 0.7 |
| **960052** | AF2-296 E | 0.3970 | Adder | 0.47 |
| **962411** | AG1-090 C O1 | 1.9375 | Adder | 4.3 |
| **962412** | AG1-090 E O1 | 1.2917 | Adder | 2.87 |
| **962951** | AG1-144 C | 0.3875 | Adder | 0.86 |
| **962952** | AG1-144 E | 0.2583 | Adder | 0.57 |
| **963571** | AG1-206 C | 0.1950 | Adder | 0.43 |
| **963572** | AG1-206 E | 0.1050 | Adder | 0.23 |
| **963891** | AG1-242 C | 0.1710 | Adder | 0.38 |
| **963892** | AG1-242 E | 0.0921 | Adder | 0.2 |
| **964031** | AG1-257 C | 1.0126 | 50/50 | 1.0126 |
| **964032** | AG1-257 E | 1.4152 | 50/50 | 1.4152 |
| **964041** | AG1-258 C | 1.0126 | 50/50 | 1.0126 |
| **964042** | AG1-258 E | 1.4152 | 50/50 | 1.4152 |
| **964191** | AG1-280 C | 0.3056 | Adder | 0.68 |
| **964192** | AG1-280 E | 0.2037 | Adder | 0.45 |
| **964201** | AG1-281 C | 0.3074 | Adder | 0.68 |
| **964202** | AG1-281 E | 0.2049 | Adder | 0.45 |
| **964391** | AG1-301 C | 1.2653 | 50/50 | 1.2653 |
| **964392** | AG1-301 E | 0.8435 | 50/50 | 0.8435 |
| **964451** | AG1-308 C O1 | 0.2722 | Adder | 0.6 |
| **964452** | AG1-308 E O1 | 0.3805 | Adder | 0.84 |
| **965121** | AG1-377 C O1 | 0.3875 | Adder | 0.86 |
| **965122** | AG1-377 E O1 | 0.2583 | Adder | 0.57 |
| **965131** | AG1-378 C O1 | 0.3875 | Adder | 0.86 |
| **965132** | AG1-378 E O1 | 0.2583 | Adder | 0.57 |
| **965201** | AG1-385 C | 0.4515 | Adder | 1.0 |
| **965202** | AG1-385 E | 0.1337 | Adder | 0.3 |
| **965301** | AG1-395 C | 0.4979 | Adder | 1.11 |
| **965302** | AG1-395 E | 0.1479 | Adder | 0.33 |
| **966041** | AG1-473 C | 5.0062 | 50/50 | 5.0062 |
| **966042** | AG1-473 E | 3.3375 | 50/50 | 3.3375 |
| **966152** | AG1-484 BAT | 0.7123 | Merchant Transmission | 0.7123 |
| **966463** | AG1-515 BAT | 0.4172 | Merchant Transmission | 0.4172 |
| **966891** | AG1-560 BAT | 13.9988 | 50/50 | 13.9988 |
| **966901** | AG1-561 BAT | 6.0982 | 50/50 | 6.0982 |
| **WEC** | WEC | 0.0460 | Confirmed LTF | 0.0460 |
| **LGEE** | LGEE | 0.0767 | Confirmed LTF | 0.0767 |
| **CALDERWOOD** | CALDERWOOD | 0.0045 | Confirmed LTF | 0.0045 |
| **CBM-W2** | CBM-W2 | 0.6630 | Confirmed LTF | 0.6630 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **TVA** | TVA | 0.0420 | Confirmed LTF | 0.0420 |
| **O-066** | O-066 | 1.9786 | Confirmed LTF | 1.9786 |
| **SIGE** | SIGE | 0.0434 | Confirmed LTF | 0.0434 |
| **CHEOAH** | CHEOAH | 0.0060 | Confirmed LTF | 0.0060 |
| **CBM-S1** | CBM-S1 | 0.0179 | Confirmed LTF | 0.0179 |
| **G-007** | G-007 | 0.3423 | Confirmed LTF | 0.3423 |
| **HAMLET** | HAMLET | 0.0982 | Confirmed LTF | 0.0982 |
| **MEC** | MEC | 0.1907 | Confirmed LTF | 0.1907 |
| **LAGN** | LAGN | 0.0683 | Confirmed LTF | 0.0683 |
| **CATAWBA** | CATAWBA | 0.0413 | Confirmed LTF | 0.0413 |
| **CBM-W1** | CBM-W1 | 2.4535 | Confirmed LTF | 2.4535 |

### 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **165975943** | 938380 | AE1-071-POI | PENELEC | 200520 | 26ROXBURY | PENELEC | 1 | PN-P2_3-PN-230-0347-16-DRT-029 | breaker | 160.0 | 236.71 | 238.02 | DC | 2.11 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **200812** | 26ALY HYDR | 0.4036 | 50/50 | 0.4036 |
| **200852** | 26WARR RDG | 0.2631 | 50/50 | 0.2631 |
| **200883** | Q-053 E | 2.1432 | Adder | 2.52 |
| **235003** | AC1-025 E | 0.1863 | 50/50 | 0.1863 |
| **236828** | 01GRAYMONT | 0.4794 | 50/50 | 0.4794 |
| **290086** | Q-036 E | 2.3276 | Adder | 2.74 |
| **293301** | N-039 E | 3.6339 | Adder | 4.28 |
| **294515** | O38_P22 | 3.1797 | Adder | 3.74 |
| **921642** | AA2-000 | 25.8051 | Adder | 30.36 |
| **930511** | AB2-092 | 0.9475 | Adder | 1.11 |
| **936421** | AD2-055 | 1.9507 | Adder | 2.29 |
| **936991** | AD2-133 C | 1.0474 | Adder | 1.23 |
| **936992** | AD2-133 E | 4.7909 | Adder | 5.64 |
| **938384** | AE1-071-C | 40.3905 | 50/50 | 40.3905 |
| **938385** | AE1-071-E | 24.7156 | 50/50 | 24.7156 |
| **939171** | AE1-147 C | 1.4302 | 50/50 | 1.4302 |
| **939172** | AE1-147 E | 0.9534 | 50/50 | 0.9534 |
| **939591** | AE1-188 C | -0.6863 | Adder | -0.81 |
| **940201** | AE2-001 C | 1.4348 | 50/50 | 1.4348 |
| **940202** | AE2-001 E | 0.9566 | 50/50 | 0.9566 |
| **940681** | **AE2-055 C (Suspended)** | **1.5056** | **50/50** | **1.5056** |
| **940682** | **AE2-055 E (Suspended)** | **1.0038** | **50/50** | **1.0038** |
| **941231** | AE2-117 C | 1.2254 | 50/50 | 1.2254 |
| **941232** | AE2-117 E | 0.8170 | 50/50 | 0.8170 |
| **941241** | AE2-118 C | 0.9903 | Adder | 1.17 |
| **941242** | AE2-118 E | 0.6602 | Adder | 0.78 |
| **941261** | AE2-120 C | 1.4374 | 50/50 | 1.4374 |
| **941262** | AE2-120 E | 0.9582 | 50/50 | 0.9582 |
| **941271** | AE2-121 C | 0.7560 | 50/50 | 0.7560 |
| **941272** | AE2-121 E | 0.5048 | 50/50 | 0.5048 |
| **941321** | AE2-126 C | 0.6954 | Adder | 0.82 |
| **941322** | AE2-126 E | 0.4636 | Adder | 0.55 |
| **941331** | AE2-129 C | 0.7293 | Adder | 0.86 |
| **941332** | AE2-129 E | 0.4862 | Adder | 0.57 |
| **941351** | **AE2-131 C (Suspended)** | **0.7293** | **Adder** | **0.86** |
| **941352** | **AE2-131 E (Suspended)** | **0.4862** | **Adder** | **0.57** |
| **942121** | AE2-224 C | 2.9631 | Adder | 3.49 |
| **942122** | AE2-224 E | 1.9754 | Adder | 2.32 |
| **942351** | AE2-248 C | 1.1809 | 50/50 | 1.1809 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| 942352 | AE2-248 E | 0.7873 | 50/50 | 0.7873 |
| 942491 | AE2-262 C | 4.2321 | Adder | 4.98 |
| 942492 | AE2-262 E | 2.8440 | Adder | 3.35 |
| 942501 | AE2-263 C | 3.9782 | Adder | 4.68 |
| 942502 | AE2-263 E | 2.6561 | Adder | 3.12 |
| 942511 | AE2-264 C | 5.1106 | 50/50 | 5.1106 |
| 942512 | AE2-264 E | 3.4070 | 50/50 | 3.4070 |
| 943751 | AF1-043 | 5.8521 | Adder | 6.88 |
| 944001 | AF1-068 C O1 (Withdrawn : 12/15/2020) | 1.5840 | 50/50 | 1.5840 |
| 944002 | AF1-068 E O1 (Withdrawn : 12/15/2020) | 0.8910 | 50/50 | 0.8910 |
| 944311 | AF1-099 C | 6.4244 | Adder | 7.56 |
| 944312 | AF1-099 E | 4.2829 | Adder | 5.04 |
| 944321 | AF1-100 C | 10.8987 | Adder | 12.82 |
| 944322 | AF1-100 E | 7.2658 | Adder | 8.55 |
| 944471 | AF1-112 C | 1.4683 | 50/50 | 1.4683 |
| 944472 | AF1-112 E | 0.9789 | 50/50 | 0.9789 |
| 944671 | AF1-132 C O1 (Withdrawn : 12/15/2020) | 1.4900 | 50/50 | 1.4900 |
| 944672 | AF1-132 E O1 (Withdrawn : 12/15/2020) | 0.9934 | 50/50 | 0.9934 |
| 944691 | AF1-134 C | 0.5935 | Adder | 0.7 |
| 944692 | AF1-134 E | 0.3957 | Adder | 0.47 |
| 944771 | AF1-142 C | 10.2790 | Adder | 12.09 |
| 944772 | AF1-142 E | 6.8527 | Adder | 8.06 |
| 944881 | AF1-153 C O1 | 0.6607 | Adder | 0.78 |
| 944882 | AF1-153 E O1 | 0.4404 | Adder | 0.52 |
| 944901 | AF1-155 C | 0.6569 | Adder | 0.77 |
| 944902 | AF1-155 E | 0.4379 | Adder | 0.52 |
| 945011 | AF1-166 C | -0.5608 | Adder | -0.66 |
| 945491 | AF1-214 C (Withdrawn : 12/03/2020) | 1.4371 | 50/50 | 1.4371 |
| 945492 | AF1-214 E (Withdrawn : 12/03/2020) | 0.9581 | 50/50 | 0.9581 |
| 945591 | AF1-224 C | -0.4303 | Adder | -0.51 |
| 946421 | AF1-306 C | 2.8667 | Adder | 3.37 |
| 946422 | AF1-306 E | 11.4669 | Adder | 13.49 |
| 957451 | AF2-039 C | 0.5175 | Adder | 0.61 |
| 957452 | AF2-039 E | 0.3450 | Adder | 0.41 |
| 957561 | AF2-050 C | 1.4816 | Adder | 1.74 |
| 957562 | AF2-050 E | 0.9877 | Adder | 1.16 |
| 957931 | AF2-087 C (Suspended) | 0.1910 | Adder | 0.22 |
| 957932 | AF2-087 E (Suspended) | 0.2631 | Adder | 0.31 |
| 957941 | AF2-088 C | 0.2492 | Adder | 0.29 |
| 957942 | AF2-088 E | 0.1661 | Adder | 0.2 |
| 958071 | AF2-101 C | -0.0921 | Adder | -0.11 |
| 958271 | AF2-121 C | 0.7293 | Adder | 0.86 |
| 958272 | AF2-121 E | 0.4862 | Adder | 0.57 |
| 958551 | AF2-146 C | 5.3162 | 50/50 | 5.3162 |
| 958552 | AF2-146 E | 3.5442 | 50/50 | 3.5442 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **958571** | AF2-148 C | 4.3078 | 50/50 | 4.3078 |
| **958572** | AF2-148 E | 2.8719 | 50/50 | 2.8719 |
| **958601** | AF2-151 C | -0.0909 | Adder | -0.11 |
| **959241** | AF2-215 C | -0.1572 | Adder | -0.18 |
| **959802** | AF2-271 E | 0.2363 | Adder | 0.28 |
| **959843** | AF2-275 BAT | 0.1031 | Merchant Transmission | 0.1031 |
| **959853** | AF2-276 BAT | 0.1031 | Merchant Transmission | 0.1031 |
| **960022** | AF2-293 E | 0.1387 | 50/50 | 0.1387 |
| **960041** | AF2-295 C | 0.6569 | Adder | 0.77 |
| **960042** | AF2-295 E | 0.4379 | Adder | 0.52 |
| **960051** | AF2-296 C | 0.5935 | Adder | 0.7 |
| **960052** | AF2-296 E | 0.3957 | Adder | 0.47 |
| **962411** | AG1-090 C O1 | 1.9326 | Adder | 4.29 |
| **962412** | AG1-090 E O1 | 1.2884 | Adder | 2.86 |
| **962951** | AG1-144 C | 0.3865 | Adder | 0.86 |
| **962952** | AG1-144 E | 0.2577 | Adder | 0.57 |
| **963571** | AG1-206 C | 0.1945 | Adder | 0.43 |
| **963572** | AG1-206 E | 0.1047 | Adder | 0.23 |
| **963891** | AG1-242 C | 0.1704 | Adder | 0.38 |
| **963892** | AG1-242 E | 0.0918 | Adder | 0.2 |
| **964031** | AG1-257 C | 1.0113 | 50/50 | 1.0113 |
| **964032** | AG1-257 E | 1.4133 | 50/50 | 1.4133 |
| **964041** | AG1-258 C | 1.0113 | 50/50 | 1.0113 |
| **964042** | AG1-258 E | 1.4133 | 50/50 | 1.4133 |
| **964191** | AG1-280 C | 0.3046 | Adder | 0.68 |
| **964192** | AG1-280 E | 0.2030 | Adder | 0.45 |
| **964201** | AG1-281 C | 0.3064 | Adder | 0.68 |
| **964202** | AG1-281 E | 0.2042 | Adder | 0.45 |
| **964391** | AG1-301 C | 1.2631 | 50/50 | 1.2631 |
| **964392** | AG1-301 E | 0.8421 | 50/50 | 0.8421 |
| **964451** | AG1-308 C O1 | 0.2716 | Adder | 0.6 |
| **964452** | AG1-308 E O1 | 0.3795 | Adder | 0.84 |
| **965121** | AG1-377 C O1 | 0.3865 | Adder | 0.86 |
| **965122** | AG1-377 E O1 | 0.2577 | Adder | 0.57 |
| **965131** | AG1-378 C O1 | 0.3865 | Adder | 0.86 |
| **965132** | AG1-378 E O1 | 0.2577 | Adder | 0.57 |
| **965201** | AG1-385 C | 0.4502 | Adder | 1.0 |
| **965202** | AG1-385 E | 0.1333 | Adder | 0.3 |
| **965301** | AG1-395 C | 0.4967 | Adder | 1.1 |
| **965302** | AG1-395 E | 0.1475 | Adder | 0.33 |
| **966041** | AG1-473 C | 5.0011 | 50/50 | 5.0011 |
| **966042** | AG1-473 E | 3.3340 | 50/50 | 3.3340 |
| **966152** | AG1-484 BAT | 0.7022 | Merchant Transmission | 0.7022 |
| **966463** | AG1-515 BAT | 0.4163 | Merchant Transmission | 0.4163 |
| **966901** | AG1-561 BAT | 6.0877 | 50/50 | 6.0877 |
| **WEC** | WEC | 0.0441 | Confirmed LTF | 0.0441 |
| **LGEE** | LGEE | 0.0729 | Confirmed LTF | 0.0729 |
| **CALDERWOOD** | CALDERWOOD | 0.0060 | Confirmed LTF | 0.0060 |
| **CBM-W2** | CBM-W2 | 0.6182 | Confirmed LTF | 0.6182 |
| **TVA** | TVA | 0.0364 | Confirmed LTF | 0.0364 |
| **O-066** | O-066 | 1.9719 | Confirmed LTF | 1.9719 |
| **SIGE** | SIGE | 0.0427 | Confirmed LTF | 0.0427 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **CHEOAH** | CHEOAH | 0.0080 | Confirmed LTF | 0.0080 |
| **CBM-S1** | CBM-S1 | 0.0163 | Confirmed LTF | 0.0163 |
| **G-007** | G-007 | 0.3402 | Confirmed LTF | 0.3402 |
| **HAMLET** | HAMLET | 0.0982 | Confirmed LTF | 0.0982 |
| **MEC** | MEC | 0.1827 | Confirmed LTF | 0.1827 |
| **LAGN** | LAGN | 0.0595 | Confirmed LTF | 0.0595 |
| **CATAWBA** | CATAWBA | 0.0416 | Confirmed LTF | 0.0416 |
| **CBM-W1** | CBM-W1 | 2.3694 | Confirmed LTF | 2.3694 |

## 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 |
|---|---|---|
| **AA2-000** | N/A | N/A |
| **AB2-092** | Bergen 138kV | Partially in Service - Under Construction |
| **AC1-025** | Dale Summit | In Service |
| **AD2-055** | Moshannon-East Towanda 230 kV | Active |
| **AD2-133** | Eagle Valley 115kV | Active |
| **AE1-071** | Shade Gap-Roxbury 115 kV | Active |
| **AE1-147** | Bellefonte 46 kV | Engineering and Procurement |
| **AE1-188** | Fayetteville 34.5 kV | Engineering and Procurement |
| **AE2-001** | Nittany-Zion 46 kV | Active |
| **AE2-055** | Shingletown-Boalsburg 46 kV | Suspended |
| **AE2-113** | Farmers Valley-Ridgeway 115 kV | Active |
| **AE2-117** | ABW Tap-Alexandria 46 kV | Active |
| **AE2-118** | ABW Tap-Williamsburg 46 kV | Active |
| **AE2-120** | Graymont-Zion 46 kV | Active |
| **AE2-121** | Milesburg-Tanney Junction 46 kV | Active |
| **AE2-126** | Dubois-Curwensville 34.5 kV | Engineering and Procurement |
| **AE2-129** | Philipsburg-Clarence 34.5 kV | Engineering and Procurement |
| **AE2-131** | Philipsburg-Karthaus 34.5 | Suspended |
| **AE2-224** | Bearrock-Johnstown 230 kV | Active |
| **AE2-248** | Fillmore-Thompson Farm 46 kV | Active |
| **AE2-262** | Moshannon-Milesburg 230 kV | Active |
| **AE2-263** | Moshannon-Milesburg 230 kV | Active |
| **AE2-264** | Altoona-Raystown 230 kV | Active |
| **AE2-316** | Brookville-Squab Hollow 138 kV | Active |
| **AF1-043** | Moshannon-East Towanda 230 kV | Active |
| **AF1-068** | Boalsburg-Centre Hall 46 kV | Withdrawn |
| **AF1-099** | Moshannon-Milesburg 230 kV | Active |
| **AF1-100** | Shawville-Moshannon 230 kV | Active |
| **AF1-112** | Centre Hall-Boalsburg 46 kV | Active |
| **AF1-132** | Shingletown-Boalsburg 46 kV | Withdrawn |
| **AF1-134** | Philipsburg-Madera 34.5 kV | Active |
| **AF1-142** | Moshannon-Milesburg 230 kV | Active |
| **AF1-153** | Motion-Ridgeway 46 kV | Active |
| **AF1-155** | Paper City-Wilcox 46 kV | Engineering and Procurement |
| **AF1-166** | Target-Chambers No.5 34.5 kV | Engineering and Procurement |
| **AF1-214** | Nittany-Zion 46 kV | Withdrawn |
| **AF1-224** | Fayetteville 34.5 kV | Engineering and Procurement |
| **AF1-302** | Brookville-Squab Hollow 138 kV | Active |
| **AF1-306** | Squab Hollow 230 kV | Active |

| Queue Number | Project Name | Status |
|---|---|---|
| **AF2-039** | Shawville-Clearfield 34.5 kV | Active |
| **AF2-050** | Bearrock-Johnstown 230 kV | Active |
| **AF2-087** | East Altoona-Pinecroft 12.47 kV | Suspended |
| **AF2-088** | Shawville-Clearfield 34.5 kV II | Active |
| **AF2-101** | Allen 13.2 kV | Engineering and Procurement |
| **AF2-121** | Philipsburg-Shawville 34.5 kV | Active |
| **AF2-146** | Hill Valley-Valley REC 46 kV | Active |
| **AF2-148** | Shade Gap-Three Springs KTS 23 kV | Active |
| **AF2-151** | Dillsburg 13.2 kV | Engineering and Procurement |
| **AF2-215** | Saint Thomas-LeMasters Junction 34.5 kV | Engineering and Procurement |
| **AF2-271** | Pemberton-Sinking Valley 12.47 kV | Engineering and Procurement |
| **AF2-275** | Guilford 12.47 kV | Active |
| **AF2-276** | Guilford 12.47 kV | Active |
| **AF2-293** | Beech Creek 12.47 kV | Active |
| **AF2-295** | Wilcox-Paper City 46 kV | Active |
| **AF2-296** | Madera 34.5 kV | Active |
| **AG1-090** | Philipsburg 115 kV | Active |
| **AG1-144** | Phillipsburg 34.5 kV | Active |
| **AG1-206** | Snyder Twp 34.5 kV | Active |
| **AG1-242** | Beccaria 34.5 kV | Active |
| **AG1-257** | Madisonburg Jct-Millheim 46 kV | Active |
| **AG1-258** | Madisonburg Jct-Millheim 46 kV | Active |
| **AG1-280** | Claysburg-Puzzletown 46 kV | Active |
| **AG1-281** | Claysburg-HCR Tap 46 kV | Active |
| **AG1-301** | Miller REC-Warrior Ridge 46 kV | Active |
| **AG1-308** | Shawville-Philipsburg 115 kV | Active |
| **AG1-377** | Philipsburg 115 kV | Active |
| **AG1-378** | Philipsburg 115 kV | Active |
| **AG1-385** | Motion-Ridgeway 46 kV | Active |
| **AG1-395** | Philipsburg-Karthaus 34.5 kV 2 | Active |
| **AG1-473** | Shingletown-Lewistown 230 kV | Active |
| **AG1-484** | Mountain 115 kV | Active |
| **AG1-515** | Guilford 138 kV | Active |
| **AG1-560** | Shade Gap-Roxbury 115 kV II | Active |
| **AG1-561** | Roxbury-Greene 138 kV II | Active |

## 11.8 Contingency Descriptions

| Contingency Name | Contingency Definition |
|---|---|
| **PN-P2_3-PN-230-0347-16-DRT-029** | CONTINGENCY 'PN-P2_3-PN-230-0347-16-DRT-029' /* 26LEWISTOWN-26RAYSTOWN 230 AND B5 FAULT<br>DISCONNECT BRANCH FROM BUS 200513 TO BUS 208005 CKT 1 /* 26LEWISTOWN-08JUNITA 230 AND B89 FAULT<br>OPEN BUS 200531 /* 26LEWISTOWN 230 BUS 2<br>END |
| **PL:10:P45:102437** | CONTINGENCY 'PL:10:P45:102437' /* JUNI BU2 230KV BUS; BUS_SEC_1-2 CB @ JUNI 230KV<br>DISCONNECT BUS 208004 /* JUNI BU1 230<br>DISCONNECT BUS 208005 /* JUNI BU2 230<br>END |
| **PN-P1-2-PN-115-094_NON** | CONTINGENCY 'PN-P1-2-PN-115-094_NON' /* ROXBURY - AE1-071 - SHADE GAP 115KV<br>DISCONNECT BRANCH FROM BUS 200520 TO BUS 938380 CKT 1 /* 26ROXBURY 115 26AE1-071-POI 115<br>DISCONNECT BRANCH FROM BUS 200522 TO BUS 938380 CKT 1 /* 26SHADE GP 115 26AE1-071-POI 115<br>END |
| **PL:10:P13:100618** | CONTINGENCY 'PL:10:P13:100618' /* JUNIATA 230/69KV TR4 OUT"<br>DISCONNECT BRANCH FROM BUS 208005 TO BUS 209997 CKT 4 /*<br>DISCONNECT BRANCH FROM BUS 208005 TO BUS 207955 CKT 1 /*<br>DISCONNECT BRANCH FROM BUS 208005 TO BUS 200009 CKT 2 /*<br>REMOVE SHUNT 1 FROM BUS 208004 /*<br>DISCONNECT BRANCH FROM BUS 208005 TO BUS 208004 CKT 1 /*<br>DISCONNECT BRANCH FROM BUS 208005 TO BUS 200513 CKT 1 /*<br>END |
| **PL:10:P24:100548** | CONTINGENCY 'PL:10:P24:100548' /* JUNI 230KV BUS_SEC_1-2 CB<br>DISCONNECT BUS 208005 /* JUNI BU2 230<br>DISCONNECT BUS 208004 /* JUNI BU1 230 /* JUNI BU1 230<br>END |
| **Base Case** | |

# 12 Short Circuit Analysis

The following Breakers are overdutied:

None

## 12.1 System Reinforcements - Short Circuit

None

# 13 Affected Systems

## 13.1 NYISO

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

## 13.2 MISO

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

## 14 Attachment 1: One Line Diagram