# Generation Interconnection

# Feasibility Study Report

# for

# Queue Project AG1-257

# MADISONBURG JCT-MILLHEIM 46 KV

# 8.3 MW Capacity / 19.9 MW Energy

January 2021

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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 APS.

## 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 Centre County, Pennsylvania. The installed facilities will have a total capability of 19.9 MW with 8.3 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is August 01, 2022. This study does not imply a TO commitment to this in-service date.

| Queue Number | AG1-257 |
|---|---|
| Project Name | MADISONBURG JCT-MILLHEIM 46 KV |
| State | Pennsylvania |
| County | Centre |
| Transmission Owner | APS |
| MFO | 19.9 |
| MWE | 19.9 |
| MWC | 8.3 |
| 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

## 4.1 Primary Point of Interconnection

AG1-257 will interconnect with the FirstEnergy, West Penn Power system. The interconnection of the project will be accomplished by tapping the Madisonburg Junction - Millheim 46 kV line and constructing a one span tap. The transmission line tap will be located approximately 2.8 miles from Madisonburg Junction and 1.6 miles from the Millheim 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 Attachment facilities. The IC will also be responsible for the rough grade of the property and an access road to the proposed site. The project will also require non-direct connection upgrades at Centre Hall and Pleasant Gap substations.

Attachment 1 shows a one-line diagram of the proposed connection facilities for the AG1-257 generation project to connect to the FirstEnergy ("FE") transmission system. IC will be responsible for constructing all of the facilities on its side of the POI, including the Attachment facilities which connect the generator to the FE transmission system.

## 4.2 Secondary Point of Interconnection

There is no secondary point of interconnection specified for AG1-257.

# 5 Cost Summary

The AG1-257 project will be responsible for the following costs:

| Description | Total Cost |
|---|---|
| **Total Physical Interconnection Costs** | $1,220,911 |
| **Total System Network Upgrade Costs (TO identified)** | $455,884[1] |
| **Total System Network Upgrade Costs (PJM identified)** | $148,836,612[2] |
| **Total Costs** | $150,513,407 |

[1] This project currently causes and contributes to overloads of the TO system (see Transmission Owner 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.

[2] This project currently causes and/or 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.

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.

## 6 Transmission Owner Scope of Work

AG1-257 will interconnect with the FirstEnergy (APS) system. The interconnection of the project at the Primary POI will be accomplished by tapping the Madisonburg Junction - Millheim 46 kV line and constructing a one span tap. The transmission line tap will be located approximately 2.8 miles from Madisonburg Junction and 1.6 miles from the Millheim 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 Attachment facilities. The IC will also be responsible for the rough grade of the property and an access road to the proposed site. The project will also require non-direct connection upgrades at Centre Hall and Pleasant Gap substations.

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

| **Description** | **Total Cost** |
|---|---|
| Construct a one span 46 kV tap into the interconnection customer's substation & install a 600 A loadbreak tap switch. Install FE owned 46 kV metering in the interconnection customer's substation. | $45,231 |
| Construct a tap and install 2 - 46 kV 1200 A network switches on the Centre Hall - Pleasant Gap 46 kV line between Madisonburg Junction and Millheim Substation. | $131,680 |
| Upgrade relaying at Centre Hall Substation. | $522,000 |
| Upgrade relaying at Pleasant Gap Substation. | $522,000 |
| **Total Physical Interconnection Costs** | **$1,220,911** |

# 7 Schedule

Based on the scope of work for the Attachment Facilities and the Direct and/or Non-Direct Connection 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 includes the requirement for the IC to make a preliminary payment that compensates FE for the first three months of the engineering design work that is related to the Attachment Facilities. Full initial payment is required for Non-Direct Connection work. 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 work 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.

# 8 Transmission Owner Analysis[3]

## 8.1 Transmission Owner Identified Network Impacts to Distribution Facilities

Potential TO identified network impacts to Transmission Owner distribution facilities were as follows:

| Idx | Overloaded Element | Contingency | Rating [MVA] | Loading Before % | Loading After % | Contribution [MW] |
|---|---|---|---|---|---|---|
| 90 | 940680 AE2-055 TAP 46.0 236711<br>01SHINGLTN 46.0 1 | Base Case | 57 | 89.00% | 101.00% | 6.84 |

## 8.2 Transmission Owner Identified Network Impacts to Sub-Regional Facilities

Potential TO identified network impacts to Transmission Owner Sub-Regional facilities were as follows:

None

## 8.3 System Reinforcements on Distribution Facilities

| Idx | Facility | Upgrade ID | Upgrade Description | Cost |
|---|---|---|---|---|
| 90 | 940680 AE2-055 TAP 46.0 236711<br>01SHINGLTN 46.0 1 | WP-AG1-F-0043 | **APS**<br>Replace 46 kV line side and bus side disconnect switches and substation conductor at Shingletown substation. Adjust line relaying as necessary at Shingletown.<br><br>Time Estimate: 12<br>Cost: $455,884 | $455,884 |
| | | | **TOTAL COST** | **$455,884** |

[3] For TO Distribution Facilities that need upgrades, the TO has applied their cost allocation rules. For TO Sub-Regional Facilities in need of upgrades, PJM Cost Allocation Criteria has been applied.

## 8.4 System Reinforcements on Sub-Regional Facilities

None

# 9 Interconnection Customer Requirements

## 9.1 System Protection

The IC must design its Customer Facilities in accordance with all applicable standards, including the standards in FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx.

Preliminary Protection requirements will be provided as part of the Facilities Study. Detailed Protection Requirements will be provided once the project enters the construction phase

## 9.2 Compliance Issues and Interconnection Customer Requirements

The proposed Customer Facilities must be designed in accordance with FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx. In particular, the IC is responsible for the following:

1. The purchase and installation of a fully rated 46 kV circuit breaker to protect the AG1-257 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 AG1-257 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 AG1-257 was evaluated as a 19.9 MW (Capacity 8.3 MW) injection tapping the Madisonburg to Millhelm 46 kV line in the APS area. Project AG1-257 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-257 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)

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 164983137 | 200769 | 26HOMER CY | 345.0 | PENELEC | 999325 | 26HOMER CT | 1.0 | PENELEC | S | AP-P2-2-WP-230-005T | bus | 827.0 | 99.98 | 100.07 | DC | 1.56 |
| 164983142 | 999325 | 26HOMER CT | 1.0 | PENELEC | 200767 | 26HOMER CT | 230.0 | PENELEC | S | AP-P2-2-WP-230-005T | bus | 827.0 | 99.98 | 100.07 | DC | 1.56 |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 165768708 | 200522 | 26SHADE GP | 115.0 | PENELEC | 938380 | AE1-071-POI | 115.0 | PENELEC | 1 | PL:10:P24:100548 | bus | 160.0 | 197.87 | 199.38 | DC | 2.43 |
| 165957881 | 200522 | 26SHADE GP | 115.0 | PENELEC | 938380 | AE1-071-POI | 115.0 | PENELEC | 1 | PL:10:P45:102437 | breaker | 160.0 | 197.87 | 199.38 | DC | 2.43 |
| 165957882 | 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 | 192.91 | 194.43 | DC | 2.42 |
| 164447297 | 235175 | 01ELKO | 230.0 | AP | 235971 | 01SQUABHLLW | 230.0 | AP | 1 | PN-P2-2-PN-230-007T | bus | 621.0 | 108.94 | 110.1 | DC | 7.16 |
| 164447502 | 235175 | 01ELKO | 230.0 | AP | 235971 | 01SQUABHLLW | 230.0 | AP | 1 | PN-P2-3-PN-230-14CT | breaker | 621.0 | 108.97 | 110.12 | DC | 7.16 |
| 164447503 | 235175 | 01ELKO | 230.0 | AP | 235971 | 01SQUABHLLW | 230.0 | AP | 1 | PN-P2-3-PN-230-14BT | breaker | 621.0 | 108.93 | 110.08 | DC | 7.16 |
| 164447504 | 235175 | 01ELKO | 230.0 | AP | 235971 | 01SQUABHLLW | 230.0 | AP | 1 | PN-P2_3-PN-230-0347-12-DRT-025 | breaker | 621.0 | 108.13 | 109.28 | DC | 7.14 |
| 165768703 | 938380 | AE1-071-POI | 115.0 | PENELEC | 200520 | 26ROXBURY | 115.0 | PENELEC | 1 | PL:10:P24:100548 | bus | 160.0 | 230.73 | 232.24 | DC | 2.43 |
| 165957871 | 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 | 233.04 | 234.56 | DC | 2.42 |
| 165957872 | 938380 | AE1-071-POI | 115.0 | PENELEC | 200520 | 26ROXBURY | 115.0 | PENELEC | 1 | PL:10:P45:102437 | breaker | 160.0 | 230.73 | 232.24 | DC | 2.43 |
| 165768807 | 999327 | 26SHAWVL 1 | 1.0 | PENELEC | 200714 | 26SHAWVL 1 | 115.0 | PENELEC | 1A | AP-P2-2-WP-230-001T | bus | 126.0 | 128.7 | 129.27 | DC | 1.59 |
| 165957985 | 999327 | 26SHAWVL 1 | 1.0 | PENELEC | 200714 | 26SHAWVL 1 | 115.0 | PENELEC | 1A | AP-P2-3-WP-230-446T | breaker | 126.0 | 128.78 | 129.35 | DC | 1.59 |
| 165957986 | 999327 | 26SHAWVL 1 | 1.0 | PENELEC | 200714 | 26SHAWVL 1 | 115.0 | PENELEC | 1A | AP-P2-3-WP-230-443T * | breaker | 126.0 | 128.7 | 129.27 | DC | 1.59 |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **167649446** | 200513 | 26LEWISTWN | 230.0 | PENELEC | 208005 | JUNI BU2 | 230.0 | PPL | 1 | Base Case | operation | 493.0 | 183.09 | 184.43 | DC | 6.61 |
| **167649447** | 200513 | 26LEWISTWN | 230.0 | PENELEC | 208005 | JUNI BU2 | 230.0 | PPL | 1 | PN-P1-2-PN-115-094_NON | operation | 618.0 | 160.51 | 161.69 | DC | 7.29 |
| **166197659** | 200522 | 26SHADEGP | 115.0 | PENELEC | 938380 | AE1-071-POI | 115.0 | PENELEC | 1 | PL:10:P13:100618 | operation | 160.0 | 192.36 | 193.87 | DC | 2.43 |
| **166197755** | 200714 | 26SHAWVL1 | 115.0 | PENELEC | 200872 | 26BIOEN TP | 115.0 | PENELEC | 1 | AP-P1-3-WP-230-326T-B | operation | 185.0 | 134.4 | 135.53 | DC | 2.1 |
| **166197903** | 200727 | 26SHAW. 2 | 115.0 | PENELEC | 964450 | AG1-308 TAP | 115.0 | PENELEC | 1 | AP-P1-3-WP-230-326T-B | operation | 202.0 | 105.33 | 106.34 | DC | 2.05 |
| **167905107** | 235157 | 01CARB | 138.0 | AP | 235159 | 01CARB J | 138.0 | AP | 1 | AP-P1-3-WP-230-001 | operation | 299.0 | 111.29 | 112.31 | DC | 3.04 |
| **167905046** | 235159 | 01CARB J | 138.0 | AP | 235174 | 01ELKO | 138.0 | AP | 1 | AP-P1-3-WP-230-001 | operation | 192.0 | 121.76 | 122.97 | DC | 2.31 |
| **164447845** | 235175 | 01ELKO | 230.0 | AP | 235971 | 01SQUABHLLW | 230.0 | AP | 1 | AP-P1-3-WP-230-326T-B | operation | 621.0 | 108.05 | 109.2 | DC | 7.14 |
| **164447813** | 235219 | 01MILESB | 230.0 | AP | 235970 | 01DALE | 230.0 | AP | 1 | Base Case | operation | 548.0 | 99.64 | 100.01 | DC | 2.01 |
| **164447684** | 235248 | 01SHINGL | 230.0 | AP | 966040 | AG1-473 TAP | 230.0 | AP | 1 | PL:03:P12:000193 | operation | 621.0 | 181.88 | 183.51 | DC | 10.06 |
| **164447686** | 235248 | 01SHINGL | 230.0 | AP | 966040 | AG1-473 TAP | 230.0 | AP | 1 | Base Case | operation | 520.0 | 178.39 | 180.29 | DC | 9.85 |
| **164447704** | 235970 | 01DALE | 230.0 | AP | 235248 | 01SHINGL | 230.0 | AP | 1 | AP-P1-3-WP-230-325T | operation | 554.0 | 142.08 | 143.09 | DC | 5.61 |
| **164447711** | 235970 | 01DALE | 230.0 | AP | 235248 | 01SHINGL | 230.0 | AP | 1 | Base Case | operation | 489.0 | 99.84 | 101.09 | DC | 6.13 |
| **166197647** | 938380 | AE1-071-POI | 115.0 | PENELEC | 200520 | 26ROXBURY | 115.0 | PENELEC | 1 | PL:10:P13:100618 | operation | 160.0 | 228.69 | 230.21 | DC | 2.43 |
| **166197802** | 964450 | AG1-308 TAP | 115.0 | PENELEC | 200716 | 26PHILIPSB | 115.0 | PENELEC | 1 | AP-P1-3-WP-230-326T-B | operation | 202.0 | 124.22 | 125.23 | DC | 2.05 |
| **164447674** | 966040 | AG1-473 TAP | 230.0 | AP | 200513 | 26LEWISTWN | 230.0 | PENELEC | 1 | PL:03:P12:000193 | operation | 621.0 | 181.8 | 183.42 | DC | 10.06 |
| **164447676** | 966040 | AG1-473 TAP | 230.0 | AP | 200513 | 26LEWISTWN | 230.0 | PENELEC | 1 | Base Case | operation | 520.0 | 178.3 | 180.19 | DC | 9.85 |
| **166197834** | 999327 | 26SHAWVL1 | 1.0 | PENELEC | 200714 | 26SHAWVL1 | 115.0 | PENELEC | 1A | AP-P1-3-WP-230-326T-B | operation | 126.0 | 123.73 | 124.35 | DC | 1.74 |

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

| ID | Idx | Facility | Upgrade Description | Cost |
|---|---|---|---|---|
| 165768708,165957881,165957882 | 3 | 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 |
|---|---|---|---|---|
| 164447504,164447502,164447297,164447503 | 4 | 01ELKO 230.0 kV - 01SQUABHLLW 230.0 kV Ckt 1 | **APS**<br>**WP-AG1-F-0004A (1181) : Replace 1033.5 ACSR & 1272 ACSR bus conductor at Elko substation.**<br>**Project Type : FAC**<br>**Cost : $162,816**<br>**Time Estimate : 12.0 Months**<br><br>**WP-AG1-F-0004B (1182) : Replace 1033.5 ACSR bus conductor at Squab Hollow.**<br>**Project Type : FAC**<br>**Cost : $162,816**<br>**Time Estimate : 12.0 Months**<br><br>**WP-AG1-F-0004C (1183) : Replace 1033.5 ACSR line riser at Elko substation.**<br>**Project Type : FAC**<br>**Cost : $162,816**<br>**Time Estimate : 12.0 Months**<br><br>**WP-AG1-F-0004D (1184) : Replace 1033.5 ACSR line riser at Squab Hollow substation.**<br>**Project Type : FAC**<br>**Cost : $162,816**<br>**Time Estimate : 12.0 Months**<br><br>**WP-AG1-F-0004E (1185) : Reconductor 4.03 miles of 1033.5 ACSR from Elko to Squab Hollow 230 kV (35 spans).**<br>**Project Type : FAC**<br>**Cost : $18,235,350**<br>**Time Estimate : 36.0 Months** | $18,886,612 |
| 164983137 | 1 | 26HOMER CY 345.0 kV - 26HOMER CT 1.0 kV Ckt S | **PENELEC**<br>**PN-AF2-F-0005 (1358) :**<br>**1) Construct 500 kV yard consisting of three-500 kV breakers configured in a breaker-and-a-half layout (initially a ring bus)**<br>**Tap the Keystone - Conemaugh 500 kV line and loop into the new Homer City 500 kV yard**<br>**2) Install one 500/345 kV transformer**<br>**3) Install a new 345 kV breaker-and-a-half string using three new breakers**<br>**Project Type : CON**<br>**Cost : $85,600,000**<br>**Time Estimate : 48.0 Months** | $85,600,000 |
| 164983142 | 2 | 26HOMER CT 1.0 kV - 26HOMER CT 230.0 kV Ckt S | | |
| 165957985,165768807,165957986 | 6 | 26SHAWVL 1 1.0 kV - 26SHAWVL 1 115.0 kV Ckt 1A | **PENELEC**<br>**PN-AF2-F-0021 (1423) : Replace 230/115-17.2 kV transformer with a larger unit.**<br>**Project Type : FAC**<br>**Cost : $5,600,000**<br>**Time Estimate : 30.0 Months** | $5,600,000 |

| ID | Idx | Facility | Upgrade Description | Cost |
|---|---|---|---|---|
| 165768703,165957871,165957872 | 5 | 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** | **$148,836,612** |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **164983137** | 200769 | 26HOMER CY | PENELEC | 999325 | 26HOMER CT | PENELEC | S | AP-P2-2-WP-230-005T | bus | 827.0 | 99.98 | 100.07 | DC | 1.56 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **200823** | 26MHP_X3-003 | 4.0900 | Adder | 4.81 |
| **200829** | 26HNSMLK 2 | 1.3168 | 50/50 | 1.3168 |
| **200830** | 26HNSMLK 3 | 1.3168 | 50/50 | 1.3168 |
| **200831** | 26HNSMLK 4 | 1.3168 | 50/50 | 1.3168 |
| **200832** | 26HNSMLK 5 | 1.3168 | 50/50 | 1.3168 |
| **200835** | 26ARN_Z1-066 | -0.4731 | Adder | -0.56 |
| **200838** | 26HOMER C2 | 28.8964 | 50/50 | 28.8964 |
| **200839** | 26HOMER C3 | 30.5907 | 50/50 | 30.5907 |
| **200894** | 26K02 | 4.5805 | Adder | 5.39 |
| **203349** | 26Z1-069 C | 0.3362 | 50/50 | 0.3362 |
| **203932** | AA2-133 GEN | 1.5442 | Adder | 1.82 |
| **203999** | P-047 E | 9.6028 | Adder | 11.3 |
| **235003** | AC1-025 E | 0.0993 | Adder | 0.12 |
| **236828** | 01GRAYMONT | 0.2688 | Adder | 0.32 |
| **294573** | P-028 E | 7.9162 | Adder | 9.31 |
| **915951** | Y3-092 FTIR | 87.3300 | Merchant Transmission | 87.3300 |
| **916202** | Z1-069 E | 9.0833 | 50/50 | 9.0833 |
| **917673** | Z2-108 BAT | 1.2523 | Merchant Transmission | 1.2523 |
| **919201** | AA1-144 OP | 13.9201 | Adder | 16.38 |
| **920341** | **AA2-132 (Withdrawn : 12/07/2020)** | **1.9992** | **Adder** | **2.35** |
| **921642** | AA2-000 | 35.8603 | Adder | 42.19 |
| **930511** | AB2-092 | 1.3167 | Adder | 1.55 |
| **931091** | AB1-160 C | 0.0961 | 50/50 | 0.0961 |
| **931092** | AB1-160 E | 2.5952 | 50/50 | 2.5952 |
| **936421** | AD2-055 | 2.7108 | Adder | 3.19 |
| **938352** | AE1-053 BAT | 0.6957 | Merchant Transmission | 0.6957 |
| **938951** | AE1-123 | 1.1839 | Adder | 1.39 |
| **939171** | AE1-147 C | 0.8086 | Adder | 0.95 |
| **939172** | AE1-147 E | 0.5390 | Adder | 0.63 |
| **939291** | AE1-160 C | 1.0201 | Adder | 1.2 |
| **939292** | AE1-160 E | 0.5864 | Adder | 0.69 |
| **940201** | AE2-001 C | 0.8073 | Adder | 0.95 |
| **940202** | AE2-001 E | 0.5382 | Adder | 0.63 |
| **940681** | **AE2-055 C (Suspended)** | **0.7876** | **Adder** | **0.93** |
| **940682** | **AE2-055 E (Suspended)** | **0.5251** | **Adder** | **0.62** |
| **940861** | AE2-074 C | 2.4726 | 50/50 | 2.4726 |
| **940862** | AE2-074 E | 3.2548 | 50/50 | 3.2548 |
| **941191** | AE2-113 C | 7.4297 | Adder | 8.74 |
| **941192** | AE2-113 E | 7.9994 | Adder | 9.41 |
| **941261** | AE2-120 C | 0.8067 | Adder | 0.95 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **941262** | AE2-120 E | 0.5378 | Adder | 0.63 |
| **941271** | AE2-121 C | 0.4307 | Adder | 0.51 |
| **941272** | AE2-121 E | 0.2876 | Adder | 0.34 |
| **941321** | AE2-126 C | 0.8490 | Adder | 1.0 |
| **941322** | AE2-126 E | 0.5660 | Adder | 0.67 |
| **941421** | AE2-139 C | 2.7184 | Adder | 6.03 |
| **941422** | AE2-139 E | 1.8123 | Adder | 4.02 |
| **942351** | AE2-248 C | 0.6373 | Adder | 0.75 |
| **942352** | AE2-248 E | 0.4249 | Adder | 0.5 |
| **942491** | AE2-262 C | 3.5284 | Adder | 4.15 |
| **942492** | AE2-262 E | 2.3711 | Adder | 2.79 |
| **942501** | AE2-263 C | 3.3166 | Adder | 3.9 |
| **942502** | AE2-263 E | 2.2144 | Adder | 2.61 |
| **942811** | AE2-299 C | 2.8070 | Adder | 3.3 |
| **942812** | AE2-299 E | 11.2282 | Adder | 13.21 |
| **942961** | AE2-316 C | 3.8352 | Adder | 4.51 |
| **942962** | AE2-316 E | 5.4689 | Adder | 6.43 |
| **943151** | AE2-344 C | 5.9766 | Adder | 7.03 |
| **943152** | AE2-344 E | 3.9844 | Adder | 4.69 |
| **943351** | AF1-006 C | 1.0407 | Adder | 1.22 |
| **943352** | AF1-006 E | 0.5854 | Adder | 0.69 |
| **943751** | AF1-043 | 8.1325 | Adder | 9.57 |
| **944001** | **AF1-068 C O1 (Withdrawn : 12/15/2020)** | **0.8465** | **Adder** | **1.0** |
| **944002** | **AF1-068 E O1 (Withdrawn : 12/15/2020)** | **0.4761** | **Adder** | **0.56** |
| **944261** | AF1-094 C | 0.9897 | Adder | 1.16 |
| **944262** | AF1-094 E | 0.6598 | Adder | 0.78 |
| **944281** | AF1-096 C | 0.9639 | Adder | 1.13 |
| **944282** | AF1-096 E | 0.6426 | Adder | 0.76 |
| **944301** | AF1-098 C | 4.2191 | Adder | 4.96 |
| **944302** | AF1-098 E | 2.8128 | Adder | 3.31 |
| **944311** | AF1-099 C | 5.3560 | Adder | 6.3 |
| **944312** | AF1-099 E | 3.5707 | Adder | 4.2 |
| **944321** | AF1-100 C | 10.4359 | Adder | 12.28 |
| **944322** | AF1-100 E | 6.9572 | Adder | 8.18 |
| **944381** | AF1-103 O1 | 2.0587 | Adder | 2.42 |
| **944391** | AF1-104 O1 | 1.5480 | Adder | 1.82 |
| **944411** | AF1-106 O1 | 2.1891 | Adder | 2.58 |
| **944471** | AF1-112 C | 0.7984 | Adder | 0.94 |
| **944472** | AF1-112 E | 0.5322 | Adder | 0.63 |
| **944671** | **AF1-132 C O1 (Withdrawn : 12/15/2020)** | **0.7921** | **Adder** | **0.93** |
| **944672** | **AF1-132 E O1 (Withdrawn : 12/15/2020)** | **0.5281** | **Adder** | **0.62** |
| **944751** | AF1-140 C | -0.6280 | Adder | -0.74 |
| **944771** | AF1-142 C | 8.5697 | Adder | 10.08 |
| **944772** | AF1-142 E | 5.7131 | Adder | 6.72 |
| **944881** | AF1-153 C O1 | 0.9849 | Adder | 1.16 |
| **944882** | AF1-153 E O1 | 0.6566 | Adder | 0.77 |
| **944901** | AF1-155 C | 0.9858 | Adder | 1.16 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| 944902 | AF1-155 E | 0.6572 | Adder | 0.77 |
| 945021 | AF1-167 C | 0.6372 | Adder | 0.75 |
| 945022 | AF1-167 E | 0.4256 | Adder | 0.5 |
| 945051 | AF1-170 C | 3.8568 | Adder | 4.54 |
| 945052 | AF1-170 E | 2.5712 | Adder | 3.02 |
| 945451 | AF1-210 C | 0.7178 | Adder | 0.84 |
| 945452 | AF1-210 E | 0.4785 | Adder | 0.56 |
| 945491 | AF1-214 C (Withdrawn : 12/03/2020) | 0.8068 | Adder | 0.95 |
| 945492 | AF1-214 E (Withdrawn : 12/03/2020) | 0.5379 | Adder | 0.63 |
| 945673 | AF1-232 BAT (Withdrawn : 01/19/2021) | 1.6250 | Merchant Transmission | 1.6250 |
| 946111 | AF1-276 C | 11.0537 | 50/50 | 11.0537 |
| 946112 | AF1-276 E | 5.4443 | 50/50 | 5.4443 |
| 946121 | AF1-277 C | 11.0537 | 50/50 | 11.0537 |
| 946122 | AF1-277 E | 5.4443 | 50/50 | 5.4443 |
| 946131 | AF1-278 C | 8.8165 | 50/50 | 8.8165 |
| 946132 | AF1-278 E | 4.3819 | 50/50 | 4.3819 |
| 946211 | AF1-286 C | 0.8866 | Adder | 1.04 |
| 946212 | AF1-286 E | 0.6020 | Adder | 0.71 |
| 946221 | AF1-287 C | 1.0306 | Adder | 1.21 |
| 946222 | AF1-287 E | 0.6871 | Adder | 0.81 |
| 946381 | AF1-302 C | 1.6747 | Adder | 1.97 |
| 946382 | AF1-302 E | 2.2330 | Adder | 2.63 |
| 946401 | AF1-304 C | 4.7700 | Adder | 5.61 |
| 946402 | AF1-304 E | 3.1800 | Adder | 3.74 |
| 946421 | AF1-306 C | 4.1188 | Adder | 4.85 |
| 946422 | AF1-306 E | 16.4754 | Adder | 19.38 |
| 946771 | AF1-217 C | 1.0306 | Adder | 1.21 |
| 946772 | AF1-217 E | 0.6871 | Adder | 0.81 |
| 957161 | AF2-010 C | 3.7892 | Adder | 4.46 |
| 957162 | AF2-010 E | 2.5536 | Adder | 3.0 |
| 957451 | AF2-039 C | 0.3964 | Adder | 0.47 |
| 957452 | AF2-039 E | 0.2642 | Adder | 0.31 |
| 957513 | AF2-045 BAT | 1.3979 | Merchant Transmission | 1.3979 |
| 957571 | AF2-051 C | 3.1545 | Adder | 3.71 |
| 957572 | AF2-051 E | 1.6250 | Adder | 1.91 |
| 957931 | AF2-087 C (Suspended) | -0.1551 | Adder | -0.18 |
| 957941 | AF2-088 C | 0.1908 | Adder | 0.22 |
| 957942 | AF2-088 E | 0.1272 | Adder | 0.15 |
| 958361 | AF2-130 C | 0.8674 | Adder | 1.02 |
| 958362 | AF2-130 E | 0.5783 | Adder | 0.68 |
| 958472 | AF2-141 BAT | 1.3914 | Merchant Transmission | 1.3914 |
| 958731 | AF2-164 C O1 | 6.3652 | Adder | 7.49 |
| 958732 | AF2-164 E O1 | 4.2435 | Adder | 4.99 |
| 958741 | AF2-165 C | 0.9681 | Adder | 1.14 |
| 958742 | AF2-165 E | 0.6454 | Adder | 0.76 |
| 958751 | AF2-166 C | 0.8674 | Adder | 1.02 |
| 958752 | AF2-166 E | 0.5783 | Adder | 0.68 |
| 959061 | AF2-197 C O1 | 3.6088 | Adder | 4.25 |
| 959062 | AF2-197 E O1 | 5.4133 | Adder | 6.37 |
| 959441 | AF2-235 C | 0.4819 | Adder | 0.57 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **959442** | AF2-235 E | 0.3213 | Adder | 0.38 |
| **959471** | AF2-238 C | 1.3362 | Adder | 1.57 |
| **959472** | AF2-238 E | 0.8908 | Adder | 1.05 |
| **959481** | AF2-239 C | 0.9687 | Adder | 1.14 |
| **959482** | AF2-239 E | 0.7767 | Adder | 0.91 |
| **959491** | AF2-240 C | 0.4137 | Adder | 0.49 |
| **959492** | AF2-240 E | 0.3524 | Adder | 0.41 |
| **959501** | AF2-241 C | 1.2368 | Adder | 1.46 |
| **959502** | AF2-241 E | 0.9523 | Adder | 1.12 |
| **959521** | AF2-243 C | 0.7261 | Adder | 0.85 |
| **959522** | AF2-243 E | 0.4840 | Adder | 0.57 |
| **959741** | AF2-265 C | 0.9576 | Adder | 1.13 |
| **959742** | AF2-265 E | 0.7126 | Adder | 0.84 |
| **959793** | AF2-270 BAT | 0.1216 | Merchant Transmission | 0.1216 |
| **959822** | AF2-273 E | 0.2847 | Adder | 0.33 |
| **960022** | AF2-293 E | 0.0786 | Adder | 0.09 |
| **960031** | AF2-294 C | 1.2055 | Adder | 1.42 |
| **960032** | AF2-294 E | 0.8037 | Adder | 0.95 |
| **960041** | AF2-295 C | 0.9858 | Adder | 1.16 |
| **960042** | AF2-295 E | 0.6572 | Adder | 0.77 |
| **960271** | AF2-318 C | 1.0472 | Adder | 1.23 |
| **960272** | AF2-318 E | 0.6982 | Adder | 0.82 |
| **960891** | AF2-380 C | 0.4594 | Adder | 0.54 |
| **960892** | AF2-380 E | 0.3063 | Adder | 0.36 |
| **961141** | AF2-405 | 1.0945 | Adder | 1.29 |
| **961151** | AF2-406 | 8.2091 | Adder | 9.66 |
| **961201** | **AF2-411 O1 (Withdrawn : 12/08/2020)** | **51.3300** | **50/50** | **51.3300** |
| **961211** | AF2-412 | 17.0888 | Adder | 20.1 |
| **961451** | AF2-436 | 0.1165 | Adder | 0.14 |
| **961971** | AG1-040 C | 0.5710 | Adder | 1.27 |
| **961972** | AG1-040 E | 0.3807 | Adder | 0.85 |
| **962511** | AG1-100 C | 0.5461 | Adder | 1.21 |
| **962512** | AG1-100 E | 0.3641 | Adder | 0.81 |
| **962642** | AG1-113 BAT | 0.3879 | Merchant Transmission | 0.3879 |
| **962652** | AG1-114 BAT | 0.3687 | Merchant Transmission | 0.3687 |
| **962891** | AG1-138 C | 0.1820 | Adder | 0.4 |
| **962892** | AG1-138 E | 0.0096 | Adder | 0.02 |
| **962901** | AG1-139 C | 0.2031 | Adder | 0.45 |
| **962902** | AG1-139 E | 0.0107 | Adder | 0.02 |
| **962911** | AG1-140 C | 0.0837 | Adder | 0.19 |
| **962912** | AG1-140 E | 0.0381 | Adder | 0.08 |
| **963281** | AG1-177 C O1 | 0.5245 | Adder | 1.16 |
| **963282** | AG1-177 E O1 | 0.3497 | Adder | 0.78 |
| **963441** | AG1-193 C | 0.5956 | Adder | 1.32 |
| **963442** | AG1-193 E | 0.3971 | Adder | 0.88 |
| **963481** | AG1-197 C | 0.4325 | Adder | 0.96 |
| **963482** | AG1-197 E | 0.2883 | Adder | 0.64 |
| **963491** | AG1-198 C | 0.3147 | Adder | 0.7 |
| **963492** | AG1-198 E | 0.2098 | Adder | 0.47 |
| **963531** | AG1-202 C | 0.2846 | Adder | 0.63 |
| **963532** | AG1-202 E | 0.1466 | Adder | 0.33 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **963571** | AG1-206 C | 0.2627 | Adder | 0.58 |
| **963572** | AG1-206 E | 0.1415 | Adder | 0.31 |
| **963941** | AG1-247 C | 0.2843 | Adder | 0.63 |
| **963942** | AG1-247 E | 0.1508 | Adder | 0.33 |
| **963991** | AG1-253 C | 0.1255 | Adder | 0.28 |
| **963992** | AG1-253 E | 0.0604 | Adder | 0.13 |
| **964031** | AG1-257 C | 0.2933 | Adder | 0.65 |
| **964032** | AG1-257 E | 0.4100 | Adder | 0.91 |
| **964041** | AG1-258 C | 0.2933 | Adder | 0.65 |
| **964042** | AG1-258 E | 0.4100 | Adder | 0.91 |
| **964341** | AG1-296 C | 0.3297 | Adder | 0.73 |
| **964342** | AG1-296 E | 0.1775 | Adder | 0.39 |
| **964411** | AG1-303 C O1 | 1.3375 | Adder | 2.97 |
| **964412** | AG1-303 E O1 | 0.8917 | Adder | 1.98 |
| **964701** | AG1-333 C | 0.2343 | Adder | 0.52 |
| **964702** | AG1-333 E | 0.0319 | Adder | 0.07 |
| **964753** | AG1-338 BAT | 0.1819 | Merchant Transmission | 0.1819 |
| **964763** | AG1-339 BAT | 0.1819 | Merchant Transmission | 0.1819 |
| **964773** | AG1-340 BAT | 0.1819 | Merchant Transmission | 0.1819 |
| **965201** | AG1-385 C | 0.6712 | Adder | 1.49 |
| **965202** | AG1-385 E | 0.1988 | Adder | 0.44 |
| **965241** | AG1-389 C O1 | 1.9321 | 50/50 | 1.9321 |
| **965242** | AG1-389 E O1 | 1.2881 | 50/50 | 1.2881 |
| **965251** | AG1-390 C O1 | 1.9321 | 50/50 | 1.9321 |
| **965252** | AG1-390 E O1 | 1.2881 | 50/50 | 1.2881 |
| **965261** | AG1-391 C O1 | 1.9321 | 50/50 | 1.9321 |
| **965262** | AG1-391 E O1 | 1.2881 | 50/50 | 1.2881 |
| **965271** | AG1-392 C O1 | 3.8642 | 50/50 | 3.8642 |
| **965272** | AG1-392 E O1 | 2.5762 | 50/50 | 2.5762 |
| **965861** | AG1-455 | 1.5386 | Adder | 3.42 |
| **966121** | AG1-481 | 0.8472 | Adder | 1.88 |
| **966771** | AG1-548 C | 5.0357 | Adder | 11.18 |
| **966772** | AG1-548 E | 1.5326 | Adder | 3.4 |
| **966783** | AG1-549 BAT | 0.8876 | Merchant Transmission | 0.8876 |
| **WEC** | WEC | 0.0740 | Confirmed LTF | 0.0740 |
| **LGEE** | LGEE | 0.1056 | Confirmed LTF | 0.1056 |
| **CALDERWOOD** | CALDERWOOD | 0.0080 | Confirmed LTF | 0.0080 |
| **CBM-W2** | CBM-W2 | 1.0125 | Confirmed LTF | 1.0125 |
| **TVA** | TVA | 0.0616 | Confirmed LTF | 0.0616 |
| **O-066** | O-066 | 3.9976 | Confirmed LTF | 3.9976 |
| **SIGE** | SIGE | 0.0805 | Confirmed LTF | 0.0805 |
| **CHEOAH** | CHEOAH | 0.0105 | Confirmed LTF | 0.0105 |
| **CBM-S1** | CBM-S1 | 0.0251 | Confirmed LTF | 0.0251 |
| **G-007** | G-007 | 0.6993 | Confirmed LTF | 0.6993 |
| **HAMLET** | HAMLET | 0.1270 | Confirmed LTF | 0.1270 |
| **MEC** | MEC | 0.3051 | Confirmed LTF | 0.3051 |
| **LAGN** | LAGN | 0.1067 | Confirmed LTF | 0.1067 |
| **CATAWBA** | CATAWBA | 0.0556 | Confirmed LTF | 0.0556 |
| **CBM-W1** | CBM-W1 | 4.5705 | Confirmed LTF | 4.5705 |

### 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **164983142** | 999325 | 26HOMER CT | PENELEC | 200767 | 26HOMER CT | PENELEC | S | AP-P2-2-WP-230-005T | bus | 827.0 | 99.98 | 100.07 | DC | 1.56 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **200823** | 26MHP_X3-003 | 4.0900 | Adder | 4.81 |
| **200829** | 26HNSMLK 2 | 1.3168 | 50/50 | 1.3168 |
| **200830** | 26HNSMLK 3 | 1.3168 | 50/50 | 1.3168 |
| **200831** | 26HNSMLK 4 | 1.3168 | 50/50 | 1.3168 |
| **200832** | 26HNSMLK 5 | 1.3168 | 50/50 | 1.3168 |
| **200835** | 26ARN_Z1-066 | -0.4731 | Adder | -0.56 |
| **200838** | 26HOMER C2 | 28.8964 | 50/50 | 28.8964 |
| **200839** | 26HOMER C3 | 30.5907 | 50/50 | 30.5907 |
| **200894** | 26K02 | 4.5805 | Adder | 5.39 |
| **203349** | 26Z1-069 C | 0.3362 | 50/50 | 0.3362 |
| **203932** | AA2-133 GEN | 1.5442 | Adder | 1.82 |
| **203999** | P-047 E | 9.6028 | Adder | 11.3 |
| **235003** | AC1-025 E | 0.0993 | Adder | 0.12 |
| **236828** | 01GRAYMONT | 0.2688 | Adder | 0.32 |
| **294573** | P-028 E | 7.9162 | Adder | 9.31 |
| **915951** | Y3-092 FTIR | 87.3300 | Merchant Transmission | 87.3300 |
| **916202** | Z1-069 E | 9.0833 | 50/50 | 9.0833 |
| **917673** | Z2-108 BAT | 1.2523 | Merchant Transmission | 1.2523 |
| **919201** | AA1-144 OP | 13.9201 | Adder | 16.38 |
| **920341** | **AA2-132 (Withdrawn : 12/07/2020)** | **1.9992** | **Adder** | **2.35** |
| **921642** | AA2-000 | 35.8603 | Adder | 42.19 |
| **930511** | AB2-092 | 1.3167 | Adder | 1.55 |
| **931091** | AB1-160 C | 0.0961 | 50/50 | 0.0961 |
| **931092** | AB1-160 E | 2.5952 | 50/50 | 2.5952 |
| **936421** | AD2-055 | 2.7108 | Adder | 3.19 |
| **938352** | AE1-053 BAT | 0.6957 | Merchant Transmission | 0.6957 |
| **938951** | AE1-123 | 1.1839 | Adder | 1.39 |
| **939171** | AE1-147 C | 0.8086 | Adder | 0.95 |
| **939172** | AE1-147 E | 0.5390 | Adder | 0.63 |
| **939291** | AE1-160 C | 1.0201 | Adder | 1.2 |
| **939292** | AE1-160 E | 0.5864 | Adder | 0.69 |
| **940201** | AE2-001 C | 0.8073 | Adder | 0.95 |
| **940202** | AE2-001 E | 0.5382 | Adder | 0.63 |
| **940681** | **AE2-055 C (Suspended)** | **0.7876** | **Adder** | **0.93** |
| **940682** | **AE2-055 E (Suspended)** | **0.5251** | **Adder** | **0.62** |
| **940861** | AE2-074 C | 2.4726 | 50/50 | 2.4726 |
| **940862** | AE2-074 E | 3.2548 | 50/50 | 3.2548 |
| **941191** | AE2-113 C | 7.4297 | Adder | 8.74 |
| **941192** | AE2-113 E | 7.9994 | Adder | 9.41 |
| **941261** | AE2-120 C | 0.8067 | Adder | 0.95 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **941262** | AE2-120 E | 0.5378 | Adder | 0.63 |
| **941271** | AE2-121 C | 0.4307 | Adder | 0.51 |
| **941272** | AE2-121 E | 0.2876 | Adder | 0.34 |
| **941321** | AE2-126 C | 0.8490 | Adder | 1.0 |
| **941322** | AE2-126 E | 0.5660 | Adder | 0.67 |
| **941421** | AE2-139 C | 2.7184 | Adder | 6.03 |
| **941422** | AE2-139 E | 1.8123 | Adder | 4.02 |
| **942351** | AE2-248 C | 0.6373 | Adder | 0.75 |
| **942352** | AE2-248 E | 0.4249 | Adder | 0.5 |
| **942491** | AE2-262 C | 3.5284 | Adder | 4.15 |
| **942492** | AE2-262 E | 2.3711 | Adder | 2.79 |
| **942501** | AE2-263 C | 3.3166 | Adder | 3.9 |
| **942502** | AE2-263 E | 2.2144 | Adder | 2.61 |
| **942811** | AE2-299 C | 2.8070 | Adder | 3.3 |
| **942812** | AE2-299 E | 11.2282 | Adder | 13.21 |
| **942961** | AE2-316 C | 3.8352 | Adder | 4.51 |
| **942962** | AE2-316 E | 5.4689 | Adder | 6.43 |
| **943151** | AE2-344 C | 5.9766 | Adder | 7.03 |
| **943152** | AE2-344 E | 3.9844 | Adder | 4.69 |
| **943351** | AF1-006 C | 1.0407 | Adder | 1.22 |
| **943352** | AF1-006 E | 0.5854 | Adder | 0.69 |
| **943751** | AF1-043 | 8.1325 | Adder | 9.57 |
| **944001** | **AF1-068 C O1 (Withdrawn : 12/15/2020)** | **0.8465** | **Adder** | **1.0** |
| **944002** | **AF1-068 E O1 (Withdrawn : 12/15/2020)** | **0.4761** | **Adder** | **0.56** |
| **944261** | AF1-094 C | 0.9897 | Adder | 1.16 |
| **944262** | AF1-094 E | 0.6598 | Adder | 0.78 |
| **944281** | AF1-096 C | 0.9639 | Adder | 1.13 |
| **944282** | AF1-096 E | 0.6426 | Adder | 0.76 |
| **944301** | AF1-098 C | 4.2191 | Adder | 4.96 |
| **944302** | AF1-098 E | 2.8128 | Adder | 3.31 |
| **944311** | AF1-099 C | 5.3560 | Adder | 6.3 |
| **944312** | AF1-099 E | 3.5707 | Adder | 4.2 |
| **944321** | AF1-100 C | 10.4359 | Adder | 12.28 |
| **944322** | AF1-100 E | 6.9572 | Adder | 8.18 |
| **944381** | AF1-103 O1 | 2.0587 | Adder | 2.42 |
| **944391** | AF1-104 O1 | 1.5480 | Adder | 1.82 |
| **944411** | AF1-106 O1 | 2.1891 | Adder | 2.58 |
| **944471** | AF1-112 C | 0.7984 | Adder | 0.94 |
| **944472** | AF1-112 E | 0.5322 | Adder | 0.63 |
| **944671** | **AF1-132 C O1 (Withdrawn : 12/15/2020)** | **0.7921** | **Adder** | **0.93** |
| **944672** | **AF1-132 E O1 (Withdrawn : 12/15/2020)** | **0.5281** | **Adder** | **0.62** |
| **944751** | AF1-140 C | -0.6280 | Adder | -0.74 |
| **944771** | AF1-142 C | 8.5697 | Adder | 10.08 |
| **944772** | AF1-142 E | 5.7131 | Adder | 6.72 |
| **944881** | AF1-153 C O1 | 0.9849 | Adder | 1.16 |
| **944882** | AF1-153 E O1 | 0.6566 | Adder | 0.77 |
| **944901** | AF1-155 C | 0.9858 | Adder | 1.16 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| 944902 | AF1-155 E | 0.6572 | Adder | 0.77 |
| 945021 | AF1-167 C | 0.6372 | Adder | 0.75 |
| 945022 | AF1-167 E | 0.4256 | Adder | 0.5 |
| 945051 | AF1-170 C | 3.8568 | Adder | 4.54 |
| 945052 | AF1-170 E | 2.5712 | Adder | 3.02 |
| 945451 | AF1-210 C | 0.7178 | Adder | 0.84 |
| 945452 | AF1-210 E | 0.4785 | Adder | 0.56 |
| 945491 | AF1-214 C (Withdrawn : 12/03/2020) | 0.8068 | Adder | 0.95 |
| 945492 | AF1-214 E (Withdrawn : 12/03/2020) | 0.5379 | Adder | 0.63 |
| 945673 | AF1-232 BAT (Withdrawn : 01/19/2021) | 1.6250 | Merchant Transmission | 1.6250 |
| 946111 | AF1-276 C | 11.0537 | 50/50 | 11.0537 |
| 946112 | AF1-276 E | 5.4443 | 50/50 | 5.4443 |
| 946121 | AF1-277 C | 11.0537 | 50/50 | 11.0537 |
| 946122 | AF1-277 E | 5.4443 | 50/50 | 5.4443 |
| 946131 | AF1-278 C | 8.8165 | 50/50 | 8.8165 |
| 946132 | AF1-278 E | 4.3819 | 50/50 | 4.3819 |
| 946211 | AF1-286 C | 0.8866 | Adder | 1.04 |
| 946212 | AF1-286 E | 0.6020 | Adder | 0.71 |
| 946221 | AF1-287 C | 1.0306 | Adder | 1.21 |
| 946222 | AF1-287 E | 0.6871 | Adder | 0.81 |
| 946381 | AF1-302 C | 1.6747 | Adder | 1.97 |
| 946382 | AF1-302 E | 2.2330 | Adder | 2.63 |
| 946401 | AF1-304 C | 4.7700 | Adder | 5.61 |
| 946402 | AF1-304 E | 3.1800 | Adder | 3.74 |
| 946421 | AF1-306 C | 4.1188 | Adder | 4.85 |
| 946422 | AF1-306 E | 16.4754 | Adder | 19.38 |
| 946771 | AF1-217 C | 1.0306 | Adder | 1.21 |
| 946772 | AF1-217 E | 0.6871 | Adder | 0.81 |
| 957161 | AF2-010 C | 3.7892 | Adder | 4.46 |
| 957162 | AF2-010 E | 2.5536 | Adder | 3.0 |
| 957451 | AF2-039 C | 0.3964 | Adder | 0.47 |
| 957452 | AF2-039 E | 0.2642 | Adder | 0.31 |
| 957513 | AF2-045 BAT | 1.3979 | Merchant Transmission | 1.3979 |
| 957571 | AF2-051 C | 3.1545 | Adder | 3.71 |
| 957572 | AF2-051 E | 1.6250 | Adder | 1.91 |
| 957931 | AF2-087 C (Suspended) | -0.1551 | Adder | -0.18 |
| 957941 | AF2-088 C | 0.1908 | Adder | 0.22 |
| 957942 | AF2-088 E | 0.1272 | Adder | 0.15 |
| 958361 | AF2-130 C | 0.8674 | Adder | 1.02 |
| 958362 | AF2-130 E | 0.5783 | Adder | 0.68 |
| 958472 | AF2-141 BAT | 1.3914 | Merchant Transmission | 1.3914 |
| 958731 | AF2-164 C O1 | 6.3652 | Adder | 7.49 |
| 958732 | AF2-164 E O1 | 4.2435 | Adder | 4.99 |
| 958741 | AF2-165 C | 0.9681 | Adder | 1.14 |
| 958742 | AF2-165 E | 0.6454 | Adder | 0.76 |
| 958751 | AF2-166 C | 0.8674 | Adder | 1.02 |
| 958752 | AF2-166 E | 0.5783 | Adder | 0.68 |
| 959061 | AF2-197 C O1 | 3.6088 | Adder | 4.25 |
| 959062 | AF2-197 E O1 | 5.4133 | Adder | 6.37 |
| 959441 | AF2-235 C | 0.4819 | Adder | 0.57 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **959442** | AF2-235 E | 0.3213 | Adder | 0.38 |
| **959471** | AF2-238 C | 1.3362 | Adder | 1.57 |
| **959472** | AF2-238 E | 0.8908 | Adder | 1.05 |
| **959481** | AF2-239 C | 0.9687 | Adder | 1.14 |
| **959482** | AF2-239 E | 0.7767 | Adder | 0.91 |
| **959491** | AF2-240 C | 0.4137 | Adder | 0.49 |
| **959492** | AF2-240 E | 0.3524 | Adder | 0.41 |
| **959501** | AF2-241 C | 1.2368 | Adder | 1.46 |
| **959502** | AF2-241 E | 0.9523 | Adder | 1.12 |
| **959521** | AF2-243 C | 0.7261 | Adder | 0.85 |
| **959522** | AF2-243 E | 0.4840 | Adder | 0.57 |
| **959741** | AF2-265 C | 0.9576 | Adder | 1.13 |
| **959742** | AF2-265 E | 0.7126 | Adder | 0.84 |
| **959793** | AF2-270 BAT | 0.1216 | Merchant Transmission | 0.1216 |
| **959822** | AF2-273 E | 0.2847 | Adder | 0.33 |
| **960022** | AF2-293 E | 0.0786 | Adder | 0.09 |
| **960031** | AF2-294 C | 1.2055 | Adder | 1.42 |
| **960032** | AF2-294 E | 0.8037 | Adder | 0.95 |
| **960041** | AF2-295 C | 0.9858 | Adder | 1.16 |
| **960042** | AF2-295 E | 0.6572 | Adder | 0.77 |
| **960271** | AF2-318 C | 1.0472 | Adder | 1.23 |
| **960272** | AF2-318 E | 0.6982 | Adder | 0.82 |
| **960891** | AF2-380 C | 0.4594 | Adder | 0.54 |
| **960892** | AF2-380 E | 0.3063 | Adder | 0.36 |
| **961141** | AF2-405 | 1.0945 | Adder | 1.29 |
| **961151** | AF2-406 | 8.2091 | Adder | 9.66 |
| **961201** | **AF2-411 O1 (Withdrawn : 12/08/2020)** | **51.3300** | **50/50** | **51.3300** |
| **961211** | AF2-412 | 17.0888 | Adder | 20.1 |
| **961451** | AF2-436 | 0.1165 | Adder | 0.14 |
| **961971** | AG1-040 C | 0.5710 | Adder | 1.27 |
| **961972** | AG1-040 E | 0.3807 | Adder | 0.85 |
| **962511** | AG1-100 C | 0.5461 | Adder | 1.21 |
| **962512** | AG1-100 E | 0.3641 | Adder | 0.81 |
| **962642** | AG1-113 BAT | 0.3879 | Merchant Transmission | 0.3879 |
| **962652** | AG1-114 BAT | 0.3687 | Merchant Transmission | 0.3687 |
| **962891** | AG1-138 C | 0.1820 | Adder | 0.4 |
| **962892** | AG1-138 E | 0.0096 | Adder | 0.02 |
| **962901** | AG1-139 C | 0.2031 | Adder | 0.45 |
| **962902** | AG1-139 E | 0.0107 | Adder | 0.02 |
| **962911** | AG1-140 C | 0.0837 | Adder | 0.19 |
| **962912** | AG1-140 E | 0.0381 | Adder | 0.08 |
| **963281** | AG1-177 C O1 | 0.5245 | Adder | 1.16 |
| **963282** | AG1-177 E O1 | 0.3497 | Adder | 0.78 |
| **963441** | AG1-193 C | 0.5956 | Adder | 1.32 |
| **963442** | AG1-193 E | 0.3971 | Adder | 0.88 |
| **963481** | AG1-197 C | 0.4325 | Adder | 0.96 |
| **963482** | AG1-197 E | 0.2883 | Adder | 0.64 |
| **963491** | AG1-198 C | 0.3147 | Adder | 0.7 |
| **963492** | AG1-198 E | 0.2098 | Adder | 0.47 |
| **963531** | AG1-202 C | 0.2846 | Adder | 0.63 |
| **963532** | AG1-202 E | 0.1466 | Adder | 0.33 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **963571** | AG1-206 C | 0.2627 | Adder | 0.58 |
| **963572** | AG1-206 E | 0.1415 | Adder | 0.31 |
| **963941** | AG1-247 C | 0.2843 | Adder | 0.63 |
| **963942** | AG1-247 E | 0.1508 | Adder | 0.33 |
| **963991** | AG1-253 C | 0.1255 | Adder | 0.28 |
| **963992** | AG1-253 E | 0.0604 | Adder | 0.13 |
| **964031** | AG1-257 C | 0.2933 | Adder | 0.65 |
| **964032** | AG1-257 E | 0.4100 | Adder | 0.91 |
| **964041** | AG1-258 C | 0.2933 | Adder | 0.65 |
| **964042** | AG1-258 E | 0.4100 | Adder | 0.91 |
| **964341** | AG1-296 C | 0.3297 | Adder | 0.73 |
| **964342** | AG1-296 E | 0.1775 | Adder | 0.39 |
| **964411** | AG1-303 C O1 | 1.3375 | Adder | 2.97 |
| **964412** | AG1-303 E O1 | 0.8917 | Adder | 1.98 |
| **964701** | AG1-333 C | 0.2343 | Adder | 0.52 |
| **964702** | AG1-333 E | 0.0319 | Adder | 0.07 |
| **964753** | AG1-338 BAT | 0.1819 | Merchant Transmission | 0.1819 |
| **964763** | AG1-339 BAT | 0.1819 | Merchant Transmission | 0.1819 |
| **964773** | AG1-340 BAT | 0.1819 | Merchant Transmission | 0.1819 |
| **965201** | AG1-385 C | 0.6712 | Adder | 1.49 |
| **965202** | AG1-385 E | 0.1988 | Adder | 0.44 |
| **965241** | AG1-389 C O1 | 1.9321 | 50/50 | 1.9321 |
| **965242** | AG1-389 E O1 | 1.2881 | 50/50 | 1.2881 |
| **965251** | AG1-390 C O1 | 1.9321 | 50/50 | 1.9321 |
| **965252** | AG1-390 E O1 | 1.2881 | 50/50 | 1.2881 |
| **965261** | AG1-391 C O1 | 1.9321 | 50/50 | 1.9321 |
| **965262** | AG1-391 E O1 | 1.2881 | 50/50 | 1.2881 |
| **965271** | AG1-392 C O1 | 3.8642 | 50/50 | 3.8642 |
| **965272** | AG1-392 E O1 | 2.5762 | 50/50 | 2.5762 |
| **965861** | AG1-455 | 1.5386 | Adder | 3.42 |
| **966121** | AG1-481 | 0.8472 | Adder | 1.88 |
| **966771** | AG1-548 C | 5.0357 | Adder | 11.18 |
| **966772** | AG1-548 E | 1.5326 | Adder | 3.4 |
| **966783** | AG1-549 BAT | 0.8876 | Merchant Transmission | 0.8876 |
| **WEC** | WEC | 0.0740 | Confirmed LTF | 0.0740 |
| **LGEE** | LGEE | 0.1056 | Confirmed LTF | 0.1056 |
| **CALDERWOOD** | CALDERWOOD | 0.0080 | Confirmed LTF | 0.0080 |
| **CBM-W2** | CBM-W2 | 1.0125 | Confirmed LTF | 1.0125 |
| **TVA** | TVA | 0.0616 | Confirmed LTF | 0.0616 |
| **O-066** | O-066 | 3.9976 | Confirmed LTF | 3.9976 |
| **SIGE** | SIGE | 0.0805 | Confirmed LTF | 0.0805 |
| **CHEOAH** | CHEOAH | 0.0105 | Confirmed LTF | 0.0105 |
| **CBM-S1** | CBM-S1 | 0.0251 | Confirmed LTF | 0.0251 |
| **G-007** | G-007 | 0.6993 | Confirmed LTF | 0.6993 |
| **HAMLET** | HAMLET | 0.1270 | Confirmed LTF | 0.1270 |
| **MEC** | MEC | 0.3051 | Confirmed LTF | 0.3051 |
| **LAGN** | LAGN | 0.1067 | Confirmed LTF | 0.1067 |
| **CATAWBA** | CATAWBA | 0.0556 | Confirmed LTF | 0.0556 |
| **CBM-W1** | CBM-W1 | 4.5705 | Confirmed LTF | 4.5705 |

### 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **165957881** | 200522 | 26SHADE GP | PENELEC | 938380 | AE1-071-POI | PENELEC | 1 | PL:10:P45:102437 | breaker | 160.0 | 197.87 | 199.38 | DC | 2.43 |

| 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 |

### 11.6.4 Index 4

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **164447503** | 235175 | 01ELKO | AP | 235971 | 01SQUABHLLW | AP | 1 | PN-P2-3-PN-230-14BT | breaker | 621.0 | 108.93 | 110.08 | DC | 7.16 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **200665** | 26SHAWVL 3 | 9.6307 | 50/50 | 9.6307 |
| **200666** | 26SHAWVL 4 | 9.4768 | 50/50 | 9.4768 |
| **200715** | 26SHAWVL 1 | 5.4583 | 50/50 | 5.4583 |
| **200722** | 26SHAWVL 2 | 5.5813 | 50/50 | 5.5813 |
| **200894** | 26K02 | 9.2098 | 50/50 | 9.2098 |
| **200905** | 26Q36 | 0.1562 | 50/50 | 0.1562 |
| **200913** | 26SHAW-D | 0.1993 | 50/50 | 0.1993 |
| **235003** | AC1-025 E | 0.5392 | 50/50 | 0.5392 |
| **236828** | 01GRAYMONT | 1.4401 | 50/50 | 1.4401 |
| **290086** | Q-036 E | 4.7704 | 50/50 | 4.7704 |
| **921642** | AA2-000 | 121.0699 | 50/50 | 121.0699 |
| **930511** | AB2-092 | 4.4453 | 50/50 | 4.4453 |
| **936421** | AD2-055 | 9.1521 | 50/50 | 9.1521 |
| **936991** | AD2-133 C | 2.1467 | 50/50 | 2.1467 |
| **936992** | AD2-133 E | 9.8187 | 50/50 | 9.8187 |
| **939171** | AE1-147 C | 4.3214 | 50/50 | 4.3214 |
| **939172** | AE1-147 E | 2.8810 | 50/50 | 2.8810 |
| **940201** | AE2-001 C | 4.3208 | 50/50 | 4.3208 |
| **940202** | AE2-001 E | 2.8806 | 50/50 | 2.8806 |
| **940681** | **AE2-055 C (Suspended)** | **4.3114** | **50/50** | **4.3114** |
| **940682** | **AE2-055 E (Suspended)** | **2.8742** | **50/50** | **2.8742** |
| **941261** | AE2-120 C | 4.3205 | 50/50 | 4.3205 |
| **941262** | AE2-120 E | 2.8803 | 50/50 | 2.8803 |
| **941271** | AE2-121 C | 2.2981 | 50/50 | 2.2981 |
| **941272** | AE2-121 E | 1.5345 | 50/50 | 1.5345 |
| **941331** | AE2-129 C | 1.9278 | 50/50 | 1.9278 |
| **941332** | AE2-129 E | 1.2852 | 50/50 | 1.2852 |
| **941351** | **AE2-131 C (Suspended)** | **1.9278** | **50/50** | **1.9278** |
| **941352** | **AE2-131 E (Suspended)** | **1.2852** | **50/50** | **1.2852** |
| **942351** | AE2-248 C | 3.4523 | 50/50 | 3.4523 |
| **942352** | AE2-248 E | 2.3015 | 50/50 | 2.3015 |
| **942491** | AE2-262 C | 18.1380 | 50/50 | 18.1380 |
| **942492** | AE2-262 E | 12.1887 | 50/50 | 12.1887 |
| **942501** | AE2-263 C | 17.0497 | 50/50 | 17.0497 |
| **942502** | AE2-263 E | 11.3834 | 50/50 | 11.3834 |
| **943751** | AF1-043 | 27.4564 | 50/50 | 27.4564 |
| **944001** | **AF1-068 C O1 (Withdrawn : 12/15/2020)** | **4.6017** | **50/50** | **4.6017** |
| **944002** | **AF1-068 E O1 (Withdrawn : 12/15/2020)** | **2.5885** | **50/50** | **2.5885** |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| 944311 | AF1-099 C | 27.5335 | 50/50 | 27.5335 |
| 944312 | AF1-099 E | 18.3557 | 50/50 | 18.3557 |
| 944321 | AF1-100 C | 53.1015 | 50/50 | 53.1015 |
| 944322 | AF1-100 E | 35.4010 | 50/50 | 35.4010 |
| 944382 | AF1-103 BAT | 3.1934 | 50/50 | 3.1934 |
| 944471 | AF1-112 C | 4.3163 | 50/50 | 4.3163 |
| 944472 | AF1-112 E | 2.8775 | 50/50 | 2.8775 |
| 944671 | AF1-132 C O1 (Withdrawn : 12/15/2020) | 4.3134 | 50/50 | 4.3134 |
| 944672 | AF1-132 E O1 (Withdrawn : 12/15/2020) | 2.8756 | 50/50 | 2.8756 |
| 944691 | AF1-134 C | 1.6358 | 50/50 | 1.6358 |
| 944692 | AF1-134 E | 1.0906 | 50/50 | 1.0906 |
| 944771 | AF1-142 C | 44.0536 | 50/50 | 44.0536 |
| 944772 | AF1-142 E | 29.3690 | 50/50 | 29.3690 |
| 944881 | AF1-153 C O1 | 2.8615 | 50/50 | 2.8615 |
| 944882 | AF1-153 E O1 | 1.9077 | 50/50 | 1.9077 |
| 944901 | AF1-155 C | 2.7005 | 50/50 | 2.7005 |
| 944902 | AF1-155 E | 1.8003 | 50/50 | 1.8003 |
| 945161 | AF1-181 | 0.0442 | 50/50 | 0.0442 |
| 945171 | AF1-182 | 0.2217 | 50/50 | 0.2217 |
| 945181 | AF1-183 | 0.0447 | 50/50 | 0.0447 |
| 945491 | AF1-214 C (Withdrawn : 12/03/2020) | 4.3205 | 50/50 | 4.3205 |
| 945492 | AF1-214 E (Withdrawn : 12/03/2020) | 2.8803 | 50/50 | 2.8803 |
| 946423 | AF1-306 BAT | 109.4041 | 50/50 | 109.4041 |
| 957451 | AF2-039 C | 1.7066 | 50/50 | 1.7066 |
| 957452 | AF2-039 E | 1.1377 | 50/50 | 1.1377 |
| 957941 | AF2-088 C | 0.8217 | 50/50 | 0.8217 |
| 957942 | AF2-088 E | 0.5478 | 50/50 | 0.5478 |
| 958271 | AF2-121 C | 1.9278 | 50/50 | 1.9278 |
| 958272 | AF2-121 E | 1.2852 | 50/50 | 1.2852 |
| 960022 | AF2-293 E | 0.4199 | 50/50 | 0.4199 |
| 960041 | AF2-295 C | 2.7005 | 50/50 | 2.7005 |
| 960042 | AF2-295 E | 1.8003 | 50/50 | 1.8003 |
| 960051 | AF2-296 C | 1.6358 | 50/50 | 1.6358 |
| 960052 | AF2-296 E | 1.0906 | 50/50 | 1.0906 |
| 962411 | AG1-090 C O1 | 9.6390 | 50/50 | 9.6390 |
| 962412 | AG1-090 E O1 | 6.4260 | 50/50 | 6.4260 |
| 962951 | AG1-144 C | 1.9278 | 50/50 | 1.9278 |
| 962952 | AG1-144 E | 1.2852 | 50/50 | 1.2852 |
| 963891 | AG1-242 C | 0.8861 | 50/50 | 0.8861 |
| 963892 | AG1-242 E | 0.4771 | 50/50 | 0.4771 |
| 964031 | AG1-257 C | 2.9860 | 50/50 | 2.9860 |
| 964032 | AG1-257 E | 4.1732 | 50/50 | 4.1732 |
| 964041 | AG1-258 C | 2.9860 | 50/50 | 2.9860 |
| 964042 | AG1-258 E | 4.1732 | 50/50 | 4.1732 |
| 964451 | AG1-308 C O1 | 1.4617 | 50/50 | 1.4617 |
| 964452 | AG1-308 E O1 | 2.0429 | 50/50 | 2.0429 |
| 965121 | AG1-377 C O1 | 1.9278 | 50/50 | 1.9278 |
| 965122 | AG1-377 E O1 | 1.2852 | 50/50 | 1.2852 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **965131** | AG1-378 C O1 | 1.9278 | 50/50 | 1.9278 |
| **965132** | AG1-378 E O1 | 1.2852 | 50/50 | 1.2852 |
| **965201** | AG1-385 C | 3.6794 | 50/50 | 3.6794 |
| **965202** | AG1-385 E | 1.0898 | 50/50 | 1.0898 |
| **965301** | AG1-395 C | 2.4772 | 50/50 | 2.4772 |
| **965302** | AG1-395 E | 0.7358 | 50/50 | 0.7358 |
| **966041** | AG1-473 C | 11.6198 | 50/50 | 11.6198 |
| **966042** | AG1-473 E | 7.7465 | 50/50 | 7.7465 |
| **966122** | AG1-481 BAT | 2.4430 | 50/50 | 2.4430 |
| **G-007A** | G-007A | 1.4984 | Confirmed LTF | 1.4984 |
| **VFT** | VFT | 4.1925 | Confirmed LTF | 4.1925 |
| **CALDERWOOD** | CALDERWOOD | 0.1730 | Confirmed LTF | 0.1730 |
| **PRAIRIE** | PRAIRIE | 1.0771 | Confirmed LTF | 1.0771 |
| **CHEOAH** | CHEOAH | 0.1732 | Confirmed LTF | 0.1732 |
| **CBM-N** | CBM-N | 0.8616 | Confirmed LTF | 0.8616 |
| **COTTONWOOD** | COTTONWOOD | 0.7959 | Confirmed LTF | 0.7959 |
| **HAMLET** | HAMLET | 0.1502 | Confirmed LTF | 0.1502 |
| **GIBSON** | GIBSON | 0.2359 | Confirmed LTF | 0.2359 |
| **BLUEG** | BLUEG | 0.7413 | Confirmed LTF | 0.7413 |
| **TRIMBLE** | TRIMBLE | 0.2376 | Confirmed LTF | 0.2376 |
| **CATAWBA** | CATAWBA | 0.1004 | Confirmed LTF | 0.1004 |

### 11.6.5 Index 5

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **165957871** | 938380 | AE1-071-POI | PENELEC | 200520 | 26ROXBURY | PENELEC | 1 | PN-P2_3-PN-230-0347-16-DRT-029 | breaker | 160.0 | 233.04 | 234.56 | DC | 2.42 |

| 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 |

### 11.6.6 Index 6

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **165957986** | 999327 | 26SHAWVL 1 | PENELEC | 200714 | 26SHAWVL 1 | PENELEC | 1A | AP-P2-3-WP-230-443T * | breaker | 126.0 | 128.7 | 129.27 | DC | 1.59 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **200665** | 26SHAWVL 3 | 3.3420 | 50/50 | 3.3420 |
| **200666** | 26SHAWVL 4 | 3.1659 | 50/50 | 3.1659 |
| **235003** | AC1-025 E | 0.0997 | Adder | 0.12 |
| **236828** | 01GRAYMONT | 0.2754 | Adder | 0.32 |
| **921642** | AA2-000 | 29.6264 | Adder | 34.85 |
| **930511** | AB2-092 | 1.0878 | Adder | 1.28 |
| **936421** | AD2-055 | 2.2396 | Adder | 2.63 |
| **939171** | AE1-147 C | 0.8308 | Adder | 0.98 |
| **939172** | AE1-147 E | 0.5539 | Adder | 0.65 |
| **940201** | AE2-001 C | 0.8282 | Adder | 0.97 |
| **940202** | AE2-001 E | 0.5522 | Adder | 0.65 |
| **940681** | **AE2-055 C (Suspended)** | **0.7895** | **Adder** | **0.93** |
| **940682** | **AE2-055 E (Suspended)** | **0.5263** | **Adder** | **0.62** |
| **941261** | AE2-120 C | 0.8268 | Adder | 0.97 |
| **941262** | AE2-120 E | 0.5512 | Adder | 0.65 |
| **941271** | AE2-121 C | 0.4440 | Adder | 0.52 |
| **941272** | AE2-121 E | 0.2965 | Adder | 0.35 |
| **941351** | **AE2-131 C (Suspended)** | **-1.3743** | **Adder** | **-1.62** |
| **942351** | AE2-248 C | 0.6446 | Adder | 0.76 |
| **942352** | AE2-248 E | 0.4297 | Adder | 0.51 |
| **942491** | AE2-262 C | 3.9967 | Adder | 4.7 |
| **942492** | AE2-262 E | 2.6858 | Adder | 3.16 |
| **942501** | AE2-263 C | 3.7569 | Adder | 4.42 |
| **942502** | AE2-263 E | 2.5083 | Adder | 2.95 |
| **943751** | AF1-043 | 6.7187 | Adder | 7.9 |
| **944001** | **AF1-068 C O1 (Withdrawn : 12/15/2020)** | **0.8542** | **Adder** | **1.0** |
| **944002** | **AF1-068 E O1 (Withdrawn : 12/15/2020)** | **0.4805** | **Adder** | **0.57** |
| **944311** | AF1-099 C | 6.0670 | Adder | 7.14 |
| **944312** | AF1-099 E | 4.0447 | Adder | 4.76 |
| **944321** | AF1-100 C | 17.5710 | 50/50 | 17.5710 |
| **944322** | AF1-100 E | 11.7140 | 50/50 | 11.7140 |
| **944471** | AF1-112 C | 0.8099 | Adder | 0.95 |
| **944472** | AF1-112 E | 0.5399 | Adder | 0.64 |
| **944671** | **AF1-132 C O1 (Withdrawn : 12/15/2020)** | **0.7980** | **Adder** | **0.94** |
| **944672** | **AF1-132 E O1 (Withdrawn : 12/15/2020)** | **0.5320** | **Adder** | **0.63** |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **944771** | AF1-142 C | 9.7072 | Adder | 11.42 |
| **944772** | AF1-142 E | 6.4715 | Adder | 7.61 |
| **945161** | AF1-181 | 0.0153 | 50/50 | 0.0153 |
| **945171** | AF1-182 | 0.0741 | 50/50 | 0.0741 |
| **945491** | **AF1-214 C (Withdrawn : 12/03/2020)** | **0.8269** | **Adder** | **0.97** |
| **945492** | **AF1-214 E (Withdrawn : 12/03/2020)** | **0.5513** | **Adder** | **0.65** |
| **960022** | AF2-293 E | 0.0808 | Adder | 0.1 |
| **964031** | AG1-257 C | 0.2982 | Adder | 0.66 |
| **964032** | AG1-257 E | 0.4167 | Adder | 0.92 |
| **964041** | AG1-258 C | 0.2982 | Adder | 0.66 |
| **964042** | AG1-258 E | 0.4167 | Adder | 0.92 |
| **965303** | AG1-395 BAT | 1.1547 | 50/50 | 1.1547 |
| **966041** | AG1-473 C | 0.7914 | Adder | 1.76 |
| **966042** | AG1-473 E | 0.5276 | Adder | 1.17 |
| **G-007A** | G-007A | 1.0357 | Confirmed LTF | 1.0357 |
| **VFT** | VFT | 2.8445 | Confirmed LTF | 2.8445 |
| **CALDERWOOD** | CALDERWOOD | 0.0924 | Confirmed LTF | 0.0924 |
| **PRAIRIE** | PRAIRIE | 0.5605 | Confirmed LTF | 0.5605 |
| **CHEOAH** | CHEOAH | 0.0926 | Confirmed LTF | 0.0926 |
| **CBM-N** | CBM-N | 0.5568 | Confirmed LTF | 0.5568 |
| **COTTONWOOD** | COTTONWOOD | 0.4200 | Confirmed LTF | 0.4200 |
| **HAMLET** | HAMLET | 0.0820 | Confirmed LTF | 0.0820 |
| **GIBSON** | GIBSON | 0.1223 | Confirmed LTF | 0.1223 |
| **BLUEG** | BLUEG | 0.3871 | Confirmed LTF | 0.3871 |
| **TRIMBLE** | TRIMBLE | 0.1247 | Confirmed LTF | 0.1247 |
| **CATAWBA** | CATAWBA | 0.0546 | Confirmed LTF | 0.0546 |

## 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 |
|---|---|---|
| **AA1-144** | East Towanda-Grover 230kV | Engineering and Procurement |
| **AA2-000** | N/A | N/A |
| **AA2-132** | Thompson 34.5kV | Withdrawn |
| **AA2-133** | Wyalusing 34.5kV | In Service |
| **AB1-160** | Gold-Sabinsville 115kV | In Service |
| **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 |
| **AE1-053** | Meyersdale North | Active |
| **AE1-071** | Shade Gap-Roxbury 115 kV | Active |
| **AE1-123** | Emlenton 34.5 kV | Engineering and Procurement |
| **AE1-147** | Bellefonte 46 kV | Engineering and Procurement |
| **AE1-160** | Venango 34.5 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 |
| **AE2-074** | Potter 46 kV | Active |
| **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 |
| **AE2-139** | East Towanda-Grover 230 kV | Active |
| **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 |
| **AE2-299** | Erie East 230 kV | Active |
| **AE2-316** | Brookville-Squab Hollow 138 kV | Active |
| **AE2-344** | Edinboro South-Venango Junction 115 kV | Active |
| **AF1-006** | Fairview East 34.5 kV | Active |
| **AF1-043** | Moshannon-East Towanda 230 kV | Active |
| **AF1-068** | Boalsburg-Centre Hall 46 kV | Withdrawn |
| **AF1-094** | Union City-Cambridge Springs 34.5 kV | Active |

| Queue Number | Project Name | Status |
|---|---|---|
| **AF1-096** | Titusville-Oil Creek 34.5 kV | Active |
| **AF1-098** | Four Mile Jct-Corry East 115 kV | Active |
| **AF1-099** | Moshannon-Milesburg 230 kV | Active |
| **AF1-100** | Shawville-Moshannon 230 kV | Active |
| **AF1-103** | Warren 34.5 kV | Active |
| **AF1-104** | Erie West 34.5 kV | Active |
| **AF1-106** | East Sayre 34.5 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 |
| **AF1-140** | Claysburg 23 kV | Engineering and Procurement |
| **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 |
| **AF1-167** | West Freedom-C&K Coal 25 kV | Active |
| **AF1-170** | Springboro-Venango Junction 115 kV | Active |
| **AF1-181** | Shawville 3 230 kV | Partially in Service - Under Construction |
| **AF1-182** | Shawville 4 230 kV | Partially in Service - Under Construction |
| **AF1-183** | Shawville 1 230 kV | Partially in Service - Under Construction |
| **AF1-210** | Burma 23 kV | Engineering and Procurement |
| **AF1-214** | Nittany-Zion 46 kV | Withdrawn |
| **AF1-217** | Edinboro -Cambridge Springs 34.5 kV | Active |
| **AF1-224** | Fayetteville 34.5 kV | Engineering and Procurement |
| **AF1-232** | Allegheny-Somerset 115 kV | Withdrawn |
| **AF1-276** | Lewis Run-Pierce Brook 230 kV | Active |
| **AF1-277** | Lewis Run-Pierce Brook 2 230 kV | Active |
| **AF1-278** | Lewis Run-Pierce Brook 3 230 kV | Active |
| **AF1-286** | East Sayre 34.5 kV II | Active |
| **AF1-287** | Edinboro South 34.5 kV II | Active |
| **AF1-302** | Brookville-Squab Hollow 138 kV | Active |
| **AF1-304** | Titusville-Grandview 115 kV | Active |
| **AF1-306** | Squab Hollow 230 kV | Active |
| **AF2-010** | Union City-Titusville 115 kV | Active |
| **AF2-039** | Shawville-Clearfield 34.5 kV | Active |
| **AF2-045** | Cambria Nug 115 kV | Engineering and Procurement |
| **AF2-050** | Bearrock-Johnstown 230 kV | Active |
| **AF2-051** | Geneva 115 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 |
| **AF2-130** | Wolfs Corners 34.5 kV | Active |
| **AF2-141** | Lick Run 115 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 |
| **AF2-164** | Handsome Lake 345 kV | Active |
| **AF2-165** | Clark Summit-Emlenton 34.5 kV | Active |
| **AF2-166** | Clark Summit-Emlenton 34 kV | Active |
| **AF2-197** | East Towanda 115 kV | Active |
| **AF2-215** | Saint Thomas-LeMasters Junction 34.5 kV | Engineering and Procurement |

| Queue Number | Project Name | Status |
|---|---|---|
| **AF2-235** | Titusville-Oil Creek 34.5 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 |
| **AF2-243** | Clark Summit 34.5 kV | Active |
| **AF2-265** | South Troy-Athens 34.5 kV | Active |
| **AF2-270** | Bedford South RCB-Bedford Area 23 kV | Engineering and Procurement |
| **AF2-271** | Pemberton-Sinking Valley 12.47 kV | Engineering and Procurement |
| **AF2-273** | Sligo 25 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 |
| **AF2-294** | Thompson 34.5 kV | Active |
| **AF2-295** | Wilcox-Paper City 46 kV | Active |
| **AF2-296** | Madera 34.5 kV | Active |
| **AF2-318** | East Towanda-New Albany 34.5 kV | Active |
| **AF2-380** | Karns City-Bear Creek 25 kV | Active |
| **AF2-405** | East Sayre 34.5 kV III | Active |
| **AF2-406** | Sayre 115 kV | Active |
| **AF2-411** | Mainesburg 345 kV | Withdrawn |
| **AF2-412** | Mainesburg 115 kV | Active |
| **AF2-436** | Wyalusing 34.5 kV II | Engineering and Procurement |
| **AG1-040** | Morgan Street-Mount Hope 34.5 kV | Active |
| **AG1-090** | Philipsburg 115 kV | Active |
| **AG1-100** | Venango-Saegertown 34.5 kV | Active |
| **AG1-113** | Somerset Windpower 22.86 kV | Active |
| **AG1-114** | Meyersdale North 115 kV | Active |
| **AG1-138** | Wolfs Corners 34.5 kV | Active |
| **AG1-139** | Clark Summit-Emlenton 34.5 kV | Active |
| **AG1-140** | Union City 34.5 kV | Active |
| **AG1-144** | Phillipsburg 34.5 kV | Active |
| **AG1-177** | Union City 34.5 kV | Active |
| **AG1-193** | Utica Junction 34.5 kV | Active |
| **AG1-197** | Morgan Street-Cochranton 34.5 kV | Active |
| **AG1-198** | Union City 34.5 kV | Active |
| **AG1-202** | Springboro 12.47 kV | Active |
| **AG1-206** | Snyder Twp 34.5 kV | Active |
| **AG1-242** | Beccaria 34.5 kV | Active |
| **AG1-247** | North Orwell 12.47 kV | Active |
| **AG1-253** | Erie East-Union City 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 |
| **AG1-296** | Snyder Township 34.5 kV | Active |
| **AG1-301** | Miller REC-Warrior Ridge 46 kV | Active |
| **AG1-303** | Geneva 115 kV | Active |
| **AG1-308** | Shawville-Philipsburg 115 kV | Active |
| **AG1-333** | Lake Como-Pine Mills 12.47 kV | Active |
| **AG1-338** | Curryville-RKB-Yellow Creek 23 kV I | Active |
| **AG1-339** | Curryville-RKB-Yellow Creek 23 kV II | Active |

| Queue Number | Project Name | Status |
|---|---|---|
| **AG1-340** | Curryville 23 kV | Active |
| **AG1-377** | Philipsburg 115 kV | Active |
| **AG1-378** | Philipsburg 115 kV | Active |
| **AG1-385** | Motion-Ridgeway 46 kV | Active |
| **AG1-389** | Gold 115 kV I | Active |
| **AG1-390** | Gold 115 kV II | Active |
| **AG1-391** | Gold 115 kV III | Active |
| **AG1-392** | Gold 115 kV IV | Active |
| **AG1-395** | Philipsburg-Karthaus 34.5 kV 2 | Active |
| **AG1-455** | Springboro-Venango Junction 115 kV | Active |
| **AG1-473** | Shingletown-Lewistown 230 kV | Active |
| **AG1-481** | Warren 34.5 kV | Active |
| **AG1-484** | Mountain 115 kV | Active |
| **AG1-515** | Guilford 138 kV | Active |
| **AG1-548** | Erie South-Union City 115 kV | Active |
| **AG1-549** | Shelocta 115 kV | Active |
| **AG1-560** | Shade Gap-Roxbury 115 kV II | Active |
| **AG1-561** | Roxbury-Greene 138 kV II | Active |
| **X3-003** | Mehoopany II 115 kV | In Service |
| **Y3-092** | Erie West 345kV | Engineering and Procurement |
| **Z1-066** | Arnold 34.5kV | In Service |
| **Z1-069** | Gold-Sabinsville 115kV | In Service |
| **Z2-108** | Meyersdale North 115kV | In Service |

## 11.8 Contingency Descriptions

| Contingency Name | Contingency Definition |
|---|---|
| **AP-P1-3-WP-230-001** | CONTINGENCY 'AP-P1-3-WP-230-001' /* ELKO #1 230/138KV XFMR<br>DISCONNECT BRANCH FROM BUS 235174 TO BUS 235175 CKT 1 /* 01ELKO 138 01ELKO 230<br>DISCONNECT BRANCH FROM BUS 235175 TO BUS 235971 CKT 1 /* 01ELKO 230 01SQUABHLLW 230<br>END |
| **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 |
| **AP-P1-3-WP-230-326T-B** | CONTINGENCY 'AP-P1-3-WP-230-326T-B' /* SHINGLETOWN #82 230/46KV XFMR<br>DISCONNECT BRANCH FROM BUS 966040 TO BUS 200513 CKT 1 /* AG1-473 TAP 230 26LEWISTWN 230<br>END |
| **AP-P2-3-WP-230-443T *** | CONTINGENCY 'AP-P2-3-WP-230-443T *' / UPDATED CON AJK 3-31-16<br>DISCONNECT BRANCH FROM BUS 200726 TO BUS 235175 CKT 1<br>DISCONNECT BRANCH FROM BUS 235175 TO BUS 235236 CKT 1<br>DISCONNECT BUS 235158<br>END |
| **AP-P2-2-WP-230-005T** | CONTINGENCY 'AP-P2-2-WP-230-005T' /* SHINGLETOWN #2 230KV BUS<br>DISCONNECT BRANCH FROM BUS 235248 TO BUS 235970 CKT 1 /* 01SHINGL 230 01DALE 230<br>DISCONNECT BRANCH FROM BUS 235248 TO BUS 966040 CKT 1 /* 01SHINGL 230 AG1-473 TAP 230<br>DISCONNECT BRANCH FROM BUS 235248 TO BUS 236711 CKT 82 /* 01SHINGL 230 01SHINGLTN 46<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 |

| Contingency Name | Contingency Definition |
|---|---|
| **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 |
| **AP-P2-2-WP-230-001T** | CONTINGENCY 'AP-P2-2-WP-230-001T' /* ELKO #2 230KV BUS<br>DISCONNECT BRANCH FROM BUS 235175 TO BUS 235158 CKT 1 /* 01ELKO 230 01CARB 230<br>DISCONNECT BRANCH FROM BUS 235175 TO BUS 235236 CKT 1 /* 01ELKO 230 01QUEHAN 230<br>DISCONNECT BRANCH FROM BUS 235175 TO BUS 200726 CKT 1 /* 01ELKO 230 26SHAWVL 2 230<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 |
| **PL:03:P12:000193** | CONTINGENCY 'PL:03:P12:000193' /* NMES-LACK 230KV LINE<br>DISCONNECT BRANCH FROM BUS 200706 TO BUS 200677 CKT 4 /*<br>DISCONNECT BUS 200708 /* OXBOW 230KV BUS<br>END |
| **PN-P2-2-PN-230-007T** | CONTINGENCY 'PN-P2-2-PN-230-007T' /* LEWISTOWN #2 230KV BUS<br>DISCONNECT BRANCH FROM BUS 200513 TO BUS 200531 CKT 2 /* 26LEWISTWN 230 26YEAGRTWN 230<br>DISCONNECT BRANCH FROM BUS 200513 TO BUS 966040 CKT 1 /* 26LEWISTWN 230 AG1-473 TAP 230<br>DISCONNECT BRANCH FROM BUS 200513 TO BUS 200517 CKT 1 /* 26LEWISTWN 230 26RAYSTOWN 230<br>END |

| Contingency Name | Contingency Definition |
|---|---|
| **PN-P2-3-PN-230-14CT** | CONTINGENCY 'PN-P2-3-PN-230-14CT' /* LEWISTOWN STUCK 230KV BREAKER - SHINGLETOWN<br>DISCONNECT BRANCH FROM BUS 200513 TO BUS 200517 CKT 1 /* 26LEWISTWN 230 26RAYSTOWN 230<br>DISCONNECT BRANCH FROM BUS 200513 TO BUS 966040 CKT 1 /* 26LEWISTWN 230 AG1-473 TAP 230<br>DISCONNECT BRANCH FROM BUS 200513 TO BUS 200531 CKT 2 /* 26LEWISTWN 230 26YEAGRTWN 230<br>DISCONNECT BRANCH FROM BUS 200513 TO BUS 200548 CKT 2 /* 26LEWISTWN 230 26LEWISTWN 46.00<br>DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 CKT 3 /* 26LEWISTWN 230 26LEWISTWN 115<br>END |
| **AP-P1-3-WP-230-325T** | CONTINGENCY 'AP-P1-3-WP-230-325T' /* SHINGLETOWN #81 230/46KV XFMR<br>DISCONNECT BRANCH FROM BUS 235248 TO BUS 236711 CKT 81 /* 01SHINGL 230 01SHINGLTN 46<br>DISCONNECT BRANCH FROM BUS 235248 TO BUS 200726 CKT 1 /* 01SHINGL 230 26SHAWVL 2 230<br>END |
| **PN-P2-3-PN-230-14BT** | CONTINGENCY 'PN-P2-3-PN-230-14BT' /* LEWISTOWN STUCK 230KV BREAKER B5 (RAYSTOWN)<br>DISCONNECT BRANCH FROM BUS 200513 TO BUS 200517 CKT 1 /* 26LEWISTWN 230 26RAYSTOWN 230<br>DISCONNECT BRANCH FROM BUS 200517 TO BUS 200539 CKT 1 /* 26RAYSTOWN 230 26RAYSTOWN 46<br>DISCONNECT BRANCH FROM BUS 200513 TO BUS 966040 CKT 1 /* 26LEWISTWN 230 AG1-473 TAP 230<br>DISCONNECT BRANCH FROM BUS 200513 TO BUS 200531 CKT 2 /* 26LEWISTWN 230 26YEAGRTWN 230<br>DISCONNECT BRANCH FROM BUS 200513 TO BUS 200548 CKT 1 /* 26LEWISTWN 230 26LEWISTWN 46.00<br>END |
| **Base Case** | |
| **PN-P2_3-PN-230-0347-12-DRT-025** | CONTINGENCY 'PN-P2_3-PN-230-0347-12-DRT-025' /* 26LEWISTOWN-26RAYSTOWN 230 AND B5 FAULT<br>DISCONNECT BRANCH FROM BUS 200513 TO BUS 966040 CKT 1 /* 26LEWISTOWN-AG1-473 TAP 230 AND B57 FAULT<br>OPEN BUS 200531 /* 26LEWISTOWN 230 BUS 2<br>END |

| Contingency Name | Contingency Definition |
|---|---|
| **AP-P2-3-WP-230-446T** | CONTINGENCY 'AP-P2-3-WP-230-446T'<br>DISCONNECT BRANCH FROM BUS 200726 TO BUS 235175 CKT 1<br>DISCONNECT BRANCH FROM BUS 235158 TO BUS 235175 CKT 1<br>DISCONNECT BRANCH FROM BUS 235175 TO BUS 235236 CKT 1<br>DISCONNECT BRANCH FROM BUS 235220 TO BUS 235236 CKT 1<br>DISCONNECT BRANCH FROM BUS 235236 TO BUS 236732 CKT 81<br>OPEN BUS 235158<br>END |

# 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).