Generation Interconnection

Feasibility Study Report

for

Queue Project AF1-086

MADERA-WESTOVER SOUTH 115 KV

20.54 MW Capacity / 109.9 MW Energy

January 2020

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1 Introduction

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 36.2, as well as the Feasibility Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Mid-Atlantic Interstate Transmission (MAIT – Penelec zone).

2 Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement. Cost allocation rules for network upgrades can be found in PJM Manual 14A, Attachment B. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

The Interconnection Customer seeking to interconnect a wind or solar generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement and Section 8 of Manual 14D.

An Interconnection Customer with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

PJM utilizes manufacturer models to ensure the performance of turbines is properly captured during the simulations performed for stability verification and, where applicable, for compliance with low voltage ride through requirements. Turbine manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is contained in Attachment B of Manual 14G. Manufacturer models may be updated from time to time, for various reasons such as to reflect changes to the control systems or to more accurately represent the capabilities turbines and controls which are currently available in the field. Additionally, as new turbine models are developed, turbine manufacturers provide such new models which must be used in the conduct of these studies. PJM needs adequate time to evaluate the new models in

order to reduce delays to the System Impact Study process timeline for the Interconnection Customer as well as other Interconnection Customers in the study group. Therefore, PJM will require that any Interconnection Customer with a new manufacturer model must supply that model to PJM, along with a $10,000 fully refundable deposit, no later than three (3) months prior to the starting date of the System Impact Study (See Section 4.3 for starting dates) for the Interconnection Request which shall specify the use of the new model. The Interconnection Customer will be required to submit a completed dynamic model study request form (Attachment B-1 of Manual 14G) in order to document the request for the study.

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 Wind generating facility located in Clearfield County, Pennsylvania. The installed facilities will have a total capability of 109.9 MW with 20.54 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is December 31, 2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AF1-086
Project Name	MADERA-WESTOVER SOUTH 115 KV
State	Pennsylvania
County	Clearfield
Transmission Owner	MAIT
MFO	109.9
MWE	109.9
MWC	20.54
Fuel	Wind
Basecase Study Year	2023

4 Point of Interconnection

4.1 Primary POI

The interconnection of the project at the Primary POI will be accomplished by constructing a new 115 kV three (3) breaker ring bus substation and looping the Garman - Shawville 115 kV line into the new station. The new substation will be located approximately 0.44 miles from Westover South substation. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection switching station and the associated facilities. The IC will also be responsible for the rough grade of the property and an access road to the proposed three breaker ring bus site. The project will also require non-direct connection upgrades at Garman and Shawville substations.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AF1-086 generation project to connect to the FirstEnergy ("FE") transmission system. IC will be responsible for constructing the facilities on its side of the POI, including the attachment facilities which connect the generator to the FE transmission system's direct connection facilities.

4.2 Secondary POI

The interconnection of the project at a Secondary POI can be accomplished by constructing a new 115 kV four (4) breaker ring bus substation at Westover South. A full scope of work or estimated cost is not provided for the proposed Secondary POI.

5 Cost Summary

The AF1-086 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$242,700
Direct Connection Network Upgrade	$6,789,700
Non-Direct Connection Network Upgrades	$2,688,200
Total Costs	**$9,720,600**

In addition, the AF1-086 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	**$102,385,850**

Cost allocations for these upgrades will be provided in the System Impact Study Report.

The Feasibility Study is used to make a preliminary determination of the type and scope of Attachment Facilities, Local Upgrades, and Network Upgrades that will be necessary to accommodate the Interconnection Request and to provide the Interconnection Customer a preliminary estimate of the time that will be required to construct any necessary facilities and upgrades and the Interconnection Customer's cost responsibility. The System Impact Study provides refined and comprehensive estimates of cost responsibility and construction lead times for new facilities and system upgrades. Facilities Studies will include, commensurate with the degree of engineering specificity as provided in the Facilities Study Agreement, good faith estimates of the cost, determined in accordance with Section 217 of the Tariff,

(a) to be charged to each affected New Service Customer for the Facilities and System Upgrades that are necessary to accommodate this queue project;

(b) the time required to complete detailed design and construction of the facilities and upgrades; and

(c) a description of any site-specific environmental issues or requirements that could reasonably be anticipated to affect the cost or time required to complete construction of such facilities and upgrades.

The costs provided above exclude the Contribution in Aid of Construction ("CIAC") Federal Income Tax Gross Up charge. If, at a future date, it is determined that the CIAC Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

The required Attachment Facilities and Direct and Non-Direct Connection work for the interconnection of the AF1-086 generation project to the FE Transmission System is detailed in the following sections. The associated one-line with the generation project Attachment Facilities and the Primary Direct and Non-Direct Connection facilities are shown in Attachment 1.

6 Transmission Owner Scope of Work

6.1 Primary POI

The interconnection of the project at the Primary POI will be accomplished by constructing a new 115 kV three (3) breaker ring bus substation and looping the Garman - Shawville 115 kV line into the new station. The new substation will be located approximately 0.44 miles from Westover South substation. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection switching station and the associated facilities. The IC will also be responsible for the rough grade of the property and an access road to the proposed three breaker ring bus site. The project will also require non-direct connection upgrades at Garman and Shawville substations.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AF1-086 generation project to connect to the FirstEnergy ("FE") transmission system. IC will be responsible for constructing the facilities on its side of the POI, including the attachment facilities which connect the generator to the FE transmission system's direct connection facilities.

6.2 Secondary POI

The interconnection of the project at a Secondary POI can be accomplished by constructing a new 115 kV four (4) breaker ring bus substation at Westover South. A full scope of work or estimated cost is not provided for the proposed Secondary POI.

7 Attachment Facilities

The total preliminary cost estimate for the Attachment work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Install 115 kV terminal position in new AF1-086 interconnection substation.	$242,700
Total Attachment Facility Costs	$242,700

8 Direct Connection Cost Estimate

The total preliminary cost estimate for the Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Construct new 115 kV three breaker ring bus interconnection substation.	$6,717,000
Review drawings and provide nameplates for customer's switchyard.	$72,700
Total Direct Connection Facility Costs	$6,789,700

9 Non-Direct Connection Cost Estimate

The total preliminary cost estimate for the Non-Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Upgrade relaying and install anti-islanding at Shawville substation.	$589,800
Upgrade relaying and install anti-islanding at Garman substation.	$589,800
Install anti-islanding at Glory substation.	$589,800
Loop the Garman - Shawville 115 kV line into the new interconnection substation.	$918,800
Total Non-Direct Connection Facility Costs	$2,688,200

10 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 **19 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 construction of the interconnection substation. This assumes that there will be no environmental issues with any of the new properties associated with this project, that there will be no delays in acquiring the necessary permits for implementing the defined direct connection and network upgrades, and that all transmission system outages will be allowed when requested.

The schedule for the required Network Impact Reinforcements will be more clearly identified in future study phases. The estimate elapsed time to complete each of the required reinforcements is identified in the "System Reinforcements" section of the report.

11 Transmission Owner Analysis

FE performed an analysis of its underlying transmission <100 kV system. The AF1-086 project did not contribute to any overloads on the FE transmission <100 kV system.

12 Interconnection Customer Requirements

12.1 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.

12.2 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 115 kV circuit breaker to protect the AF1-086 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 AF1-086 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 system.

12.3 Power Factor Requirements

The IC shall design its wind-powered 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.

13 Revenue Metering and SCADA Requirements

13.1 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.

13.2 FirstEnergy Requirements

The IC will be required to comply with all FE revenue metering requirements for generation interconnection customers which can be found in FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx

14 Network Impacts – Primary POI

The Queue Project AF1-086 was evaluated as a 109.9 MW (Capacity 20.5 MW) injection tapping the Westover to Madera 115 kV line in the PENELEC area. Project AF1-086 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-086 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

14.1 Generation Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

None

14.2 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
42128701	200810	26KEYSTONE	230.0	PENELEC	999401	STAR592	1.0	PJM	4	PJM500_PN_P4-500-001A	breaker	635.0	97.3	100.12	DC	17.61
42128702	200810	26KEYSTONE	230.0	PENELEC	999401	STAR592	1.0	PJM	4	PJM500_PN_P4-500-001D	breaker	635.0	97.29	100.1	DC	17.61
41511548	200904	26EAGLVAL	115.0	PENELEC	200527	26TYRONE N	115.0	PENELEC	1	PN-P2-3-PN-115-28B_A	breaker	191.0	94.47	103.83	DC	17.86
41511549	200904	26EAGLVAL	115.0	PENELEC	200527	26TYRONE N	115.0	PENELEC	1	PN-P2-3-PN-115-59B	breaker	191.0	94.47	103.83	DC	17.86

14.3 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
41511931	200740	26BLRSVL E	115.0	PENELEC	200763	26BLAIRSVL	138.0	PENELEC	1	PN_P4-500-001J	breaker	364.0	101.67	102.9	DC	9.95
42128585	200767	26HOMER CT	230.0	PENELEC	200795	26SHELOCT A	230.0	PENELEC	1	PN_P4-500-002A	breaker	917.0	140.04	140.95	DC	18.18
42128586	200767	26HOMER CT	230.0	PENELEC	200795	26SHELOCT A	230.0	PENELEC	1	PN_P4-500-002F	breaker	917.0	140.05	140.96	DC	18.18
42128595	200795	26SHELOCT A	230.0	PENELEC	200810	26KEYSTONE	230.0	PENELEC	1	PN_P4-500-002F	breaker	917.0	116.32	119.82	DC	31.61
42128596	200795	26SHELOCT A	230.0	PENELEC	200810	26KEYSTONE	230.0	PENELEC	1	PN_P4-500-002A	breaker	917.0	116.32	119.82	DC	31.61
41783462	200904	26EAGLVAL	115.0	PENELEC	200527	26TYRONE N	115.0	PENELEC	1	AP-P2-2-WP-230-005T	bus	191.0	113.68	115.0	DC	5.54
41511350	235248	01SHINGL	230.0	AP	200513	26LEWISTW N	230.0	PENELEC	1	AP-P2-3-WP-230-446T	breaker	570.0	118.91	120.13	DC	15.36
41511351	235248	01SHINGL	230.0	AP	200513	26LEWISTW N	230.0	PENELEC	1	AP-P2-3-WP-230-443T *	breaker	570.0	118.77	119.99	DC	15.36
41511352	235248	01SHINGL	230.0	AP	200513	26LEWISTW N	230.0	PENELEC	1	AP-P2-2-WP-230-001T	breaker	570.0	118.77	119.99	DC	15.36

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
41783375	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	AP-P2-2-WP-230-001T	bus	570.0	118.77	119.99	DC	15.36

14.4 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
41173521	200599	26ERIE W	345.0	PENELEC	238547	02AT	345.0	ATSI	1	Base Case	operation	1560.0	115.74	116.2	DC	15.91
41172680	200726	26SHAWVL 2	230.0	PENELEC	235248	01SHINGL	230.0	AP	1	AP-P1-3-WP-230-005	operation	554.0	103.07	103.9	DC	10.68
41172681	200726	26SHAWVL 2	230.0	PENELEC	235248	01SHINGL	230.0	AP	1	AP-P1-2-WP-230-005B	operation	554.0	103.07	103.9	DC	10.68
41173273	200740	26BLRSVLE	115.0	PENELEC	200763	26BLAIRSVL	138.0	PENELEC	1	PJM_P1_APS_B_G692	operation	364.0	101.24	102.4	DC	9.36
42410799	200767	26HOMER CT	230.0	PENELEC	200795	26SHELOCTA	230.0	PENELEC	1	PN-P1-3-PN-230-001T	operation	917.0	135.32	136.23	DC	18.21
42410800	200767	26HOMER CT	230.0	PENELEC	200795	26SHELOCTA	230.0	PENELEC	1	PN-P1-2-PN-230-025	operation	917.0	135.32	136.23	DC	18.21
42410801	200767	26HOMER CT	230.0	PENELEC	200795	26SHELOCTA	230.0	PENELEC	1	Base Case	operation	731.0	139.58	140.25	DC	10.74
42410815	200795	26SHELOCTA	230.0	PENELEC	200810	26KEYSTONE	230.0	PENELEC	1	PN-P1-2-PN-230-025	operation	917.0	110.95	114.45	DC	31.64
42410816	200795	26SHELOCTA	230.0	PENELEC	200810	26KEYSTONE	230.0	PENELEC	1	PN-P1-3-PN-230-001T	operation	917.0	110.95	114.45	DC	31.64
42410817	200795	26SHELOCTA	230.0	PENELEC	200810	26KEYSTONE	230.0	PENELEC	1	Base Case	operation	731.0	113.37	116.67	DC	23.76
41172693	200904	26EAGLVAL	115.0	PENELEC	200527	26TYRONEN	115.0	PENELEC	1	PN-P1-2-PN-115-048	operation	191.0	94.31	103.67	DC	17.86
41172535	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	Base Case	operation	491.0	112.98	114.09	DC	12.45
41172538	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	AP-P1-2-WP-230-324T_FSA_B	operation	570.0	104.87	105.99	DC	14.52
49445590	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	200909 26LOBO+ 230 919490 AA2-000 TAP 230 1	operation	570.0	104.87	105.99	DC	14.52

14.5 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
42128701,42128702	1	26KEYSTONE 230.0 kV - STAR592 1.0 kV Ckt 4	**PENELEC** **PN-AF1-F-0046a: Replace transformer** **Replace substation conductor at Keystone (3A)** **Project Type : FAC** **Cost : $26,180,000** **Time Estimate : 24.0 Months**	$26,180,000
41511350,41511351, 41511352,41783375	6	01SHINGL 230.0 kV - 26LEWISTWN 230.0 kV Ckt 1	**APS** **WP-AF1-F-0005a: Replace substation conductor at Shingletown** **Project Type : FAC** **Cost : $126,000** **Time Estimate : 6.0 Months** **WP-AF1-F-0005b: Replace substation conductor** **Replace switches at Shingletown** **Project Type : FAC** **Cost : $378,000** **Time Estimate : 9.0 Months** **PENELEC** **PN-AF1-F-0061a: Replace substation conductor at Shingletown** **Project Type : FAC** **Cost : $238,000** **Time Estimate : 6.0 Months** **PN-AF1-F-0061b : Replace substation conductor at Shingletown.Replace disconnect switches at Shingletown** **Reconductor Shingletown - Lewistown 115 kV (~26 miles)** **Project Type : FAC** **Cost : $46,826,500** **Time Estimate : 9.0 Months**	$47,568,500
41783462,41511549, 41511548	2	26EAGL VAL 115.0 kV - 26TYRONE N 115.0 kV Ckt 1	**PENELEC** **s1776.1: Supplemental upgrade s1776.1: Tyrone North - Construct a four breaker 115 kV ring bus. The supplemental project has a projected in-service date of 12/31/2020.** **Project Type: CON** **Cost : $0** **s1776.2: Supplemental upgrade s1776.2: Replace the Tyrone North #2 115/46 kV 45/60/75 MVA transformer. The supplemental project has a projected in-service date of 12/31/2020.** **Project Type: CON** **Cost : $0** **s1776.3: Supplemental upgrade s1776.3: Install a 46 kV 1200 A bypass switch between the Tipton and Warrior Ridge 46 kV lines. The supplemental project has a projected in-service date of 12/31/2020.** **Project Type: CON** **Cost : $0**	$0

ID	Index	Facility	Upgrade Description	Cost
41511931	3	**26BLRSVL E 115.0 kV - 26BLAIRSVL 138.0 kV Ckt 1**	**PENELEC** **PN-AF1-F-0088a: At Blairsville East substation, replace the 138/115 kV transformer.** **Project Type : FAC** **Cost : $4,165,000** **Time Estimate : 24.0 Months** **PN-AF1-F-0088b: At Blairsville East, replace the transformer circuit breaker.** **Project Type : FAC** **Cost : $595,000** **Time Estimate : 12.0 Months** **Note: AF1-086 currently has a cost responsibility for the above upgrade. The following baseline project is "on-hold"; if the following baseline project is approved for construction, then AF1-086 will not have a cost responsibility and can take advantage of the following baseline project. If additional mitigations beyond the following baseline project are needed, AF1-086 will have a cost responsibility for those additional mitigations.** **b3073 : PJM Baseline Upgrade b3073: Replace the Blairsville East 138/115 kV transformer and associated equipment such as breaker disconnects and bus conductor. The baseline project has a projected in-service date of 06/01/2022.**	$4,760,000
42128586,42128585	4	**26HOMER CT 230.0 kV - 26SHELOCTA 230.0 kV Ckt 1**	**PENELEC** **PN-AF1-F-0040a: Replace Wave Trap at Homer City** **Project Type : FAC** **Cost : $119,000** **Time Estimate : 9.0 Months** **PN-AF1-F-0040b: Reconductor Homer City - Sheloctoa 230 kV (~11 miles)** **Project Type : FAC** **Cost : $19,188,750** **Time Estimate : 6.0 Months** **PN-AF1-F-0040c: Replace line drops at Shelocta** **Project Type : FAC** **Cost : $119,000** **Time Estimate : 6.0 Months** **PN-AF1-F-0040d: Replace disconnect switch at Shelocta** **Project Type : FAC** **Cost : $119,000** **Time Estimate : 9.0 Months**	$19,545,750

ID	Index	Facility	Upgrade Description	Cost
42128595,42128596	5	26SHELOCTA 230.0 kV - 26KEYSTONE 230.0 kV Ckt 1	**PENELEC** **PN-AF1-F-0044a: Replace Wave Trap at Keystone** **Project Type : FAC** **Cost : $119,000** **Time Estimate : 9.0 Months** **PN-AF1-F-0044b: Reconductor Shelocta - Keystone 230 kV (~3 miles)** **Project Type : FAC** **Cost : $4,034,100** **Time Estimate : 6.0 Months** **PN-AF1-F-0044c: Replace substation conductor at Shelocta and Keystone** **Project Type : FAC** **Cost : $178,500** **Time Estimate : 6.0 Months**	$4,331,600
			TOTAL COST	**$102,385,850**

14.6 Flow Gate Details

The following indices contain additional information about each flowgate presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact.It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

14.7 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
42128702	200810	26KEYSTONE	PENELEC	999401	STAR592	PJM	4	PJM500_PN_P4-500-001D	breaker	635.0	97.29	100.1	DC	17.61

Bus #	Bus	MW Impact
200503	**26C.SLOPE (Deativation : 06/07/19)**	**16.7325**
200636	26IUP CO-G	0.4069
200794	26CONEMAGH	0.2755
200805	**26COLVER13 (Deativation : 09/01/20)**	**19.5371**
200809	26SITHE	1.2781
200833	26SEWRDB34	13.2926
200834	26SW_E13_K22	0.0419
200835	26DSGENWIN	0.2043
200837	26HOMER C1	22.0118
200838	26HOMER C2	18.4521
200839	26HOMER C3	19.5339
200846	26FORWARD	0.1497
200864	K-013 E	4.2904
200883	Q-053 E	7.8926
200886	26ARWF_N39	0.3654
200888	26HIGHLAND	0.3256
200889	26STNY CRK	0.2507
200890	26BF_G21_K23	0.1002
200891	26CSLMN_L13	0.1571
200892	26LOOKOUT	0.1493
200894	26K02	4.2783
200898	26AA1-106	1.6183
200906	26KEYSTN#3	0.6753
200915	26CHSTN_FL	0.1744
200925	26R32	0.3757
200945	26CT_V3-030	0.1279
201144	W3-099 C OP1	0.8862
201477	26Y2-055	2.5227
202158	26CON.GEN1	0.0706
202160	26CON.GEN2	0.0494
202225	26SCI_S29B	0.0652
203034	26NA_O38_P22	0.3198
203910	26Z1-091	1.4594
203999	P-047 E	7.6636
235003	AC1-025 E	0.1066
236828	01GRAYMONT	0.2892
290086	Q-036 E	4.7474
292350	K-023	4.6300
292542	L-013 1	4.5034
293301	N-039 E	10.4723
293393	V3-030E	4.8293
293432	R-040 E	0.2153

Bus #	Bus	MW Impact
293603	O-018 E	9.3319
293902	O-048 E	4.0530
294515	O38_P22	9.1633
294903	P-060 E	7.1841
296332	R-032 E	10.7676
903644	W3-099 E OP1	5.9308
913142	Y1-033 E OP1	3.1317
916202	Z1-069 E	6.1155
917672	Z2-108 E	2.1532
918682	AA1-082 E	4.1617
919201	AA1-144 OP	11.8405
919491	AA2-000	36.9701
920341	AA2-132	1.6166
922932	AB1-082 OP	2.2258
923443	AB1-160 E	1.7473
930511	AB1-092	1.3574
935191	AD1-154	2.3565
936421	AD2-055	2.7947
936991	AD2-133 C	2.1363
936992	AD2-133 E	9.7714
938351	AE1-053	1.1962
938881	AE1-116	0.7506
938951	AE1-123	1.6552
938991	AE1-128 C	12.7001
938992	AE1-128 E	8.4667
939171	AE1-147 C	0.8700
939172	AE1-147 E	0.5800
939291	AE1-160 C	1.0268
939292	AE1-160 E	0.5902
939381	AE1-169 C O1	4.1867
939382	AE1-169 E O1	2.7912
940201	AE2-001 C	0.8686
940202	AE2-001 E	0.5791
940681	AE2-055 C	0.8483
940682	AE2-055 E	0.5656
940861	AE2-074 C	1.6901
940862	AE2-074 E	2.2247
941191	AE2-113 C	6.6183
941192	AE2-113 E	7.1257
941231	AE2-117 C	1.0872
941232	AE2-117 E	0.7248
941241	AE2-118 C	1.0872
941242	AE2-118 E	0.7248
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**1.1764**
941252	**AE2-119 E (Withdrawn : 12/16/2019)**	**0.7842**
941261	AE2-120 C	0.8679
941262	AE2-120 E	0.5786
941271	AE2-121 C	0.4638
941272	AE2-121 E	0.3097
941321	AE2-126 C	1.1560
941322	AE2-126 E	0.7706
941331	AE2-129 C	1.3127

Bus #	Bus	MW Impact
941332	AE2-129 E	0.8752
941351	AE2-131 C	1.3127
941352	AE2-131 E	0.8752
941421	AE2-139 C	4.4582
941422	AE2-139 E	2.9721
942121	AE2-224 C	11.0976
942122	AE2-224 E	7.3984
942351	AE2-248 C	0.6854
942352	AE2-248 E	0.4570
942361	AE2-249 C	1.4288
942362	AE2-249 E	0.9525
942491	AE2-262 C	3.9062
942492	AE2-262 E	2.6249
942501	AE2-263 C	3.6718
942502	AE2-263 E	2.4515
942511	AE2-264 C	5.1734
942512	AE2-264 E	3.4490
942811	AE2-299 C	2.2018
942812	AE2-299 E	8.8074
942961	AE2-316 C	3.5892
942962	AE2-316 E	5.1182
943151	AE2-344 C	4.6968
943152	AE2-344 E	3.1312
943351	AF1-006 C	0.4299
943352	AF1-006 E	0.2418
943711	AF1-039 C O1	0.4391
943712	AF1-039 E O1	0.2927
943751	AF1-043	4.4436
943871	AF1-055 C O1	1.8031
943872	AF1-055 E O1	1.2020
944001	AF1-068 C O1	0.4829
944002	AF1-068 E O1	0.2717
944181	AF1-086 C O1	3.2911
944182	AF1-086 E O1	14.3182
944261	AF1-094 C	0.4556
944262	AF1-094 E	0.3037
944281	AF1-096 C	0.5142
944282	AF1-096 E	0.3428
944301	AF1-098 C	1.7941
944302	AF1-098 E	1.1961
944311	AF1-099 C	3.1427
944312	AF1-099 E	2.0951
944321	AF1-100 C O1	6.7325
944322	AF1-100 E O1	4.4883
944381	AF1-103 O1	0.9216
944391	AF1-104 O1	0.6234
944411	AF1-106 O1	0.9338
944471	AF1-112 C	0.4553
944472	AF1-112 E	0.3035
944671	AF1-132 C O1	0.4520
944672	AF1-132 E O1	0.3013
944691	AF1-134 C O1	1.4096

Bus #	Bus	MW Impact
944692	AF1-134 E O1	1.4096
944701	AF1-135 C	1.6915
944702	AF1-135 E	1.1277
944731	AF1-138 C O1	0.5762
944732	AF1-138 E O1	0.3842
944741	AF1-139 C O1	0.5167
944742	AF1-139 E O1	0.3444
944751	AF1-140 C	1.6938
944752	AF1-140 E	1.1292
944771	AF1-142 C	5.0283
944772	AF1-142 E	3.3522
944781	AF1-143 C	8.4438
944782	AF1-143 E	5.6292
944841	AF1-149 C	0.8678
944842	AF1-149 E	0.5785
944881	AF1-153 C O1	0.5496
944882	AF1-153 E O1	0.3664
944901	AF1-155 C	0.5495
944902	AF1-155 E	0.3663
945021	AF1-167 C	0.4031
945022	AF1-167 E	0.2687
945051	AF1-170 C	1.5485
945052	AF1-170 E	1.0323
945071	AF1-172 C	6.4352
945072	AF1-172 E	4.2901
945121	AF1-177	0.2304
945161	AF1-181	0.0359
945171	AF1-182	0.1795
945181	AF1-183	0.0483
945331	AF1-198	0.1254
945451	AF1-210 C	0.3750
945452	AF1-210 E	0.2500
945481	AF1-213 C	5.2754
945482	AF1-213 E	3.5170
945491	AF1-214 C	0.4601
945492	AF1-214 E	0.3067
945551	AF1-220 C	4.5899
945552	AF1-220 E	3.0616
945671	AF1-232 C O1	17.6831
945672	AF1-232 E O1	9.5217
945751	AF1-240 C O1	0.7494
945752	AF1-240 E O1	0.4996
945771	AF1-242 C	0.5495
945772	AF1-242 E	0.3663
945901	AF1-255 C	0.9932
945902	AF1-255 E	1.3715
946071	AF1-272 C O1	17.9595
946072	AF1-272 E O1	11.9730
946081	AF1-273 C O1	10.2018
946082	AF1-273 E O1	6.8012
946091	AF1-274 C	2.5949
946092	AF1-274 E	1.7299

Bus #	Bus	MW Impact
946131	AF1-278	11.2469
946191	AF1-284 C O1	0.4553
946192	AF1-284 E O1	0.2732
946211	AF1-286 C O1	0.3782
946212	AF1-286 E O1	0.2568
946221	AF1-287 C	0.4297
946222	AF1-287 E	0.2864
946241	AF1-289 C O1	4.1647
946242	AF1-289 E O1	2.7765
946381	AF1-302 C	0.8307
946382	AF1-302 E	1.1076
946401	AF1-304 C	2.6330
946402	AF1-304 E	1.7553
946421	AF1-306 C	2.6955
946422	AF1-306 E	10.7819
946431	AF1-307 C	7.1429
946432	AF1-307 E	4.7619
946571	AF1-321 C O1	2.2446
946572	AF1-321 E O1	1.4964
946771	AF1-217 C O1	0.4297
946772	AF1-217 E O1	0.2864
DUCKCREEK	DUCKCREEK	0.5619
NEWTON	NEWTON	0.5458
FARMERCITY	FARMERCITY	0.0284
PRAIRIE	PRAIRIE	1.3354
COFFEEN	COFFEEN	0.2664
EDWARDS	EDWARDS	0.1698
CHEOAH	CHEOAH	0.2933
TILTON	TILTON	0.3112
G-007	G-007	0.0426
MADISON	MADISON	0.0262
GIBSON	GIBSON	0.2790
CALDERWOOD	CALDERWOOD	0.2907
BLUEG	BLUEG	0.9062
TRIMBLE	TRIMBLE	0.2905
CATAWBA	CATAWBA	0.2188

14.8 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
41783462	200904	26EAGL VAL	PENELEC	200527	26TYRONE N	PENELEC	1	AP-P2-2-WP-230-005T	bus	191.0	113.68	115.0	DC	5.54

Bus #	Bus	MW Impact
200665	26SHAWVL 3	2.5507
200666	26SHAWVL 4	2.5057
200715	26SHAWVL 1	2.2589
200722	26SHAWVL 2	2.3221
200905	26Q36	0.7172
200913	26SHAW-D	0.1365
235003	AC1-025 E	0.1219
236828	01GRAYMONT	0.3194
290086	Q-036 E	20.5528
919491	AA2-000	28.5206
930511	AB1-092	1.0472
936421	AD2-055	2.1560
936991	AD2-133 C	9.2488
936992	AD2-133 E	42.3028
939171	AE1-147 C	0.9548
939172	AE1-147 E	0.6365
940201	AE2-001 C	0.9570
940202	AE2-001 E	0.6380
940681	AE2-055 C	0.9910
940682	AE2-055 E	0.6607
941191	AE2-113 C	2.9319
941192	AE2-113 E	3.1567
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**1.9591**
941252	**AE2-119 E (Withdrawn : 12/16/2019)**	**1.3061**
941261	AE2-120 C	0.9578
941262	AE2-120 E	0.6385
941271	AE2-121 C	0.5067
941272	AE2-121 E	0.3383
941321	AE2-126 C	1.4356
941322	AE2-126 E	0.9570
941331	AE2-129 C	4.2805
941332	AE2-129 E	2.8537
941351	AE2-131 C	4.2805
941352	AE2-131 E	2.8537
942351	AE2-248 C	0.7794
942352	AE2-248 E	0.5196
942491	AE2-262 C	3.9032
942492	AE2-262 E	2.6230
942501	AE2-263 C	3.6690
942502	AE2-263 E	2.4496
943751	AF1-043	3.4280

Bus #	Bus	MW Impact
944001	AF1-068 C O1	0.5542
944002	AF1-068 E O1	0.3117
944181	AF1-086 C O1	0.4667
944182	AF1-086 E O1	2.0305
944311	AF1-099 C	3.1403
944312	AF1-099 E	2.0935
944321	AF1-100 C O1	15.7470
944322	AF1-100 E O1	10.4980
944471	AF1-112 C	0.5150
944472	AF1-112 E	0.3433
944671	AF1-132 C O1	0.5210
944672	AF1-132 E O1	0.3473
944691	AF1-134 C O1	0.4449
944692	AF1-134 E O1	0.4449
944701	AF1-135 C	0.5338
944702	AF1-135 E	0.3559
944771	AF1-142 C	5.0244
944772	AF1-142 E	3.3496
944841	AF1-149 C	0.9578
944842	AF1-149 E	0.6385
944881	AF1-153 C O1	0.3827
944882	AF1-153 E O1	0.2552
944901	AF1-155 C	0.3798
944902	AF1-155 E	0.2532
945071	AF1-172 C	5.4317
945072	AF1-172 E	3.6211
945161	AF1-181	0.0839
945171	AF1-182	0.4199
945181	AF1-183	0.1327
945481	AF1-213 C	11.8213
945482	AF1-213 E	7.8808
945491	AF1-214 C	0.5076
945492	AF1-214 E	0.3384
945551	AF1-220 C	3.6798
945552	AF1-220 E	2.4545
945771	AF1-242 C	0.3798
945772	AF1-242 E	0.2532
946091	AF1-274 C	5.6595
946092	AF1-274 E	3.7730
946421	AF1-306 C	2.0125
946422	AF1-306 E	8.0498
DUCKCREEK	DUCKCREEK	0.0115
NEWTON	NEWTON	0.0161
FARMERCITY	FARMERCITY	0.0009
CBM-W1	CBM-W1	0.0375
PRAIRIE	PRAIRIE	0.0465
O-066	O-066	0.3494
COFFEEN	COFFEEN	0.0074
EDWARDS	EDWARDS	0.0032
CHEOAH	CHEOAH	0.0205
TILTON	TILTON	0.0069
G-007	G-007	0.0686

Bus #	Bus	MW Impact
GIBSON	GIBSON	0.0082
CALDERWOOD	CALDERWOOD	0.0199
BLUEG	BLUEG	0.0278
TRIMBLE	TRIMBLE	0.0089
CATAWBA	CATAWBA	0.0203

14.9 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
41511931	200740	26BLRSVLE	PENELEC	200763	26BLAIRSVL	PENELEC	1	PN_P4-500-001J	breaker	364.0	101.67	102.9	DC	9.95

Bus #	Bus	MW Impact
200636	26IUP CO-G	0.2723
200794	26CONEMAGH	0.1881
200805	**26COLVER13 (Deativation : 09/01/20)**	**11.8140**
200864	K-013 E	1.7770
200883	Q-053 E	3.4276
202158	26CON.GEN1	0.0485
202160	26CON.GEN2	0.0989
290086	Q-036 E	2.2304
292350	K-023	1.8658
292542	L-013 1	1.8148
293301	N-039 E	3.6481
293393	V3-030E	2.3416
293432	R-040 E	0.1021
293603	O-018 E	4.0717
293902	O-048 E	1.6333
294515	O38_P22	3.1921
294903	P-060 E	2.9877
296332	R-032 E	4.6981
917672	Z2-108 E	1.0208
935191	AD1-154	1.0416
936991	AD2-133 C	1.0037
936992	AD2-133 E	4.5907
938351	AE1-053	0.5671
938362	AE1-054 BAT	1.0105
938881	AE1-116	0.3078
938991	AE1-128 C	5.3691
938992	AE1-128 E	3.5794
941331	AE2-129 C	0.5873
941332	AE2-129 E	0.3915
941351	AE2-131 C	0.5873
941352	AE2-131 E	0.3915
942121	AE2-224 C	3.7475
942122	AE2-224 E	2.4983
942361	AE2-249 C	0.6040
942362	AE2-249 E	0.4027
942511	AE2-264 C	2.2636
942512	AE2-264 E	1.5091
944181	AF1-086 C O1	0.8374
944182	AF1-086 E O1	3.6432
944691	AF1-134 C O1	0.3250
944692	AF1-134 E O1	0.3250

Bus #	Bus	MW Impact
944701	AF1-135 C	0.3900
944702	AF1-135 E	0.2600
944751	AF1-140 C	0.3899
944752	AF1-140 E	0.2599
944781	AF1-143 C	1.8034
944782	AF1-143 E	1.2023
945481	AF1-213 C	2.4767
945482	AF1-213 E	1.6511
945671	AF1-232 C O1	3.8850
945672	AF1-232 E O1	2.0919
945751	AF1-240 C O1	0.3312
945752	AF1-240 E O1	0.2208
945901	AF1-255 C	0.2249
945902	AF1-255 E	0.3105
946071	AF1-272 C O1	12.2977
946072	AF1-272 E O1	8.1985
946081	AF1-273 C O1	2.2413
946082	AF1-273 E O1	1.4942
946241	AF1-289 C O1	0.9560
946242	AF1-289 E O1	0.6373
946431	AF1-307 C	4.7625
946432	AF1-307 E	3.1750
946571	AF1-321 C O1	0.4904
946572	AF1-321 E O1	0.3269
DUCKCREEK	DUCKCREEK	1.1250
NEWTON	NEWTON	1.0358
FARMERCITY	FARMERCITY	0.0530
G-007A	G-007A	2.9489
VFT	VFT	7.9980
PRAIRIE	PRAIRIE	2.4306
COFFEEN	COFFEEN	0.5089
EDWARDS	EDWARDS	0.3433
CHEOAH	CHEOAH	0.4114
TILTON	TILTON	0.6180
MADISON	MADISON	0.0907
GIBSON	GIBSON	0.5302
CALDERWOOD	CALDERWOOD	0.4110
BLUEG	BLUEG	1.6909
TRIMBLE	TRIMBLE	0.5426
CATAWBA	CATAWBA	0.2460

14.10 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
42128586	200767	26HOMER CT	PENELEC	200795	26SHELOCTA	PENELEC	1	PN_P4-500-002F	breaker	917.0	140.05	140.96	DC	18.18

Bus #	Bus	MW Impact
200503	**26C.SLOPE (Deativation : 06/07/19)**	**28.9164**
200794	26CONEMAGH	0.4629
200805	**26COLVER13 (Deativation : 09/01/20)**	**14.5103**
200809	26SITHE	2.2348
200823	26MHP_X3-003	1.9016
200833	26SEWRDB34	27.2507
200834	26SW_E13_K22	0.0724
200835	26DSGENWIN	0.3532
200837	26HOMER C1	38.4884
200838	26HOMER C2	32.0070
200839	26HOMER C3	33.8836
200846	26FORWARD	0.2587
200864	K-013 E	7.4126
200883	Q-053 E	13.4971
200886	26ARWF_N39	0.6904
200888	26HIGHLAND	0.5687
200889	26STNY CRK	0.4333
200890	26BF_G21_K23	0.1732
200891	26CSLMN_L13	0.2717
200892	26LOOKOUT	0.2581
200894	26K02	7.0234
200898	26AA1-106	2.6973
200905	26Q36	0.3168
200915	26CHSTN_FL	0.2983
200925	26R32	0.6562
201144	W3-099 C OP1	1.4662
201477	26Y2-055	4.1676
202225	26SCI_S29B	0.1127
203034	26NA_O38_P22	0.6041
203909	26Z1-038	1.8767
203910	26Z1-091	2.4569
203999	P-047 E	12.9768
235003	AC1-025 E	0.1729
236828	01GRAYMONT	0.4680
290086	Q-036 E	9.0772
292350	K-023	8.0052
292542	L-013 1	7.7862
293301	N-039 E	19.7843
293393	V3-030E	5.3060
293432	R-040 E	0.4380
293603	O-018 E	16.2963

Bus #	Bus	MW Impact
293902	O-048 E	7.0076
294515	O38_P22	17.3113
294573	P-028 E	11.4097
294903	P-060 E	12.4160
296332	R-032 E	18.8034
903644	W3-099 E OP1	9.8124
913142	Y1-033 E OP1	5.4199
915951	Y3-092 FTIR	107.9900
916202	Z1-069 E	10.3402
917672	Z2-108 E	4.3798
918682	AA1-082 E	6.9637
919201	AA1-144 OP	19.7891
919491	AA2-000	59.5323
920341	AA2-132	2.7294
922932	AB1-082 OP	3.7512
923443	AB1-160 E	2.9544
930511	AB1-092	2.1859
935191	AD1-154	2.5503
936421	AD2-055	4.5003
936991	AD2-133 C	4.0847
936992	AD2-133 E	18.6831
938351	AE1-053	2.4332
938881	AE1-116	1.2972
938951	AE1-123	2.2336
938991	AE1-128 C	21.9514
938992	AE1-128 E	14.6342
939171	AE1-147 C	1.4073
939172	AE1-147 E	0.9382
939291	AE1-160 C	1.5320
939292	AE1-160 E	0.8806
939381	AE1-169 C O1	6.2038
939382	AE1-169 E O1	4.1359
940201	AE2-001 C	1.4055
940202	AE2-001 E	0.9370
940681	AE2-055 C	1.3775
940682	AE2-055 E	0.9183
940861	AE2-074 C	2.8483
940862	AE2-074 E	3.7494
941191	AE2-113 C	10.9112
941192	AE2-113 E	11.7479
941231	AE2-117 C	1.9816
941232	AE2-117 E	1.3210
941241	AE2-118 C	1.9816
941242	AE2-118 E	1.3210
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**1.7524**
941252	**AE2-119 E (Withdrawn : 12/16/2019)**	**1.1682**
941261	AE2-120 C	1.4044
941262	AE2-120 E	0.9363
941271	AE2-121 C	0.7499
941272	AE2-121 E	0.5007
941321	AE2-126 C	1.7879
941322	AE2-126 E	1.1919

Bus #	Bus	MW Impact
941331	AE2-129 C	2.0624
941332	AE2-129 E	1.3750
941351	AE2-131 C	2.0624
941352	AE2-131 E	1.3750
941421	AE2-139 C	7.4089
941422	AE2-139 E	4.9393
942121	AE2-224 C	21.1962
942122	AE2-224 E	14.1308
942351	AE2-248 C	1.1113
942352	AE2-248 E	0.7409
942361	AE2-249 C	2.4695
942362	AE2-249 E	1.6464
942491	AE2-262 C	6.2505
942492	AE2-262 E	4.2003
942501	AE2-263 C	5.8754
942502	AE2-263 E	3.9228
942511	AE2-264 C	11.2229
942512	AE2-264 E	7.4819
942811	AE2-299 C	3.6451
942812	AE2-299 E	14.5803
942961	AE2-316 C	5.6956
942962	AE2-316 E	8.1220
943151	AE2-344 C	7.6841
943152	AE2-344 E	5.1228
943351	AF1-006 C	0.7075
943352	AF1-006 E	0.3980
943711	AF1-039 C O1	0.7599
943712	AF1-039 E O1	0.5066
943751	AF1-043	7.1554
943871	AF1-055 C O1	2.9015
943872	AF1-055 E O1	1.9343
944001	AF1-068 C O1	0.7834
944002	AF1-068 E O1	0.4406
944181	AF1-086 C O1	1.5310
944182	AF1-086 E O1	6.6609
944261	AF1-094 C	0.7197
944262	AF1-094 E	0.4798
944281	AF1-096 C	0.7672
944282	AF1-096 E	0.5115
944301	AF1-098 C	2.9545
944302	AF1-098 E	1.9697
944311	AF1-099 C	5.0288
944312	AF1-099 E	3.3525
944321	AF1-100 C O1	10.5721
944322	AF1-100 E O1	7.0481
944381	AF1-103 O1	1.5226
944391	AF1-104 O1	1.0293
944411	AF1-106 O1	1.5776
944471	AF1-112 C	0.7379
944472	AF1-112 E	0.4919
944671	AF1-132 C O1	0.7333
944672	AF1-132 E O1	0.4889

Bus #	Bus	MW Impact
944691	AF1-134 C O1	0.7576
944692	AF1-134 E O1	0.7576
944701	AF1-135 C	0.9091
944702	AF1-135 E	0.6061
944731	AF1-138 C O1	1.0502
944732	AF1-138 E O1	0.7001
944741	AF1-139 C O1	0.8723
944742	AF1-139 E O1	0.5815
944751	AF1-140 C	2.9287
944752	AF1-140 E	1.9525
944771	AF1-142 C	8.0460
944772	AF1-142 E	5.3640
944781	AF1-143 C	14.5992
944782	AF1-143 E	9.7328
944841	AF1-149 C	1.4043
944842	AF1-149 E	0.9362
944881	AF1-153 C O1	0.8674
944882	AF1-153 E O1	0.5783
944901	AF1-155 C	0.8670
944902	AF1-155 E	0.5780
945021	AF1-167 C	0.5944
945022	AF1-167 E	0.3963
945051	AF1-170 C	2.5442
945052	AF1-170 E	1.6961
945071	AF1-172 C	10.3025
945072	AF1-172 E	6.8683
945121	AF1-177	0.3806
945161	AF1-181	0.0564
945171	AF1-182	0.2819
945181	AF1-183	0.0738
945331	AF1-198	0.2114
945451	AF1-210 C	0.5540
945452	AF1-210 E	0.3694
945481	AF1-213 C	6.9713
945482	AF1-213 E	4.6475
945491	AF1-214 C	0.7444
945492	AF1-214 E	0.4963
945551	AF1-220 C	7.2853
945552	AF1-220 E	4.8595
945671	AF1-232 C O1	30.5604
945672	AF1-232 E O1	16.4556
945751	AF1-240 C O1	0.8110
945752	AF1-240 E O1	0.5407
945771	AF1-242 C	0.8670
945772	AF1-242 E	0.5780
945901	AF1-255 C	1.7168
945902	AF1-255 E	2.3708
946081	AF1-273 C O1	17.6310
946082	AF1-273 E O1	11.7540
946091	AF1-274 C	4.0432
946092	AF1-274 E	2.6955
946131	AF1-278	42.0132

Bus #	Bus	MW Impact
946191	AF1-284 C O1	0.7890
946192	AF1-284 E O1	0.4734
946211	AF1-286 C O1	0.6389
946212	AF1-286 E O1	0.4338
946221	AF1-287 C	0.7027
946222	AF1-287 E	0.4684
946241	AF1-289 C O1	7.2007
946242	AF1-289 E O1	4.8005
946381	AF1-302 C	1.3182
946382	AF1-302 E	1.7576
946401	AF1-304 C	3.8864
946402	AF1-304 E	2.5909
946421	AF1-306 C	4.2972
946422	AF1-306 E	17.1887
946431	AF1-307 C	12.0207
946432	AF1-307 E	8.0138
946571	AF1-321 C O1	3.8779
946572	AF1-321 E O1	2.5853
946771	AF1-217 C O1	0.7027
946772	AF1-217 E O1	0.4684
DUCKCREEK	DUCKCREEK	0.7128
NEWTON	NEWTON	0.7049
FARMERCITY	FARMERCITY	0.0370
PRAIRIE	PRAIRIE	1.7487
O-066	O-066	1.6733
COFFEEN	COFFEEN	0.3430
EDWARDS	EDWARDS	0.2142
CHEOAH	CHEOAH	0.4109
TILTON	TILTON	0.3956
G-007	G-007	0.3588
MADISON	MADISON	0.0202
GIBSON	GIBSON	0.3593
CALDERWOOD	CALDERWOOD	0.4065
BLUEG	BLUEG	1.1735
TRIMBLE	TRIMBLE	0.3756
CATAWBA	CATAWBA	0.3206

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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
42128596	200795	26SHELOCTA	PENELEC	200810	26KEYSTONE	PENELEC	1	PN_P4-500-002A	breaker	917.0	116.32	119.82	DC	31.61

Bus #	Bus	MW Impact
200503	**26C.SLOPE (Deativation : 06/07/19)**	**32.5076**
200636	26IUP CO-G	0.6752
200794	26CONEMAGH	0.5468
200805	**26COLVER13 (Deativation : 09/01/20)**	**34.8876**
200809	26SITHE	2.1598
200833	26SEWRDB34	28.3096
200834	26SW_E13_K22	0.0787
200835	26DSGENWIN	0.3844
200837	26HOMER C1	37.1972
200838	26HOMER C2	31.2734
200839	26HOMER C3	33.1070
200846	26FORWARD	0.2807
200864	K-013 E	8.0446
200883	Q-053 E	15.1296
200886	26ARWF_N39	0.7144
200888	26HIGHLAND	0.6259
200889	26STNY CRK	0.4725
200890	26BF_G21_K23	0.1885
200891	26CSLMN_L13	0.2957
200892	26LOOKOUT	0.2809
200894	26K02	7.3804
200898	26AA1-106	2.7668
200915	26CHSTN_FL	0.3344
200925	26R32	0.7222
200945	26CT_V3-030	0.2375
201144	W3-099 C OP1	1.5476
201477	26Y2-055	4.3870
202158	26CON.GEN1	0.1133
202160	26CON.GEN2	0.0848
202225	26SCI_S29B	0.1224
203034	26NA_O38_P22	0.6251
203910	26Z1-091	2.4645
203999	P-047 E	13.0226
235003	AC1-025 E	0.1912
236828	01GRAYMONT	0.5180
290086	Q-036 E	8.8754
292350	K-023	8.7126
292542	L-013 1	8.4742
293301	N-039 E	20.4723
293393	V3-030E	8.9704
293432	R-040 E	0.4052

Bus #	Bus	MW Impact
293603	O-018 E	17.9374
293902	O-048 E	7.6268
294515	O38_P22	17.9133
294903	P-060 E	13.5395
296332	R-032 E	20.6970
903644	W3-099 E OP1	10.3567
913142	Y1-033 E OP1	5.9219
916202	Z1-069 E	10.4453
917672	Z2-108 E	4.0517
918682	AA1-082 E	7.0566
919201	AA1-144 OP	20.0981
919491	AA2-000	64.8177
920341	AA2-132	2.7367
922932	AB1-082 OP	3.8155
923443	AB1-160 E	2.9844
930511	AB1-092	2.3799
935191	AD1-154	4.1854
936421	AD2-055	4.8998
936991	AD2-133 C	3.9939
936992	AD2-133 E	18.2677
938351	AE1-053	2.2510
938881	AE1-116	1.4089
938951	AE1-123	2.9191
938991	AE1-128 C	24.0523
938992	AE1-128 E	16.0349
939171	AE1-147 C	1.5578
939172	AE1-147 E	1.0386
939291	AE1-160 C	1.8016
939292	AE1-160 E	1.0356
939381	AE1-169 C O1	7.3470
939382	AE1-169 E O1	4.8980
940201	AE2-001 C	1.5556
940202	AE2-001 E	1.0371
940681	AE2-055 C	1.5221
940682	AE2-055 E	1.0148
940861	AE2-074 C	2.8971
940862	AE2-074 E	3.8136
941191	AE2-113 C	11.4763
941192	AE2-113 E	12.3563
941231	AE2-117 C	2.0808
941232	AE2-117 E	1.3872
941241	AE2-118 C	2.0808
941242	AE2-118 E	1.3872
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**2.1153**
941252	**AE2-119 E (Withdrawn : 12/16/2019)**	**1.4102**
941261	AE2-120 C	1.5544
941262	AE2-120 E	1.0363
941271	AE2-121 C	0.8303
941272	AE2-121 E	0.5544
941321	AE2-126 C	2.0539
941322	AE2-126 E	1.3692
941331	AE2-129 C	2.4166

Bus #	Bus	MW Impact
941332	AE2-129 E	1.6111
941351	AE2-131 C	2.4166
941352	AE2-131 E	1.6111
941421	AE2-139 C	7.6068
941422	AE2-139 E	5.0712
942121	AE2-224 C	21.8082
942122	AE2-224 E	14.5388
942351	AE2-248 C	1.2289
942352	AE2-248 E	0.8193
942361	AE2-249 C	2.7059
942362	AE2-249 E	1.8039
942491	AE2-262 C	6.9530
942492	AE2-262 E	4.6724
942501	AE2-263 C	6.5358
942502	AE2-263 E	4.3637
942511	AE2-264 C	9.9878
942512	AE2-264 E	6.6586
942811	AE2-299 C	3.8423
942812	AE2-299 E	15.3691
942961	AE2-316 C	6.2990
942962	AE2-316 E	8.9823
943151	AE2-344 C	8.2183
943152	AE2-344 E	5.4789
943351	AF1-006 C	0.7537
943352	AF1-006 E	0.4239
943711	AF1-039 C O1	0.8303
943712	AF1-039 E O1	0.5535
943751	AF1-043	7.7907
943871	AF1-055 C O1	3.1386
943872	AF1-055 E O1	2.0924
944001	AF1-068 C O1	0.8661
944002	AF1-068 E O1	0.4872
944181	AF1-086 C O1	5.9075
944182	AF1-086 E O1	25.7008
944261	AF1-094 C	0.7983
944262	AF1-094 E	0.5322
944281	AF1-096 C	0.9022
944282	AF1-096 E	0.6015
944301	AF1-098 C	3.1348
944302	AF1-098 E	2.0899
944311	AF1-099 C	5.5940
944312	AF1-099 E	3.7293
944321	AF1-100 C O1	11.9824
944322	AF1-100 E O1	7.9883
944381	AF1-103 O1	1.6028
944391	AF1-104 O1	1.0955
944411	AF1-106 O1	1.5856
944471	AF1-112 C	0.8161
944472	AF1-112 E	0.5441
944671	AF1-132 C O1	0.8107
944672	AF1-132 E O1	0.5405
944691	AF1-134 C O1	1.1405

Bus #	Bus	MW Impact
944692	AF1-134 E O1	1.1405
944701	AF1-135 C	1.3686
944702	AF1-135 E	0.9124
944731	AF1-138 C O1	1.1028
944732	AF1-138 E O1	0.7352
944741	AF1-139 C O1	0.8746
944742	AF1-139 E O1	0.5831
944751	AF1-140 C	3.2443
944752	AF1-140 E	2.1629
944771	AF1-142 C	8.9503
944772	AF1-142 E	5.9669
944781	AF1-143 C	15.8892
944782	AF1-143 E	10.5928
944841	AF1-149 C	1.5543
944842	AF1-149 E	1.0362
944881	AF1-153 C O1	0.9693
944882	AF1-153 E O1	0.6462
944901	AF1-155 C	0.9691
944902	AF1-155 E	0.6461
945021	AF1-167 C	0.7104
945022	AF1-167 E	0.4736
945051	AF1-170 C	2.7153
945052	AF1-170 E	1.8102
945071	AF1-172 C	11.3364
945072	AF1-172 E	7.5576
945121	AF1-177	0.4007
945161	AF1-181	0.0639
945171	AF1-182	0.3195
945181	AF1-183	0.0864
945331	AF1-198	0.2136
945451	AF1-210 C	0.6626
945452	AF1-210 E	0.4418
945481	AF1-213 C	9.4791
945482	AF1-213 E	6.3194
945491	AF1-214 C	0.8239
945492	AF1-214 E	0.5492
945551	AF1-220 C	8.0851
945552	AF1-220 E	5.3930
945671	AF1-232 C O1	33.2946
945672	AF1-232 E O1	17.9278
945751	AF1-240 C O1	1.3310
945752	AF1-240 E O1	0.8873
945771	AF1-242 C	0.9691
945772	AF1-242 E	0.6461
945901	AF1-255 C	1.8890
945902	AF1-255 E	2.6086
946071	AF1-272 C O1	29.2485
946072	AF1-272 E O1	19.4990
946081	AF1-273 C O1	19.2084
946082	AF1-273 E O1	12.8056
946091	AF1-274 C	4.5988
946092	AF1-274 E	3.0659

Bus #	Bus	MW Impact
946131	AF1-278	19.3364
946191	AF1-284 C O1	0.8671
946192	AF1-284 E O1	0.5203
946211	AF1-286 C O1	0.6422
946212	AF1-286 E O1	0.4360
946221	AF1-287 C	0.7518
946222	AF1-287 E	0.5012
946241	AF1-289 C O1	7.9675
946242	AF1-289 E O1	5.3117
946381	AF1-302 C	1.4578
946382	AF1-302 E	1.9438
946401	AF1-304 C	4.6208
946402	AF1-304 E	3.0805
946421	AF1-306 C	4.7503
946422	AF1-306 E	19.0010
946431	AF1-307 C	14.1382
946432	AF1-307 E	9.4254
946571	AF1-321 C O1	4.1989
946572	AF1-321 E O1	2.7993
946771	AF1-217 C O1	0.7518
946772	AF1-217 E O1	0.5012
DUCKCREEK	DUCKCREEK	0.5412
NEWTON	NEWTON	0.5491
FARMERCITY	FARMERCITY	0.0290
PRAIRIE	PRAIRIE	1.3845
O-066	O-066	3.3130
COFFEEN	COFFEEN	0.2664
EDWARDS	EDWARDS	0.1617
CHEOAH	CHEOAH	0.3544
TILTON	TILTON	0.3018
G-007	G-007	0.6157
MADISON	MADISON	0.0081
GIBSON	GIBSON	0.2796
CALDERWOOD	CALDERWOOD	0.3499
BLUEG	BLUEG	0.9218
TRIMBLE	TRIMBLE	0.2949
CATAWBA	CATAWBA	0.2902

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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
41511350	235248	01SHINGL	AP	200513	26LEWISTWN	PENELEC	1	AP-P2-3-WP-230-446T	breaker	570.0	118.91	120.13	DC	15.36

Bus #	Bus	MW Impact
200665	26SHAWVL 3	11.2213
200666	26SHAWVL 4	11.0429
200715	26SHAWVL 1	6.8508
200722	26SHAWVL 2	7.0237
200894	26K02	13.1208
200898	26AA1-106	2.6976
200905	26Q36	0.2708
200913	26SHAW-D	0.2828
203352	26CANZ2-011	0.4430
235003	AC1-025 E	0.9180
236828	01GRAYMONT	2.3847
290086	Q-036 E	7.7608
919491	AA2-000	169.8793
930511	AB1-092	6.2375
936421	AD2-055	12.8419
936991	AD2-133 C	3.4924
936992	AD2-133 E	15.9737
939171	AE1-147 C	7.1243
939172	AE1-147 E	4.7495
940201	AE2-001 C	7.1412
940202	AE2-001 E	4.7608
940681	AE2-055 C	7.3998
940682	AE2-055 E	4.9332
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**4.0520**
941252	**AE2-119 E (Withdrawn : 12/16/2019)**	**2.7014**
941261	AE2-120 C	7.1504
941262	AE2-120 E	4.7670
941271	AE2-121 C	3.7720
941272	AE2-121 E	2.5186
941321	AE2-126 C	2.6525
941322	AE2-126 E	1.7683
941331	AE2-129 C	3.1049
941332	AE2-129 E	2.0699
941351	AE2-131 C	3.1049
941352	AE2-131 E	2.0699
941421	AE2-139 C	7.8236
941422	AE2-139 E	5.2157
942351	AE2-248 C	5.8335
942352	AE2-248 E	3.8890
942491	AE2-262 C	26.1095

Bus #	Bus	MW Impact
942492	AE2-262 E	17.5456
942501	AE2-263 C	24.5429
942502	AE2-263 E	16.3863
943751	AF1-043	38.5255
944001	AF1-068 C O1	7.8127
944002	AF1-068 E O1	4.3947
944181	AF1-086 C O1	1.2931
944182	AF1-086 E O1	5.6255
944311	AF1-099 C	39.6342
944312	AF1-099 E	26.4228
944321	AF1-100 C O1	69.3975
944322	AF1-100 E O1	46.2650
944471	AF1-112 C	7.2636
944472	AF1-112 E	4.8424
944671	AF1-132 C O1	7.3427
944672	AF1-132 E O1	4.8951
944691	AF1-134 C O1	2.2470
944692	AF1-134 E O1	2.2470
944701	AF1-135 C	2.6964
944702	AF1-135 E	1.7976
944771	AF1-142 C	63.4148
944772	AF1-142 E	42.2765
944841	AF1-149 C	7.1515
944842	AF1-149 E	4.7677
945071	AF1-172 C	61.3380
945072	AF1-172 E	40.8920
945161	AF1-181	0.3692
945171	AF1-182	1.8506
945181	AF1-183	0.4023
945481	AF1-213 C	25.4386
945482	AF1-213 E	16.9591
945491	AF1-214 C	7.1500
945492	AF1-214 E	4.7666
945551	AF1-220 C	5.7668
945552	AF1-220 E	3.8467
946091	AF1-274 C	10.0853
946092	AF1-274 E	6.7235
946312	AF1-295 BAT	1.5296
LGEE	LGEE	0.0673
WEC	WEC	0.0444
CBM-W2	CBM-W2	0.6962
CBM-W1	CBM-W1	2.1267
TVA	TVA	0.0672
O-066	O-066	5.0266
CBM-S1	CBM-S1	0.5197
G-007	G-007	0.8403
MEC	MEC	0.1907
CATAWBA	CATAWBA	0.0231

Affected Systems

14.13 Affected Systems

14.13.1 LG&E

LG&E Impacts to be determined during later study phases (as applicable).

14.13.2 MISO

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

14.13.3 TVA

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

14.13.4 Duke Energy Progress

Duke Energy Progress Impacts to be determined during later study phases (as applicable).

14.13.5 NYISO

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

14.14 Contingency Definitions

Contingency Name	Contingency Definition
PJM500_PN_P4-500-001A	CONTINGENCY 'PJM500_PN_P4-500-001A' /* KEYSTONE 500KV BKR 1 DISCONNECT BRANCH FROM BUS 200011 TO BUS 200810 CKT 3 /* KEYSTONE 500 26KEYSTONE 230 REMOVE MACHINE H FROM BUS 200033 /* KEYS G2 20 REMOVE MACHINE L FROM BUS 200033 /* KEYS G2 20 DISCONNECT BUS 200033 /* KEYS G2 20 END
AP-P1-3-WP-230-005	CONTINGENCY 'AP-P1-3-WP-230-005' /* MILESBURG #82 230/46KV XFMR DISCONNECT BRANCH FROM BUS 235219 TO BUS 236745 CKT 82 /* 01MILESB 230 01MILESBG 46 DISCONNECT BRANCH FROM BUS 942490 TO BUS 235219 CKT 1 /* AE2-262 TAP 230 01MILESB 230 END
AP-P1-2-WP-230-324T_FSA_B	CONTINGENCY 'AP-P1-2-WP-230-324T_FSA_B' /* MOSHANNON-MARSHALL 230KV APS-PN TIE DISCONNECT BRANCH FROM BUS 919490 TO BUS 200909 CKT 1 /* AA2-000 TAP 230 26LOBO+ 230 DISCONNECT BRANCH FROM BUS 200857 TO BUS 200909 CKT 1 /* 26MARSHALL 230 26LOBO+ 230 DISCONNECT BRANCH FROM BUS 236829 TO BUS 200909 CKT 81 /* 01LOBO 46 46 26LOBO+ 230 REMOVE LOAD 1 FROM BUS 236829 /* 01LOBO 46 46 END
PJM500_PN_P4-500-001D	CONTINGENCY 'PJM500_PN_P4-500-001D' /* KEYSTONE 500KV BKR 4 DISCONNECT BRANCH FROM BUS 200011 TO BUS 200810 CKT 3 /* KEYSTONE 500 26KEYSTONE 230 REMOVE MACHINE H FROM BUS 200032 /* KEYS G1 20 REMOVE MACHINE L FROM BUS 200032 /* KEYS G1 20 DISCONNECT BUS 200032 /* KEYS G1 20 END
AP-P2-2-WP-230-005T	CONTINGENCY 'AP-P2-2-WP-230-005T' /* SHINGLETOWN #2 230KV BUS DISCONNECT BRANCH FROM BUS 235248 TO BUS 235970 CKT 1 /* 01SHINGL 230 01DALE 230 DISCONNECT BRANCH FROM BUS 235248 TO BUS 200513 CKT 1 /* 01SHINGL 230 26LEWISTWN 230 DISCONNECT BRANCH FROM BUS 235248 TO BUS 236711 CKT 82 /* 01SHINGL 230 01SHINGLTN 46 DISCONNECT BUS 237058 /*SHINGLETOWN 230 KV CAPACITOR END
PN-P1-2-PN-115-048	CONTINGENCY 'PN-P1-2-PN-115-048' /* GARMAN - SPANGLER 115KV DISCONNECT BRANCH FROM BUS 200801 TO BUS 200524 CKT 1 /* 26GARMAN 115 26SPANGLER 115 DISCONNECT BRANCH FROM BUS 200524 TO BUS 200533 CKT 2 /* 26SPANGLER 115 26SPANGLER 46 DISCONNECT BRANCH FROM BUS 200801 TO BUS 200755 CKT 1 /* 26GARMAN 115 26WESTOVER 115 DISCONNECT BUS 200524 /* 26SPANGLER 115 END
AP-P2-3-WP-230-446T	CONTINGENCY 'AP-P2-3-WP-230-446T' /* ELKO-MOSHANNON STK BKR AT ELKO DISCONNECT BRANCH FROM BUS 200726 TO BUS 235175 CKT 1 /* 26SHAWVL 2 230 01ELKO 230 DISCONNECT BRANCH FROM BUS 235158 TO BUS 235175 CKT 1 /* 01CARB 230 01ELKO 230 DISCONNECT BRANCH FROM BUS 235175 TO BUS 235236 CKT 1 /* 01ELKO 230 01QUEHAN 230 DISCONNECT BRANCH FROM BUS 235220 TO BUS 235236 CKT 1 /* 01MOSHAN 230 01QUEHAN 230 DISCONNECT BRANCH FROM BUS 235236 TO BUS 236732 CKT 81 /* 01QUEHAN 230 01QUEHANNA 46 END

Contingency Name	Contingency Definition
AP-P1-2-WP-230-005B	CONTINGENCY 'AP-P1-2-WP-230-005B' /* QUEUE AE2-262 - MOSHANNON 230KV DISCONNECT BRANCH FROM BUS 942490 TO BUS 235219 CKT 1 /* AE2-262 TAP 230 01MILESB 230 END
PJM_P1_APS_B_G692	CONTINGENCY 'PJM_P1_APS_B_G692' / 200011 KEYSTONE 500 235104 01CABOT 500 1 OPEN BRANCH FROM BUS 200011 TO BUS 235104 CKT 1 END
AP-P2-2-WP-230-001T	CONTINGENCY 'AP-P2-2-WP-230-001T' /* ELKO #2 230KV BUS DISCONNECT BRANCH FROM BUS 235175 TO BUS 235158 CKT 1 /* 01ELKO 230 01CARB 230 DISCONNECT BRANCH FROM BUS 235175 TO BUS 235236 CKT 1 /* 01ELKO 230 01QUEHAN 230 DISCONNECT BRANCH FROM BUS 235175 TO BUS 200726 CKT 1 /* 01ELKO 230 26SHAWVL 2 230 REDUCE BUS 237007 SHUNT BY 100 PERCENT /* 01ELKO CAP 138 DISCONNECT BUS 237007 /* 01ELKO CAP 138 END
200909 26LOBO+ 230 919490 AA2-000 TAP 230 1	CONTINGENCY '200909 26LOBO+ 230 919490 AA2-000 TAP 230 1' OPEN BRANCH FROM BUS 200909 TO BUS 919490 CKT 1 END
PN-P1-3-PN-230-001T	CONTINGENCY 'PN-P1-3-PN-230-001T' /* CONEMAUGH #1 500/230KV XFMR DISCONNECT BRANCH FROM BUS 200005 TO BUS 200912 CKT 3 /* CONEM-GH 500 26CONEMAGH 230 END
PN_P4-500-001J	CONTINGENCY 'PN_P4-500-001J' /* KEYSTONE 500KV BKR 16 DISCONNECT BRANCH FROM BUS 200011 TO BUS 235104 CKT 1 /* KEYSTONE 500 01CABOT 500 DISCONNECT BRANCH FROM BUS 200011 TO BUS 200810 TO BUS 200907 CKT 4/* KEYSTONE 500 26KEYSTONE 230 26KEYSTN#4 20.00 REDUCE BUS 200011 SHUNT BY 100 PERCENT /* KEYSTONE 500 END
Base Case	
PN_P4-500-002A	CONTINGENCY 'PN_P4-500-002A' /* CONEMAUGH 500KV BKR 1 DISCONNECT BRANCH FROM BUS 200005 TO BUS 200912 CKT 3 /* CONEM-GH 500 26CONEMAGH 230 DISCONNECT BUS 200031 /* CONE G2 22 END
PN-P2-3-PN-115-28B_A	CONTINGENCY 'PN-P2-3-PN-115-28B_A' /* 630 DISCONNECT BRANCH FROM BUS 200755 TO BUS 200801 CKT 1 /* 26WESTOVER 115 26GARMAN 115 DISCONNECT BRANCH FROM BUS 200682 TO BUS 200755 CKT 1 /* 26WEST.SOU 35 26WESTOVER 115 DISCONNECT BRANCH FROM BUS 200524 TO BUS 200801 CKT 1 /* 26SPANGLER 115 26GARMAN 115 DISCONNECT BRANCH FROM BUS 200524 TO BUS 200533 CKT 2 /* 26SPANGLER 115 26SPANGLER 46 END

Contingency Name	Contingency Definition
PN-P1-2-PN-230-025	CONTINGENCY 'PN-P1-2-PN-230-025' /* CONEMAUGH - SEWARD 230KV DISCONNECT BRANCH FROM BUS 200912 TO BUS 200793 CKT 1 /* 26CONEMAGH 230 26SEWARD 2 230 END
PN-P2-3-PN-115-59B	CONTINGENCY 'PN-P2-3-PN-115-59B' /* GARMAN 115 KV STUCK CB - CB (SPANGLER - WESTOVER SOUTH) DISCONNECT BRANCH FROM BUS 200755 TO BUS 944180 CKT 1 /* WESTOVER-AF1-086 TAP DISCONNECT BUS 200755 DISCONNECT BRANCH FROM BUS 200801 TO BUS 200524 CKT 1 /* GARMAN-SPANGLER DISCONNECT BRANCH FROM BUS 200524 TO BUS 200533 CKT 2 /* SPANGLER TR2 DISCONNECT BUS 200524 END
PN_P4-500-002F	CONTINGENCY 'PN_P4-500-002F' /* CONEMAUGH 500KV BKR 6 DISCONNECT BRANCH FROM BUS 200005 TO BUS 200912 CKT 3 /* CONEM-GH 500 26CONEMAGH 230 DISCONNECT BUS 200030 /* CONE G1 22 END
AP-P2-3-WP-230-443T *	CONTINGENCY 'AP-P2-3-WP-230-443T *' / UPDATED CON AJK 3-31-16 DISCONNECT BRANCH FROM BUS 200726 TO BUS 235175 CKT 1 DISCONNECT BRANCH FROM BUS 235175 TO BUS 235236 CKT 1 DISCONNECT BUS 235158 END

Short Circuit

14.15 Short Circuit

The following Breakers are overduty:

None

15 Network Impacts – Secondary POI

The Queue Project AF1-086 was evaluated as a 109.9 MW (Capacity 20.5 MW) injection at the Westover 115 kV substation in the PENELEC area. Project AF1-086 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-086 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

15.1 Generation Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

None

15.2 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
4212870 1	200810	26KEYSTON E	230.0	PENELEC	999401	STAR592	1.0	PJM	4	PJM500_PN_P4-500-001A	breaker	635.0	97.25	100.07	DC	17.67
4212870 2	200810	26KEYSTON E	230.0	PENELEC	999401	STAR592	1.0	PJM	4	PJM500_PN_P4-500-001D	breaker	635.0	97.25	100.07	DC	17.67

15.3 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
4151193 1	200740	26BLRSVL E	115.0	PENELEC	200763	26BLAIRSVL	138.0	PENELEC	1	PN_P4-500-001J	breaker	364.0	101.67	102.91	DC	10.0
4212858 5	200767	26HOMER CT	230.0	PENELEC	200795	26SHELOCTA	230.0	PENELEC	1	PN_P4-500-002A	breaker	917.0	139.99	140.9	DC	18.18
4212858 6	200767	26HOMER CT	230.0	PENELEC	200795	26SHELOCTA	230.0	PENELEC	1	PN_P4-500-002F	breaker	917.0	140.0	140.91	DC	18.18
4212859 5	200795	26SHELOCTA	230.0	PENELEC	200810	26KEYSTONE	230.0	PENELEC	1	PN_P4-500-002F	breaker	917.0	116.26	119.78	DC	31.72
4212859 6	200795	26SHELOCTA	230.0	PENELEC	200810	26KEYSTONE	230.0	PENELEC	1	PN_P4-500-002A	breaker	917.0	116.26	119.78	DC	31.72
4151135 0	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	AP-P2-3-WP-230-446T	breaker	570.0	118.88	120.07	DC	15.09
4151135 1	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	AP-P2-3-WP-230-443T *	breaker	570.0	118.74	119.93	DC	15.09
4178337 5	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	AP-P2-2-WP-230-001T	bus	570.0	118.72	119.92	DC	15.09

15.4 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
41173521	200599	26ERIE W	345.0	PENELEC	238547	02AT	345.0	ATSI	1	Base Case	operation	1560.0	115.8	116.26	DC	15.88
41172680	200726	26SHAWVL 2	230.0	PENELEC	235248	01SHINGL	230.0	AP	1	AP-P1-3-WP-230-005	operation	554.0	103.03	103.85	DC	10.52
41172681	200726	26SHAWVL 2	230.0	PENELEC	235248	01SHINGL	230.0	AP	1	AP-P1-2-WP-230-005B	operation	554.0	103.03	103.85	DC	10.52
41173273	200740	26BLRSVLE	115.0	PENELEC	200763	26BLAIRSVL	138.0	PENELEC	1	PJM_P1_APS_B_G692	operation	364.0	101.24	102.41	DC	9.42
42410799	200767	26HOMER CT	230.0	PENELEC	200795	26SHELOCTA	230.0	PENELEC	1	PN-P1-3-PN-230-001T	operation	917.0	135.27	136.18	DC	18.21
42410800	200767	26HOMER CT	230.0	PENELEC	200795	26SHELOCTA	230.0	PENELEC	1	PN-P1-2-PN-230-025	operation	917.0	135.27	136.18	DC	18.21
42410801	200767	26HOMER CT	230.0	PENELEC	200795	26SHELOCTA	230.0	PENELEC	1	Base Case	operation	731.0	139.54	140.21	DC	10.7
42410815	200795	26SHELOCTA	230.0	PENELEC	200810	26KEYSTONE	230.0	PENELEC	1	PN-P1-2-PN-230-025	operation	917.0	110.89	114.41	DC	31.75
42410816	200795	26SHELOCTA	230.0	PENELEC	200810	26KEYSTONE	230.0	PENELEC	1	PN-P1-3-PN-230-001T	operation	917.0	110.89	114.41	DC	31.75
42410817	200795	26SHELOCTA	230.0	PENELEC	200810	26KEYSTONE	230.0	PENELEC	1	Base Case	operation	731.0	113.31	116.62	DC	23.84
49446050	200810	26KEYSTONE	230.0	PENELEC	999401	STAR592	1.0	PJM	4	PN-P1-2-PN-345-107T	operation	635.0	98.31	100.45	DC	13.38
49446051	200810	26KEYSTONE	230.0	PENELEC	999401	STAR592	1.0	PJM	4	ATSI-P1-2-CEI-345-700T	operation	635.0	98.31	100.45	DC	13.38
41172535	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	Base Case	operation	491.0	112.95	114.03	DC	12.26
41172538	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	AP-P1-2-WP-230-324T_FSA_B	operation	570.0	104.84	105.94	DC	14.3
49445590	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	200909 26LOBO+ 230 919490 AA2-000 TAP 230 1	operation	570.0	104.84	105.94	DC	14.3

15.5 Flow Gate Details

The following indices contain additional information about each flowgate presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact. It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

15.6 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
42128702	200810	26KEYSTONE	PENELEC	999401	STAR592	PJM	4	PJM500_PN_P4-500-001D	breaker	635.0	97.25	100.07	DC	17.67

Bus #	Bus	MW Impact
200503	**26C.SLOPE (Deativation : 06/07/19)**	**16.7325**
200636	26IUP CO-G	0.4069
200794	26CONEMAGH	0.2755
200805	**26COLVER13 (Deativation : 09/01/20)**	**19.5371**
200809	26SITHE	1.2781
200833	26SEWRDB34	13.2926
200834	26SW_E13_K22	0.0419
200835	26DSGENWIN	0.2043
200837	26HOMER C1	22.0118
200838	26HOMER C2	18.4521
200839	26HOMER C3	19.5339
200846	26FORWARD	0.1497
200864	K-013 E	4.2904
200883	Q-053 E	7.8926
200886	26ARWF_N39	0.3654
200888	26HIGHLAND	0.3256
200889	26STNY CRK	0.2507
200890	26BF_G21_K23	0.1002
200891	26CSLMN_L13	0.1571
200892	26LOOKOUT	0.1493
200894	26K02	4.2783
200898	26AA1-106	1.6183
200906	26KEYSTN#3	0.6753
200915	26CHSTN_FL	0.1744
200925	26R32	0.3757
200945	26CT_V3-030	0.1279
201144	W3-099 C OP1	0.8862
201477	26Y2-055	2.5227
202158	26CON.GEN1	0.0706
202160	26CON.GEN2	0.0494
202225	26SCI_S29B	0.0652
203034	26NA_O38_P22	0.3198
203910	26Z1-091	1.4594
203999	P-047 E	7.6636
235003	AC1-025 E	0.1066
236828	01GRAYMONT	0.2892
290086	Q-036 E	4.7474
292350	K-023	4.6300
292542	L-013 1	4.5034
293301	N-039 E	10.4723
293393	V3-030E	4.8293
293432	R-040 E	0.2153

Bus #	Bus	MW Impact
293603	O-018 E	9.3319
293902	O-048 E	4.0530
294515	O38_P22	9.1633
294903	P-060 E	7.1841
296332	R-032 E	10.7676
903644	W3-099 E OP1	5.9308
913142	Y1-033 E OP1	3.1317
916202	Z1-069 E	6.1155
917672	Z2-108 E	2.1532
918682	AA1-082 E	4.1617
919201	AA1-144 OP	11.8405
919491	AA2-000	36.9701
920341	AA2-132	1.6166
922932	AB1-082 OP	2.2258
923443	AB1-160 E	1.7473
930511	AB1-092	1.3574
935191	AD1-154	2.3565
936421	AD2-055	2.7947
936991	AD2-133 C	2.1363
936992	AD2-133 E	9.7714
938351	AE1-053	1.1962
938881	AE1-116	0.7506
938951	AE1-123	1.6552
938991	AE1-128 C	12.7001
938992	AE1-128 E	8.4667
939171	AE1-147 C	0.8700
939172	AE1-147 E	0.5800
939291	AE1-160 C	1.0268
939292	AE1-160 E	0.5902
939381	AE1-169 C O1	4.1867
939382	AE1-169 E O1	2.7912
940201	AE2-001 C	0.8686
940202	AE2-001 E	0.5791
940681	AE2-055 C	0.8483
940682	AE2-055 E	0.5656
940861	AE2-074 C	1.6901
940862	AE2-074 E	2.2247
941191	AE2-113 C	6.6183
941192	AE2-113 E	7.1257
941231	AE2-117 C	1.0872
941232	AE2-117 E	0.7248
941241	AE2-118 C	1.0872
941242	AE2-118 E	0.7248
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**1.1764**
941252	**AE2-119 E (Withdrawn : 12/16/2019)**	**0.7842**
941261	AE2-120 C	0.8679
941262	AE2-120 E	0.5786
941271	AE2-121 C	0.4638
941272	AE2-121 E	0.3097
941321	AE2-126 C	1.1560
941322	AE2-126 E	0.7706
941331	AE2-129 C	1.3127

Bus #	Bus	MW Impact
941332	AE2-129 E	0.8752
941351	AE2-131 C	1.3127
941352	AE2-131 E	0.8752
941421	AE2-139 C	4.4582
941422	AE2-139 E	2.9721
942121	AE2-224 C	11.0976
942122	AE2-224 E	7.3984
942351	AE2-248 C	0.6854
942352	AE2-248 E	0.4570
942361	AE2-249 C	1.4288
942362	AE2-249 E	0.9525
942491	AE2-262 C	3.9062
942492	AE2-262 E	2.6249
942501	AE2-263 C	3.6718
942502	AE2-263 E	2.4515
942511	AE2-264 C	5.1734
942512	AE2-264 E	3.4490
942811	AE2-299 C	2.2018
942812	AE2-299 E	8.8074
942961	AE2-316 C	3.5892
942962	AE2-316 E	5.1182
943151	AE2-344 C	4.6968
943152	AE2-344 E	3.1312
943351	AF1-006 C	0.4299
943352	AF1-006 E	0.2418
943711	AF1-039 C O2	0.3793
943712	AF1-039 E O2	0.2528
943751	AF1-043	4.4436
943871	AF1-055 C O2	1.8147
943872	AF1-055 E O2	1.2098
944001	AF1-068 C O2	0.4826
944002	AF1-068 E O2	0.2715
944181	AF1-086 C O2	3.3026
944182	AF1-086 E O2	14.3682
944261	AF1-094 C	0.4556
944262	AF1-094 E	0.3037
944281	AF1-096 C	0.5142
944282	AF1-096 E	0.3428
944301	AF1-098 C	1.7941
944302	AF1-098 E	1.1961
944311	AF1-099 C	3.1427
944312	AF1-099 E	2.0951
944321	AF1-100 C O2	6.6899
944322	AF1-100 E O2	4.4599
944381	AF1-103 O2	0.9216
944391	AF1-104 O2	0.6234
944411	AF1-106 O2	0.9338
944471	AF1-112 C	0.4553
944472	AF1-112 E	0.3035
944671	AF1-132 C O2	0.4524
944672	AF1-132 E O2	0.3016
944691	AF1-134 C O1	1.4096

Bus #	Bus	MW Impact
944692	AF1-134 E O1	1.4096
944701	AF1-135 C	1.6915
944702	AF1-135 E	1.1277
944731	AF1-138 C O2	0.5762
944732	AF1-138 E O2	0.3842
944741	AF1-139 C O1	0.5167
944742	AF1-139 E O1	0.3444
944751	AF1-140 C	1.6938
944752	AF1-140 E	1.1292
944771	AF1-142 C	5.0283
944772	AF1-142 E	3.3522
944781	AF1-143 C	8.4438
944782	AF1-143 E	5.6292
944841	AF1-149 C	0.8678
944842	AF1-149 E	0.5785
944881	AF1-153 C O2	0.5496
944882	AF1-153 E O2	0.3664
944901	AF1-155 C	0.5495
944902	AF1-155 E	0.3663
945021	AF1-167 C	0.4031
945022	AF1-167 E	0.2687
945051	AF1-170 C	1.5485
945052	AF1-170 E	1.0323
945071	AF1-172 C	6.4352
945072	AF1-172 E	4.2901
945121	AF1-177	0.2304
945161	AF1-181	0.0359
945171	AF1-182	0.1795
945181	AF1-183	0.0483
945331	AF1-198	0.1254
945451	AF1-210 C	0.3750
945452	AF1-210 E	0.2500
945481	AF1-213 C	5.2754
945482	AF1-213 E	3.5170
945491	AF1-214 C	0.4601
945492	AF1-214 E	0.3067
945521	AF1-217 C O2	0.4297
945522	AF1-217 E O2	0.2864
945551	AF1-220 C	4.5899
945552	AF1-220 E	3.0616
945671	AF1-232 C O2	17.6332
945672	AF1-232 E O2	9.4948
945751	AF1-240 C O2	0.7494
945752	AF1-240 E O2	0.4996
945771	AF1-242 C	0.5495
945772	AF1-242 E	0.3663
945901	AF1-255 C	0.9932
945902	AF1-255 E	1.3715
946081	AF1-273 C O2	10.1352
946082	AF1-273 E O2	6.7568
946091	AF1-274 C	2.5949
946092	AF1-274 E	1.7299

Bus #	Bus	MW Impact
946131	AF1-278	11.2469
946191	AF1-284 C O2	0.5267
946192	AF1-284 E O2	0.3160
946211	AF1-286 C O2	0.3782
946212	AF1-286 E O2	0.2568
946221	AF1-287 C	0.4297
946222	AF1-287 E	0.2864
946241	AF1-289 C O2	4.1618
946242	AF1-289 E O2	2.7746
946381	AF1-302 C	0.8307
946382	AF1-302 E	1.1076
946401	AF1-304 C	2.6330
946402	AF1-304 E	1.7553
946421	AF1-306 C	2.6955
946422	AF1-306 E	10.7819
946431	AF1-307 C O2	8.2138
946432	AF1-307 E O2	5.4759
946571	AF1-321 C O2	2.6302
946572	AF1-321 E O2	1.7534
DUCKCREEK	DUCKCREEK	0.5619
NEWTON	NEWTON	0.5458
FARMERCITY	FARMERCITY	0.0284
PRAIRIE	PRAIRIE	1.3354
COFFEEN	COFFEEN	0.2664
EDWARDS	EDWARDS	0.1698
CHEOAH	CHEOAH	0.2933
TILTON	TILTON	0.3112
G-007	G-007	0.0426
MADISON	MADISON	0.0262
GIBSON	GIBSON	0.2790
CALDERWOOD	CALDERWOOD	0.2907
BLUEG	BLUEG	0.9062
TRIMBLE	TRIMBLE	0.2905
CATAWBA	CATAWBA	0.2188

15.7 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
41511931	200740	26BLRSVLE	PENELEC	200763	26BLAIRSVL	PENELEC	1	PN_P4-500-001J	breaker	364.0	101.67	102.91	DC	10.0

Bus #	Bus	MW Impact
200636	26IUP CO-G	0.2723
200794	26CONEMAGH	0.1881
200805	**26COLVER13 (Deativation : 09/01/20)**	**11.8140**
200864	K-013 E	1.7770
200883	Q-053 E	3.4276
202158	26CON.GEN1	0.0485
202160	26CON.GEN2	0.0989
290086	Q-036 E	2.2304
292350	K-023	1.8658
292542	L-013 1	1.8148
293301	N-039 E	3.6481
293393	V3-030E	2.3416
293432	R-040 E	0.1021
293603	O-018 E	4.0717
293902	O-048 E	1.6333
294515	O38_P22	3.1921
294903	P-060 E	2.9877
296332	R-032 E	4.6981
917672	Z2-108 E	1.0208
935191	AD1-154	1.0416
936991	AD2-133 C	1.0037
936992	AD2-133 E	4.5907
938351	AE1-053	0.5671
938362	AE1-054 BAT	1.0105
938881	AE1-116	0.3078
938991	AE1-128 C	5.3691
938992	AE1-128 E	3.5794
941331	AE2-129 C	0.5873
941332	AE2-129 E	0.3915
941351	AE2-131 C	0.5873
941352	AE2-131 E	0.3915
942121	AE2-224 C	3.7475
942122	AE2-224 E	2.4983
942361	AE2-249 C	0.6040
942362	AE2-249 E	0.4027
942511	AE2-264 C	2.2636
942512	AE2-264 E	1.5091
944181	AF1-086 C O2	0.8422
944182	AF1-086 E O2	3.6642
944691	AF1-134 C O1	0.3250
944692	AF1-134 E O1	0.3250

Bus #	Bus	MW Impact
944701	AF1-135 C	0.3900
944702	AF1-135 E	0.2600
944751	AF1-140 C	0.3899
944752	AF1-140 E	0.2599
944781	AF1-143 C	1.8034
944782	AF1-143 E	1.2023
945481	AF1-213 C	2.4767
945482	AF1-213 E	1.6511
945671	AF1-232 C O2	3.8681
945672	AF1-232 E O2	2.0828
945751	AF1-240 C O2	0.3312
945752	AF1-240 E O2	0.2208
945901	AF1-255 C	0.2249
945902	AF1-255 E	0.3105
946081	AF1-273 C O2	2.2186
946082	AF1-273 E O2	1.4791
946241	AF1-289 C O2	0.9562
946242	AF1-289 E O2	0.6375
946431	AF1-307 C O2	1.3310
946432	AF1-307 E O2	0.8874
946571	AF1-321 C O2	0.4287
946572	AF1-321 E O2	0.2858
DUCKCREEK	DUCKCREEK	1.1250
NEWTON	NEWTON	1.0358
FARMERCITY	FARMERCITY	0.0530
G-007A	G-007A	2.9489
VFT	VFT	7.9980
PRAIRIE	PRAIRIE	2.4306
COFFEEN	COFFEEN	0.5089
EDWARDS	EDWARDS	0.3433
CHEOAH	CHEOAH	0.4114
TILTON	TILTON	0.6180
MADISON	MADISON	0.0907
GIBSON	GIBSON	0.5302
CALDERWOOD	CALDERWOOD	0.4110
BLUEG	BLUEG	1.6909
TRIMBLE	TRIMBLE	0.5426
CATAWBA	CATAWBA	0.2460

15.8 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
42128586	200767	26HOMER CT	PENELEC	200795	26SHELOCTA	PENELEC	1	PN_P4-500-002F	breaker	917.0	140.0	140.91	DC	18.18

Bus #	Bus	MW Impact
200503	**26C.SLOPE (Deativation : 06/07/19)**	**28.9164**
200794	26CONEMAGH	0.4629
200805	**26COLVER13 (Deativation : 09/01/20)**	**14.5103**
200809	26SITHE	2.2348
200823	26MHP_X3-003	1.9016
200833	26SEWRDB34	27.2507
200834	26SW_E13_K22	0.0724
200835	26DSGENWIN	0.3532
200837	26HOMER C1	38.4884
200838	26HOMER C2	32.0070
200839	26HOMER C3	33.8836
200846	26FORWARD	0.2587
200864	K-013 E	7.4126
200883	Q-053 E	13.4971
200886	26ARWF_N39	0.6904
200888	26HIGHLAND	0.5687
200889	26STNY CRK	0.4333
200890	26BF_G21_K23	0.1732
200891	26CSLMN_L13	0.2717
200892	26LOOKOUT	0.2581
200894	26K02	7.0234
200898	26AA1-106	2.6973
200905	26Q36	0.3168
200915	26CHSTN_FL	0.2983
200925	26R32	0.6562
201144	W3-099 C OP1	1.4662
201477	26Y2-055	4.1676
202225	26SCI_S29B	0.1127
203034	26NA_O38_P22	0.6041
203909	26Z1-038	1.8767
203910	26Z1-091	2.4569
203999	P-047 E	12.9768
235003	AC1-025 E	0.1729
236828	01GRAYMONT	0.4680
290086	Q-036 E	9.0772
292350	K-023	8.0052
292542	L-013 1	7.7862
293301	N-039 E	19.7843
293393	V3-030E	5.3060
293432	R-040 E	0.4380
293603	O-018 E	16.2963

Bus #	Bus	MW Impact
293902	O-048 E	7.0076
294515	O38_P22	17.3113
294573	P-028 E	11.4097
294903	P-060 E	12.4160
296332	R-032 E	18.8034
903644	W3-099 E OP1	9.8124
913142	Y1-033 E OP1	5.4199
915951	Y3-092 FTIR	107.9900
916202	Z1-069 E	10.3402
917672	Z2-108 E	4.3798
918682	AA1-082 E	6.9637
919201	AA1-144 OP	19.7891
919491	AA2-000	59.5323
920341	AA2-132	2.7294
922932	AB1-082 OP	3.7512
923443	AB1-160 E	2.9544
930511	AB1-092	2.1859
935191	AD1-154	2.5503
936421	AD2-055	4.5003
936991	AD2-133 C	4.0847
936992	AD2-133 E	18.6831
938351	AE1-053	2.4332
938881	AE1-116	1.2972
938951	AE1-123	2.2336
938991	AE1-128 C	21.9514
938992	AE1-128 E	14.6342
939171	AE1-147 C	1.4073
939172	AE1-147 E	0.9382
939291	AE1-160 C	1.5320
939292	AE1-160 E	0.8806
939381	AE1-169 C O1	6.2038
939382	AE1-169 E O1	4.1359
940201	AE2-001 C	1.4055
940202	AE2-001 E	0.9370
940681	AE2-055 C	1.3775
940682	AE2-055 E	0.9183
940861	AE2-074 C	2.8483
940862	AE2-074 E	3.7494
941191	AE2-113 C	10.9112
941192	AE2-113 E	11.7479
941231	AE2-117 C	1.9816
941232	AE2-117 E	1.3210
941241	AE2-118 C	1.9816
941242	AE2-118 E	1.3210
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**1.7524**
941252	**AE2-119 E (Withdrawn : 12/16/2019)**	**1.1682**
941261	AE2-120 C	1.4044
941262	AE2-120 E	0.9363
941271	AE2-121 C	0.7499
941272	AE2-121 E	0.5007
941321	AE2-126 C	1.7879
941322	AE2-126 E	1.1919

Bus #	Bus	MW Impact
941331	AE2-129 C	2.0624
941332	AE2-129 E	1.3750
941351	AE2-131 C	2.0624
941352	AE2-131 E	1.3750
941421	AE2-139 C	7.4089
941422	AE2-139 E	4.9393
942121	AE2-224 C	21.1962
942122	AE2-224 E	14.1308
942351	AE2-248 C	1.1113
942352	AE2-248 E	0.7409
942361	AE2-249 C	2.4695
942362	AE2-249 E	1.6464
942491	AE2-262 C	6.2505
942492	AE2-262 E	4.2003
942501	AE2-263 C	5.8754
942502	AE2-263 E	3.9228
942511	AE2-264 C	11.2229
942512	AE2-264 E	7.4819
942811	AE2-299 C	3.6451
942812	AE2-299 E	14.5803
942961	AE2-316 C	5.6956
942962	AE2-316 E	8.1220
943151	AE2-344 C	7.6841
943152	AE2-344 E	5.1228
943351	AF1-006 C	0.7075
943352	AF1-006 E	0.3980
943711	AF1-039 C O2	0.6567
943712	AF1-039 E O2	0.4378
943751	AF1-043	7.1554
943871	AF1-055 C O2	2.9939
943872	AF1-055 E O2	1.9959
944001	AF1-068 C O2	0.7828
944002	AF1-068 E O2	0.4404
944181	AF1-086 C O2	1.5303
944182	AF1-086 E O2	6.6576
944261	AF1-094 C	0.7197
944262	AF1-094 E	0.4798
944281	AF1-096 C	0.7672
944282	AF1-096 E	0.5115
944301	AF1-098 C	2.9545
944302	AF1-098 E	1.9697
944311	AF1-099 C	5.0288
944312	AF1-099 E	3.3525
944321	AF1-100 C O2	10.5343
944322	AF1-100 E O2	7.0228
944381	AF1-103 O2	1.5226
944391	AF1-104 O2	1.0293
944411	AF1-106 O2	1.5776
944471	AF1-112 C	0.7379
944472	AF1-112 E	0.4919
944671	AF1-132 C O2	0.7339
944672	AF1-132 E O2	0.4893

Bus #	Bus	MW Impact
944691	AF1-134 C O1	0.7576
944692	AF1-134 E O1	0.7576
944701	AF1-135 C	0.9091
944702	AF1-135 E	0.6061
944731	AF1-138 C O2	1.0502
944732	AF1-138 E O2	0.7001
944741	AF1-139 C O1	0.8723
944742	AF1-139 E O1	0.5815
944751	AF1-140 C	2.9287
944752	AF1-140 E	1.9525
944771	AF1-142 C	8.0460
944772	AF1-142 E	5.3640
944781	AF1-143 C	14.5992
944782	AF1-143 E	9.7328
944841	AF1-149 C	1.4043
944842	AF1-149 E	0.9362
944881	AF1-153 C O2	0.8674
944882	AF1-153 E O2	0.5783
944901	AF1-155 C	0.8670
944902	AF1-155 E	0.5780
945021	AF1-167 C	0.5944
945022	AF1-167 E	0.3963
945051	AF1-170 C	2.5442
945052	AF1-170 E	1.6961
945071	AF1-172 C	10.3025
945072	AF1-172 E	6.8683
945121	AF1-177	0.3806
945161	AF1-181	0.0564
945171	AF1-182	0.2819
945181	AF1-183	0.0738
945331	AF1-198	0.2114
945451	AF1-210 C	0.5540
945452	AF1-210 E	0.3694
945481	AF1-213 C	6.9713
945482	AF1-213 E	4.6475
945491	AF1-214 C	0.7444
945492	AF1-214 E	0.4963
945521	AF1-217 C O2	0.7027
945522	AF1-217 E O2	0.4684
945551	AF1-220 C	7.2853
945552	AF1-220 E	4.8595
945671	AF1-232 C O2	30.4751
945672	AF1-232 E O2	16.4097
945751	AF1-240 C O2	0.8110
945752	AF1-240 E O2	0.5407
945771	AF1-242 C	0.8670
945772	AF1-242 E	0.5780
945901	AF1-255 C	1.7168
945902	AF1-255 E	2.3708
946081	AF1-273 C O2	17.5158
946082	AF1-273 E O2	11.6772
946091	AF1-274 C	4.0432

Bus #	Bus	MW Impact
946092	AF1-274 E	2.6955
946131	AF1-278	42.0132
946191	AF1-284 C O2	0.9121
946192	AF1-284 E O2	0.5473
946211	AF1-286 C O2	0.6389
946212	AF1-286 E O2	0.4338
946221	AF1-287 C	0.7027
946222	AF1-287 E	0.4684
946241	AF1-289 C O2	7.1962
946242	AF1-289 E O2	4.7974
946381	AF1-302 C	1.3182
946382	AF1-302 E	1.7576
946401	AF1-304 C	3.8864
946402	AF1-304 E	2.5909
946421	AF1-306 C	4.2972
946422	AF1-306 E	17.1887
946431	AF1-307 C O2	15.3882
946432	AF1-307 E O2	10.2588
946571	AF1-321 C O2	4.5743
946572	AF1-321 E O2	3.0495
DUCKCREEK	DUCKCREEK	0.7128
NEWTON	NEWTON	0.7049
FARMERCITY	FARMERCITY	0.0370
PRAIRIE	PRAIRIE	1.7487
O-066	O-066	1.6733
COFFEEN	COFFEEN	0.3430
EDWARDS	EDWARDS	0.2142
CHEOAH	CHEOAH	0.4109
TILTON	TILTON	0.3956
G-007	G-007	0.3588
MADISON	MADISON	0.0202
GIBSON	GIBSON	0.3593
CALDERWOOD	CALDERWOOD	0.4065
BLUEG	BLUEG	1.1735
TRIMBLE	TRIMBLE	0.3756
CATAWBA	CATAWBA	0.3206

15.9 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
42128596	200795	26SHELOCTA	PENELEC	200810	26KEYSTONE	PENELEC	1	PN_P4-500-002A	breaker	917.0	116.26	119.78	DC	31.72

Bus #	Bus	MW Impact
200503	**26C.SLOPE (Deativation : 06/07/19)**	**32.5076**
200636	26IUP CO-G	0.6752
200794	26CONEMAGH	0.5468
200805	**26COLVER13 (Deativation : 09/01/20)**	**34.8876**
200809	26SITHE	2.1598
200833	26SEWRDB34	28.3096
200834	26SW_E13_K22	0.0787
200835	26DSGENWIN	0.3844
200837	26HOMER C1	37.1972
200838	26HOMER C2	31.2734
200839	26HOMER C3	33.1070
200846	26FORWARD	0.2807
200864	K-013 E	8.0446
200883	Q-053 E	15.1296
200886	26ARWF_N39	0.7144
200888	26HIGHLAND	0.6259
200889	26STNY CRK	0.4725
200890	26BF_G21_K23	0.1885
200891	26CSLMN_L13	0.2957
200892	26LOOKOUT	0.2809
200894	26K02	7.3804
200898	26AA1-106	2.7668
200915	26CHSTN_FL	0.3344
200925	26R32	0.7222
200945	26CT_V3-030	0.2375
201144	W3-099 C OP1	1.5476
201477	26Y2-055	4.3870
202158	26CON.GEN1	0.1133
202160	26CON.GEN2	0.0848
202225	26SCI_S29B	0.1224
203034	26NA_O38_P22	0.6251
203910	26Z1-091	2.4645
203999	P-047 E	13.0226
235003	AC1-025 E	0.1912
236828	01GRAYMONT	0.5180
290086	Q-036 E	8.8754
292350	K-023	8.7126
292542	L-013 1	8.4742
293301	N-039 E	20.4723
293393	V3-030E	8.9704
293432	R-040 E	0.4052

Bus #	Bus	MW Impact
293603	O-018 E	17.9374
293902	O-048 E	7.6268
294515	O38_P22	17.9133
294903	P-060 E	13.5395
296332	R-032 E	20.6970
903644	W3-099 E OP1	10.3567
913142	Y1-033 E OP1	5.9219
916202	Z1-069 E	10.4453
917672	Z2-108 E	4.0517
918682	AA1-082 E	7.0566
919201	AA1-144 OP	20.0981
919491	AA2-000	64.8177
920341	AA2-132	2.7367
922932	AB1-082 OP	3.8155
923443	AB1-160 E	2.9844
930511	AB1-092	2.3799
935191	AD1-154	4.1854
936421	AD2-055	4.8998
936991	AD2-133 C	3.9939
936992	AD2-133 E	18.2677
938351	AE1-053	2.2510
938881	AE1-116	1.4089
938951	AE1-123	2.9191
938991	AE1-128 C	24.0523
938992	AE1-128 E	16.0349
939171	AE1-147 C	1.5577
939172	AE1-147 E	1.0385
939291	AE1-160 C	1.8016
939292	AE1-160 E	1.0356
939381	AE1-169 C O1	7.3470
939382	AE1-169 E O1	4.8980
940201	AE2-001 C	1.5556
940202	AE2-001 E	1.0371
940681	AE2-055 C	1.5221
940682	AE2-055 E	1.0148
940861	AE2-074 C	2.8971
940862	AE2-074 E	3.8136
941191	AE2-113 C	11.4763
941192	AE2-113 E	12.3563
941231	AE2-117 C	2.0808
941232	AE2-117 E	1.3872
941241	AE2-118 C	2.0808
941242	AE2-118 E	1.3872
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**2.1153**
941252	**AE2-119 E (Withdrawn : 12/16/2019)**	**1.4102**
941261	AE2-120 C	1.5544
941262	AE2-120 E	1.0363
941271	AE2-121 C	0.8303
941272	AE2-121 E	0.5544
941321	AE2-126 C	2.0539
941322	AE2-126 E	1.3692
941331	AE2-129 C	2.4166

Bus #	Bus	MW Impact
941332	AE2-129 E	1.6111
941351	AE2-131 C	2.4166
941352	AE2-131 E	1.6111
941421	AE2-139 C	7.6068
941422	AE2-139 E	5.0712
942121	AE2-224 C	21.8082
942122	AE2-224 E	14.5388
942351	AE2-248 C	1.2289
942352	AE2-248 E	0.8193
942361	AE2-249 C	2.7059
942362	AE2-249 E	1.8039
942491	AE2-262 C	6.9530
942492	AE2-262 E	4.6724
942501	AE2-263 C	6.5358
942502	AE2-263 E	4.3637
942511	AE2-264 C	9.9878
942512	AE2-264 E	6.6586
942811	AE2-299 C	3.8423
942812	AE2-299 E	15.3691
942961	AE2-316 C	6.2990
942962	AE2-316 E	8.9823
943151	AE2-344 C	8.2183
943152	AE2-344 E	5.4789
943351	AF1-006 C	0.7537
943352	AF1-006 E	0.4239
943711	AF1-039 C O2	0.7195
943712	AF1-039 E O2	0.4797
943751	AF1-043	7.7907
943871	AF1-055 C O2	3.1500
943872	AF1-055 E O2	2.1000
944001	AF1-068 C O2	0.8654
944002	AF1-068 E O2	0.4868
944181	AF1-086 C O2	5.9280
944182	AF1-086 E O2	25.7902
944261	AF1-094 C	0.7983
944262	AF1-094 E	0.5322
944281	AF1-096 C	0.9022
944282	AF1-096 E	0.6015
944301	AF1-098 C	3.1348
944302	AF1-098 E	2.0899
944311	AF1-099 C	5.5940
944312	AF1-099 E	3.7293
944321	AF1-100 C O2	11.8952
944322	AF1-100 E O2	7.9302
944381	AF1-103 O2	1.6028
944391	AF1-104 O2	1.0955
944411	AF1-106 O2	1.5856
944471	AF1-112 C	0.8161
944472	AF1-112 E	0.5441
944671	AF1-132 C O2	0.8113
944672	AF1-132 E O2	0.5409
944691	AF1-134 C O1	1.1405

Bus #	Bus	MW Impact
944692	AF1-134 E O1	1.1405
944701	AF1-135 C	1.3686
944702	AF1-135 E	0.9124
944731	AF1-138 C O2	1.1028
944732	AF1-138 E O2	0.7352
944741	AF1-139 C O1	0.8746
944742	AF1-139 E O1	0.5831
944751	AF1-140 C	3.2443
944752	AF1-140 E	2.1629
944771	AF1-142 C	8.9503
944772	AF1-142 E	5.9669
944781	AF1-143 C	15.8892
944782	AF1-143 E	10.5928
944841	AF1-149 C	1.5543
944842	AF1-149 E	1.0362
944881	AF1-153 C O2	0.9693
944882	AF1-153 E O2	0.6462
944901	AF1-155 C	0.9691
944902	AF1-155 E	0.6461
945021	AF1-167 C	0.7104
945022	AF1-167 E	0.4736
945051	AF1-170 C	2.7153
945052	AF1-170 E	1.8102
945071	AF1-172 C	11.3364
945072	AF1-172 E	7.5576
945121	AF1-177	0.4007
945161	AF1-181	0.0639
945171	AF1-182	0.3195
945181	AF1-183	0.0864
945331	AF1-198	0.2136
945451	AF1-210 C	0.6626
945452	AF1-210 E	0.4418
945481	AF1-213 C	9.4791
945482	AF1-213 E	6.3194
945491	AF1-214 C	0.8239
945492	AF1-214 E	0.5492
945521	AF1-217 C O2	0.7518
945522	AF1-217 E O2	0.5012
945551	AF1-220 C	8.0851
945552	AF1-220 E	5.3930
945671	AF1-232 C O2	33.1864
945672	AF1-232 E O2	17.8696
945751	AF1-240 C O2	1.3310
945752	AF1-240 E O2	0.8873
945771	AF1-242 C	0.9691
945772	AF1-242 E	0.6461
945901	AF1-255 C	1.8890
945902	AF1-255 E	2.6086
946081	AF1-273 C O2	19.0632
946082	AF1-273 E O2	12.7088
946091	AF1-274 C	4.5988
946092	AF1-274 E	3.0659

Bus #	Bus	MW Impact
946131	AF1-278	19.3364
946191	AF1-284 C O2	0.9993
946192	AF1-284 E O2	0.5996
946211	AF1-286 C O2	0.6422
946212	AF1-286 E O2	0.4360
946221	AF1-287 C	0.7518
946222	AF1-287 E	0.5012
946241	AF1-289 C O2	7.9654
946242	AF1-289 E O2	5.3102
946381	AF1-302 C	1.4578
946382	AF1-302 E	1.9438
946401	AF1-304 C	4.6208
946402	AF1-304 E	3.0805
946421	AF1-306 C	4.7503
946422	AF1-306 E	19.0010
946431	AF1-307 C O2	15.5810
946432	AF1-307 E O2	10.3873
946571	AF1-321 C O2	4.6567
946572	AF1-321 E O2	3.1045
DUCKCREEK	DUCKCREEK	0.5412
NEWTON	NEWTON	0.5491
FARMERCITY	FARMERCITY	0.0290
PRAIRIE	PRAIRIE	1.3845
O-066	O-066	3.3130
COFFEEN	COFFEEN	0.2664
EDWARDS	EDWARDS	0.1617
CHEOAH	CHEOAH	0.3544
TILTON	TILTON	0.3018
G-007	G-007	0.6157
MADISON	MADISON	0.0081
GIBSON	GIBSON	0.2796
CALDERWOOD	CALDERWOOD	0.3499
BLUEG	BLUEG	0.9218
TRIMBLE	TRIMBLE	0.2949
CATAWBA	CATAWBA	0.2902

15.10 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
41511350	235248	01SHINGL	AP	200513	26LEWISTWN	PENELEC	1	AP-P2-3-WP-230-446T	breaker	570.0	118.88	120.07	DC	15.09

Bus #	Bus	MW Impact
200665	26SHAWVL 3	11.2213
200666	26SHAWVL 4	11.0429
200715	26SHAWVL 1	6.8508
200722	26SHAWVL 2	7.0238
200894	26K02	13.1208
200898	26AA1-106	2.6976
200905	26Q36	0.2708
200913	26SHAW-D	0.2828
203352	26CANZ2-011	0.4430
235003	AC1-025 E	0.9180
236828	01GRAYMONT	2.3847
290086	Q-036 E	7.7608
919491	AA2-000	169.8793
930511	AB1-092	6.2375
936421	AD2-055	12.8419
936991	AD2-133 C	3.4924
936992	AD2-133 E	15.9737
939171	AE1-147 C	7.1243
939172	AE1-147 E	4.7495
940201	AE2-001 C	7.1412
940202	AE2-001 E	4.7608
940681	AE2-055 C	7.3998
940682	AE2-055 E	4.9332
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**4.0520**
941252	**AE2-119 E (Withdrawn : 12/16/2019)**	**2.7014**
941261	AE2-120 C	7.1504
941262	AE2-120 E	4.7670
941271	AE2-121 C	3.7720
941272	AE2-121 E	2.5186
941321	AE2-126 C	2.6525
941322	AE2-126 E	1.7683
941331	AE2-129 C	3.1049
941332	AE2-129 E	2.0699
941351	AE2-131 C	3.1049
941352	AE2-131 E	2.0699
941421	AE2-139 C	7.8236
941422	AE2-139 E	5.2157
942351	AE2-248 C	5.8335
942352	AE2-248 E	3.8890
942491	AE2-262 C	26.1095

Bus #	Bus	MW Impact
942492	AE2-262 E	17.5456
942501	AE2-263 C	24.5429
942502	AE2-263 E	16.3863
943751	AF1-043	38.5255
944001	AF1-068 C O2	7.8216
944002	AF1-068 E O2	4.3996
944181	AF1-086 C O2	1.2704
944182	AF1-086 E O2	5.5268
944311	AF1-099 C	39.6342
944312	AF1-099 E	26.4228
944321	AF1-100 C O2	69.4320
944322	AF1-100 E O2	46.2880
944471	AF1-112 C	7.2631
944472	AF1-112 E	4.8421
944671	AF1-132 C O2	7.3327
944672	AF1-132 E O2	4.8885
944691	AF1-134 C O1	2.2470
944692	AF1-134 E O1	2.2470
944701	AF1-135 C	2.6964
944702	AF1-135 E	1.7976
944771	AF1-142 C	63.4148
944772	AF1-142 E	42.2765
944841	AF1-149 C	7.1515
944842	AF1-149 E	4.7677
945071	AF1-172 C	61.3380
945072	AF1-172 E	40.8920
945161	AF1-181	0.3692
945171	AF1-182	1.8506
945181	AF1-183	0.4023
945481	AF1-213 C	25.4386
945482	AF1-213 E	16.9591
945491	AF1-214 C	7.1500
945492	AF1-214 E	4.7666
945551	AF1-220 C	5.7668
945552	AF1-220 E	3.8467
946091	AF1-274 C	10.0853
946092	AF1-274 E	6.7235
946312	AF1-295 BAT	1.5296
LGEE	LGEE	0.0673
WEC	WEC	0.0444
CBM-W2	CBM-W2	0.6962
CBM-W1	CBM-W1	2.1267
TVA	TVA	0.0672
O-066	O-066	5.0266
CBM-S1	CBM-S1	0.5197
G-007	G-007	0.8403
MEC	MEC	0.1907
CATAWBA	CATAWBA	0.0231

Affected Systems

15.11 Affected Systems

15.11.1 LG&E

LG&E Impacts to be determined during later study phases (as applicable).

15.11.2 MISO

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

15.11.3 TVA

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

15.11.4 Duke Energy Progress

Duke Energy Progress Impacts to be determined during later study phases (as applicable).

15.11.5 NYISO

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

15.12 Contingency Definitions

Contingency Name	Contingency Definition
PJM500_PN_P4-500-001A	CONTINGENCY 'PJM500_PN_P4-500-001A' /* KEYSTONE 500KV BKR 1 DISCONNECT BRANCH FROM BUS 200011 TO BUS 200810 CKT 3 /* KEYSTONE 500 26KEYSTONE 230 REMOVE MACHINE H FROM BUS 200033 /* KEYS G2 20 REMOVE MACHINE L FROM BUS 200033 /* KEYS G2 20 DISCONNECT BUS 200033 /* KEYS G2 20 END
AP-P1-3-WP-230-005	CONTINGENCY 'AP-P1-3-WP-230-005' /* MILESBURG #82 230/46KV XFMR DISCONNECT BRANCH FROM BUS 235219 TO BUS 236745 CKT 82 /* 01MILESB 230 01MILESBG 46 DISCONNECT BRANCH FROM BUS 942490 TO BUS 235219 CKT 1 /* AE2-262 TAP 230 01MILESB 230 END
PJM500_PN_P4-500-001D	CONTINGENCY 'PJM500_PN_P4-500-001D' /* KEYSTONE 500KV BKR 4 DISCONNECT BRANCH FROM BUS 200011 TO BUS 200810 CKT 3 /* KEYSTONE 500 26KEYSTONE 230 REMOVE MACHINE H FROM BUS 200032 /* KEYS G1 20 REMOVE MACHINE L FROM BUS 200032 /* KEYS G1 20 DISCONNECT BUS 200032 /* KEYS G1 20 END
ATSI-P1-2-CEI-345-700T	CONTINGENCY 'ATSI-P1-2-CEI-345-700T' /* PN/ATSI ERIE WEST - ASHTABULA - PERRY 345KV DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1 /* 02PERRY 345 02AT 345 DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /* 02AT 345 02S8-ATT 345 DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /* 02S8-ATT 345 02ASH_3 138 DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /* 02AT 345 26ERIE W 345 END
AP-P2-3-WP-230-446T	CONTINGENCY 'AP-P2-3-WP-230-446T' /* ELKO-MOSHANNON STK BKR AT ELKO DISCONNECT BRANCH FROM BUS 200726 TO BUS 235175 CKT 1 /* 26SHAWVL 2 230 01ELKO 230 DISCONNECT BRANCH FROM BUS 235158 TO BUS 235175 CKT 1 /* 01CARB 230 01ELKO 230 DISCONNECT BRANCH FROM BUS 235175 TO BUS 235236 CKT 1 /* 01ELKO 230 01QUEHAN 230 DISCONNECT BRANCH FROM BUS 235220 TO BUS 235236 CKT 1 /* 01MOSHAN 230 01QUEHAN 230 DISCONNECT BRANCH FROM BUS 235236 TO BUS 236732 CKT 81 /* 01QUEHAN 230 01QUEHANNA 46 END
AP-P1-2-WP-230-005B	CONTINGENCY 'AP-P1-2-WP-230-005B' /* QUEUE AE2-262 - MOSHANNON 230KV DISCONNECT BRANCH FROM BUS 942490 TO BUS 235219 CKT 1 /* AE2-262 TAP 230 01MILESB 230 END
PJM_P1_APS_B_G692	CONTINGENCY 'PJM_P1_APS_B_G692' / 200011 KEYSTONE 500 235104 01CABOT 500 1 OPEN BRANCH FROM BUS 200011 TO BUS 235104 CKT 1 END
PN-P1-2-PN-345-107T	CONTINGENCY 'PN-P1-2-PN-345-107T' /* ERIE WEST - ASHTABULA - PERRY 345KV DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1 /* 26ERIE W 345 02AT 345 DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /* 02AT 345 02S8-ATT 345 DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1 /* 02AT 345 02PERRY 345 DISCONNECT BUS 238547 /* 02AT 345 END

Contingency Name	Contingency Definition
200909 26LOBO+ 230 919490 AA2-000 TAP 230 1	CONTINGENCY '200909 26LOBO+ 230 919490 AA2-000 TAP 230 1' OPEN BRANCH FROM BUS 200909 TO BUS 919490 CKT 1 END
PN-P1-3-PN-230-001T	CONTINGENCY 'PN-P1-3-PN-230-001T' /* CONEMAUGH #1 500/230KV XFMR DISCONNECT BRANCH FROM BUS 200005 TO BUS 200912 CKT 3 /* CONEM-GH 500 26CONEMAGH 230 END
PN_P4-500-001J	CONTINGENCY 'PN_P4-500-001J' /* KEYSTONE 500KV BKR 16 DISCONNECT BRANCH FROM BUS 200011 TO BUS 235104 CKT 1 /* KEYSTONE 500 01CABOT 500 DISCONNECT BRANCH FROM BUS 200011 TO BUS 200810 TO BUS 200907 CKT 4/* KEYSTONE 500 26KEYSTONE 230 26KEYSTN#4 20.00 REDUCE BUS 200011 SHUNT BY 100 PERCENT /* KEYSTONE 500 END
Base Case	
PN_P4-500-002A	CONTINGENCY 'PN_P4-500-002A' /* CONEMAUGH 500KV BKR 1 DISCONNECT BRANCH FROM BUS 200005 TO BUS 200912 CKT 3 /* CONEM-GH 500 26CONEMAGH 230 DISCONNECT BUS 200031 /* CONE G2 22 END
AP-P1-2-WP-230-324T_FSA_B	CONTINGENCY 'AP-P1-2-WP-230-324T_FSA_B' /* MOSHANNON-MARSHALL 230KV APS-PN TIE DISCONNECT BRANCH FROM BUS 919490 TO BUS 200909 CKT 1 /* AA2-000 TAP 230 26LOBO+ 230 DISCONNECT BRANCH FROM BUS 200857 TO BUS 200909 CKT 1 /* 26MARSHALL 230 26LOBO+ 230 DISCONNECT BRANCH FROM BUS 236829 TO BUS 200909 CKT 81 /* 01LOBO 46 46 26LOBO+ 230 REMOVE LOAD 1 FROM BUS 236829 /* 01LOBO 46 46 END
PN-P1-2-PN-230-025	CONTINGENCY 'PN-P1-2-PN-230-025' /* CONEMAUGH - SEWARD 230KV DISCONNECT BRANCH FROM BUS 200912 TO BUS 200793 CKT 1 /* 26CONEMAGH 230 26SEWARD 2 230 END
AP-P2-2-WP-230-001T	CONTINGENCY 'AP-P2-2-WP-230-001T' /* ELKO #2 230KV BUS DISCONNECT BRANCH FROM BUS 235175 TO BUS 235158 CKT 1 /* 01ELKO 230 01CARB 230 DISCONNECT BRANCH FROM BUS 235175 TO BUS 235236 CKT 1 /* 01ELKO 230 01QUEHAN 230 DISCONNECT BRANCH FROM BUS 235175 TO BUS 200726 CKT 1 /* 01ELKO 230 26SHAWVL 2 230 REDUCE BUS 237007 SHUNT BY 100 PERCENT /* 01ELKO CAP 138 DISCONNECT BUS 237007 /* 01ELKO CAP 138 END
PN_P4-500-002F	CONTINGENCY 'PN_P4-500-002F' /* CONEMAUGH 500KV BKR 6 DISCONNECT BRANCH FROM BUS 200005 TO BUS 200912 CKT 3 /* CONEM-GH 500 26CONEMAGH 230 DISCONNECT BUS 200030 /* CONE G1 22 END

Contingency Name	Contingency Definition
AP-P2-3-WP-230-443T *	CONTINGENCY 'AP-P2-3-WP-230-443T *' / UPDATED CON AJK 3-31-16 DISCONNECT BRANCH FROM BUS 200726 TO BUS 235175 CKT 1 DISCONNECT BRANCH FROM BUS 235175 TO BUS 235236 CKT 1 DISCONNECT BUS 235158 END

Short Circuit

15.13 Short Circuit

The following Breakers are overduty:

None

16 Attachment 1 – One Line