



Generation Interconnection

Feasibility Study Report

for

Queue Project AE2-146

GOLD 115 KV

75.95 MW Capacity / 183 MW Energy

July, 2019

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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 Pennsylvania Electric Company (Penelec).

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 Solar generating facility located in Potter County, Pennsylvania. The installed facilities will have a total capability of 183 MW with 75.95 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is March 5, 2021. This study does not imply a TO commitment to this in-service date.

Queue Number	AE2-146
Project Name	GOLD 115 KV
Interconnection Customer	
State	PA
County	Potter
Transmission Owner	PENELEC
MFO	183
MWE	183
MWC	75.95
Fuel	Solar
Basecase Study Year	2022

3.1 Point of Interconnection

Primary POI

The interconnection of the project at the Primary POI will be accomplished by constructing a new 115 kV four (4) breaker ring bus substation at the existing Gold substation. The IC will be responsible for acquiring all easements, properties, and permits that may be required to expand Gold substation.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AE2-146 generation project to connect to the FirstEnergy (“FE”) transmission system. Attachment 2 provides the proposed location for the point of interconnection. IC will be responsible for constructing all of the facilities on its side of the POI, including the attachment facilities which connect the generator to the FE transmission system’s direct connection facilities.

3.2 Cost Summary

The AE2-146 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$671,610
Direct Connection Network Upgrade	\$8,283,190
Non Direct Connection Network Upgrades	\$0
Total Costs	\$8,954,800

In addition, the AE2-146 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	\$384,315,000

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

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 AE2-146 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.

4 Transmission Owner Scope of Work

The interconnection of the project at the Primary POI will be accomplished by constructing a new 115 kV four (4) breaker ring bus substation at the existing Gold substation. The IC will be responsible for acquiring all easements, properties, and permits that may be required to expand Gold substation.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AE2-146 generation project to connect to the FirstEnergy (“FE”) transmission system. Attachment 2 provides the proposed location for the point of interconnection. IC will be responsible for constructing all of the facilities on its side of the POI, including the attachment facilities which connect the generator to the FE transmission system’s direct connection facilities.

5 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 line exit take-off structure, foundations, disconnect switch and associated equipment at new ring bus substation.	\$671,610
Total Attachment Facility Costs	\$671,610

6 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
Build four breaker ring bus at Gold substation.	\$8,283,190
Total Direct Connection Facility Costs	\$8,283,190

7 Non-Direct Connection Cost Estimate

There is no Non-Direct Connection scope of work required.

8 System Reinforcements Cost Estimate

Facility	Upgrade Description	Cost
26WARREN 230.0 kV - 26ERIE S TIE 230.0 kV Ckt 1	PN-0012 (800) : Upgrade 1033 ASCR bus conductor at Glade and Warren substations Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months	\$130,000
26TENGASVM 115.0 kV - 01POTTER 115.0 kV Ckt 1	APS WP-0013 (221) : Reconductor 636 Line Conductor Project Type : FAC Cost : \$6,500,000 Time Estimate : 9.0 Months PENELEC PN-0014 (801) : Reconductor line with 636 ACSS high temperature conductor (2.7 miles) Project Type : FAC Cost : \$5,200,000 Time Estimate : 12.0 Months	\$11,700,000
01KISSNG 138.0 kV - 01KARNSC 138.0 kV Ckt 1	WP-0008 (183) : Replace 556 Line Conductor Project Type : FAC Cost : \$13,000,000 Time Estimate : 9.0 Months	\$13,000,000
26TOWANDA 115.0 kV - 26NO MESHO 115.0 kV Ckt 1	PN-0009a (795) : At East Towanda, replace the breaker disconnect, line trap and relaying. At North Meshoppen, replace the relaying and bus conductor. Project Type : FAC Cost : \$650,000 Time Estimate : 12.0 Months PN-0009b (796) : Reconductor line with high temperature conductor (636 ACSS - 2.45 miles; 477 ACSS - 20.12 miles). Project Type : FAC Cost : \$40,300,000 Time Estimate : 36.0 Months	\$40,950,000

Facility	Upgrade Description	Cost
LACK 230.0 kV - LACKAW 500.0 kV Ckt 3	R-PL-0001 (825) : Re-Terminate LACK T4 500/230kV transformer Project Type : CON Cost : \$4,000,000 Time Estimate : 24.0 Months	\$4,000,000
26GOLD 115.0 kV - 26TENGASVM 115.0 kV Ckt 1	PN-0008 (794) : Reconductor line with 636 ACSS high temperature conductor (13.3 miles). Project Type : FAC Cost : \$24,700,000 Time Estimate : 24.0 Months	\$24,700,000
AE2-113 TAP 115.0 kV - 26RIDGWAY 115.0 kV Ckt 1	PN-0003 (789) : Reconductor line with 636 ACSS high temperature conductor (22 miles). Project Type : FAC Cost : \$40,300,000 Time Estimate : 36.0 Months	\$40,300,000
26TWO MILE 115.0 kV - 26PIERCEBRK 115.0 kV Ckt 1	PN-0005 (791) : Reconductor line with 636 ACSS high temperature conductor (5.6 miles). At Pierce Brook, replace the wave trap and adjust relay settings. At Two Mile, replace the bus conductor. Project Type : FAC Cost : \$11,700,000 Time Estimate : 20.0 Months	\$11,700,000
02PERRY 345.0 kV - 02L.CENTER 345.0 kV Ckt 1	CEI-002A (286) : Reconductor the Leroy Center-Perry S6 345 kV Line (~10 miles from Leroy Center to Perry). The existing conductor is (2) 954 ACSR conductor and the new conductor is (2) 954 kcmil ACSS conductor. Upgrade terminals as required. Project Type : FAC Cost : \$28,600,000 Time Estimate : 30.0 Months	\$28,600,000

Facility	Upgrade Description	Cost
01KARNSC 138.0 kV - 01BUTLER 138.0 kV Ckt 1	<p>WP-0007 (178) : Reconductor 336 ACSR Line Project Type : FAC Cost : \$26,000,000 Time Estimate : 30.0 Months</p> <p>WP-0007a (179) : Replace line and bus side disconnect switches at Butler Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0007b (180) : Replace Bus Side Disconnect Switches at Butler Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0007c (181) : Replace Wavetrap at Butler Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0007d (182) : Replace Wavetrap Leads at Butler Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p>	\$26,520,000
26ERIE W 345.0 kV - 02AT 345.0 kV Ckt 1	<p><u>ATSI</u> CEI-001A (285) : Reconductor the ATSI owned portion of the Erie West-Ashtabula 3-point tap 345 kV Line (~ 15 miles from Ashtabula to structure 13083). The existing conductor is (2) 954 ACSR conductor and the new conductor is (2) 954 kcmil ACSS conductor. Project Type : Facility Cost : \$42,900,000 Time Estimate : 36.0 Months</p> <p><u>PENELEC</u> PN-0004 (790) : Reconductor line with high temperature conductor (MAIT Portion - 7.17 miles) Project Type : FAC Cost : \$20,800,000 Time Estimate : 20.0 Months</p>	\$63,700,000

Facility	Upgrade Description	Cost
01POTTER 115.0 kV - 26TWOMILE 115.0 kV Ckt 1	<p>APS</p> <p>WP-0015 (187) : Replace Line Conductor Project Type : FAC Cost : \$28,600,000 Time Estimate : 9.0 Months</p> <p>WP-0015a (188) : Replace Breaker Failure Relays at Potter Project Type : FAC Cost : \$195,000 Time Estimate : 9.0 Months</p> <p>WP-0015b (189) : Replace Wavetrap Leads at Potter Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0015c (190) : Replace Potter Line Exit Conductor Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0015d (191) : Replace Two Miles SS Conductor Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0015e (192) : Replace Potter Wavetrap Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>PENELEC</p> <p>PN-0006 (792) : Reconductor line with 636 ACSS high temperature conductor (13.3 miles). At Two Mile, replace the bus conductor. Upgrades will also be required by West Penn (APS). Project Type : FAC Cost : \$24,700,000 Time Estimate : 24.0 Months</p>	\$54,015,000

Facility	Upgrade Description	Cost
02PERRY 345.0 kV - 02EASTLK 345.0 kV Ckt 1	CEI-003A (287) : Reconductor the Eastlake-Perry S8 345 kV Line (~22 miles from Eastlake to Perry). The existing conductor is (2) 954 ACSR conductor and the new conductor is (2) 954 kcmil ACSS conductor. Upgrade terminals as required. Project Type : FAC Cost : \$65,000,000 Time Estimate : 48.0 Months	\$65,000,000
	TOTAL COST	\$384,315,000

9 Schedule

Based on the scope of work for the Attachment Facilities and the Direct and Non-Direct Connection facilities, it is expected to take a minimum of **22 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 expansion 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.

10 Transmission Owner Analysis

10.1 Power Flow Analysis

FE performed an analysis of its underlying transmission <100 kV system. The AE2-146 project did not contribute to any overloads on the FE transmission <100 kV system.

11 Interconnection Customer Requirements

11.1 System Protection

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

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

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

11.2 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 AE2-146 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 AE2-146 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.

11.3 Power Factor Requirements

The IC shall design its non-synchronous Customer Facility with the ability to maintain a power factor of at least 0.95 leading (absorbing VARs) to 0.95 lagging (supplying VARs) measured at the high-side of the facility substation transformer(s) connected to the FE transmission system.

12 Revenue Metering and SCADA Requirements

12.1 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.

12.2 FE 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>.

13 Network Impacts

The Queue Project AE2-146 was evaluated as a 183.0 MW (Capacity 75.9 MW) injection at the Gold 115kV substation in the PENELEC area. Project AE2-146 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-146 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

14 Generation Deliverability

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

None

15 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	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
7061320	200654	26ERIE E	PENELEC	903645	W3-099 TAP	PENELEC	1	PN-P2-3-PN-345-3A	breaker	592.0	98.77	100.13	DC	18.04
7061321	200654	26ERIE E	PENELEC	903645	W3-099 TAP	PENELEC	1	PN-P2-3-PN-345-002A	breaker	592.0	98.77	100.13	DC	18.04
1526584	200663	26TWO MILE	PENELEC	200944	26PIERCEBRK	PENELEC	1	PN-P2-2-PN-115-064	bus	245.0	46.23	120.92	DC	182.98
1526626	200669	26GOLD	PENELEC	200923	26TENGASVM	PENELEC	1	PN-P2-2-PN-115-064	bus	245.0	39.33	114.02	DC	182.98
1526664	200923	26TENGASVM	PENELEC	235234	01POTTER	AP	1	PN-P2-2-PN-115-064	bus	245.0	35.78	110.47	DC	182.98
1527426	200928	26FOUR MILE	PENELEC	200819	26ERIE SE	PENELEC	1	PN-P2-3-PN-345-003A	breaker	666.0	85.48	86.62	DC	16.84
1527452	208009	LACK	PPL	200074	LACKAW	PJM	3	PL:02:P42:001057	breaker	1165.0	99.56	100.36	DC	20.33
1526556	235234	01POTTER	AP	200663	26TWO MILE	PENELEC	1	PN-P2-2-PN-115-064	bus	245.0	51.7	126.39	DC	182.98
1527014	941190	AE2-113 TAP	PENELEC	200582	26RIDGWAY	PENELEC	1	PN-P2-3-PN-230-26A2	breaker	160.0	85.79	129.9	DC	70.57
1527015	941190	AE2-113 TAP	PENELEC	200582	26RIDGWAY	PENELEC	1	PN-P2-3-PN-230-26A1	breaker	160.0	85.79	129.9	DC	70.57
1527016	941190	AE2-113 TAP	PENELEC	200582	26RIDGWAY	PENELEC	1	PN-P2-3-PN-230-26B2	breaker	160.0	85.79	129.9	DC	70.57

16 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	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
7061441	135251	S RIPLEY	NYISO	200654	26ERIE E	PENELEC	1	PN-P2-3-PN-345-003A	breaker	607.0	101.98	103.32	DC	18.1
7061442	135251	S RIPLEY	NYISO	200654	26ERIE E	PENELEC	1	PN-P2-3-PN-345-3A	breaker	607.0	100.75	102.09	DC	18.04
7061443	135251	S RIPLEY	NYISO	200654	26ERIE E	PENELEC	1	PN-P2-3-PN-345-002A	breaker	607.0	100.75	102.09	DC	18.04
1527894	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	Base Case	single	1560.0	110.5	110.97	DC	16.18
7061319	200654	26ERIE E	PENELEC	903645	W3-099 TAP	PENELEC	1	PN-P2-3-PN-345-003A	breaker	592.0	100.02	101.38	DC	18.1

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
1527267	200674	26TOWANDA	PENELEC	200677	26NO MESHO	PENELEC	1	PN-P2-3-PN-230-3C	breaker	172.0	113.38	117.99	DC	17.47
1527268	200674	26TOWANDA	PENELEC	200677	26NO MESHO	PENELEC	1	PN-P2-3-PN-230-17B25	breaker	172.0	109.77	114.13	DC	16.59
1527292	200677	26NO MESHO	PENELEC	200706	26N.MESHPN	PENELEC	4	PN-P2-3-PN-230-17B19	breaker	189.0	106.24	110.52	DC	18.55
1527410	200811	26WARREN	PENELEC	200918	26ERIE S TIE	PENELEC	1	PN-P2-3-PN-345-003A	breaker	621.0	100.38	101.53	DC	15.86
1526882	200927	26FOURMILE	PENELEC	200820	26ERIE SE	PENELEC	1	PN-P2-3-PN-230-6G	breaker	245.0	126.55	129.23	DC	14.55
7061960	235197	01KARNSC	AP	235152	01BUTLER	AP	1	PN-P1-2-PN-345-107T	single	179.0	128.32	129.44	DC	4.43
7061961	235197	01KARNSC	AP	235152	01BUTLER	AP	1	ATSI-P1-2-CEI-345-700T	single	179.0	128.32	129.44	DC	4.43
7062345	235203	01KISSNG	AP	235197	01KARNSC	AP	1	ATSI-P1-2-CEI-345-700T	single	268.0	103.17	103.96	DC	4.67
7062346	235203	01KISSNG	AP	235197	01KARNSC	AP	1	PN-P1-2-PN-345-107T	single	268.0	103.17	103.96	DC	4.67
2222585	239036	02PERRY	ATSI	239334	02L.CENTER	ATSI	1	ATSI-P7-1-CEI-345-012	tower	1667.0	126.62	127.38	DC	28.59
2222603	239036	02PERRY	ATSI	238684	02EASTLK	ATSI	1	ATSI-P7-1-CEI-345-016	tower	1667.0	119.63	120.37	DC	27.69
7061175	903645	W3-099 TAP	PENELEC	200928	26FOURMILE	PENELEC	1	PN-P2-3-PN-345-003A	breaker	592.0	110.04	111.31	DC	18.1
7061176	903645	W3-099 TAP	PENELEC	200928	26FOURMILE	PENELEC	1	PN-P2-3-PN-345-3A	breaker	592.0	108.84	110.11	DC	18.04
7061177	903645	W3-099 TAP	PENELEC	200928	26FOURMILE	PENELEC	1	PN-P2-3-PN-345-002A	breaker	592.0	108.84	110.11	DC	18.04

17 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	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPAC T
7062367	135251	S RIPLEY	NYISO	200654	26ERIE E	PENELE C	1	PN-P1-2-PN-345-003	operatio n	607.0	100.68	102.02	DC	18.04
1527893	200599	26ERIE W	PENELE C	238547	02AT	ATSI	1	Base Case	operatio n	1560.0	115.84	116.96	DC	38.98
2543811	200599	26ERIE W	PENELE C	238547	02AT	ATSI	1	23510401CABOT50023928002CRNBR Y5001	operatio n	1900.0	104.05	105.0	DC	40.58
7062206	200654	26ERIE E	PENELE C	903645	W3-099 TAP	PENELE C	1	PN-P1-2-PN-345-003	operatio n	592.0	98.69	100.05	DC	18.04
7062244	200663	26TOWMILE	PENELE C	200944	26PIERCEBRK	PENELE C	1	PN-P1-2-PN-115-108	operatio n	245.0	41.25	115.94	DC	182.98
7062025	200669	26GOLD	PENELE C	916200	Z1-069 TAP	PENELE C	1	PN-P1-2-PN-115-104T	operatio n	157.0	26.83	132.17	DC	183.0
7062373	200669	26GOLD	PENELE C	200923	26TENGASVM	PENELE C	1	PN-P1-2-PN-115-108	operatio n	245.0	34.35	109.04	DC	182.98
1528033	200670	26SABINSVI	PENELE C	200671	26NILES VA	PENELE C	1	Base Case	operatio n	137.0	56.14	118.41	DC	85.3
7061770	200670	26SABINSVI	PENELE C	200671	26NILES VA	PENELE C	1	PN-P1-2-PN-115-104T	operatio n	172.0	73.58	179.97	DC	182.98
7061819	200671	26NILES VA	PENELE C	203345	26WELLSBORO +	PENELE C	ZL	PN-P1-2-PN-115-104T	operatio n	185.0	59.82	158.73	DC	182.98
7062006	200672	26MANSFIEL	PENELE C	200929	26MAINESBURG	PENELE C	1	PN-P1-2-PN-115-104T	operatio n	191.0	41.53	134.74	DC	178.02
7062288	200674	26TOWANDA	PENELE C	200677	26NO MESHO	PENELE C	1	PN-P1-2-PN-230-013	operatio n	172.0	109.71	114.07	DC	16.59
7062349	200767	26HOMER CT	PENELE C	200795	26SHELOCTA	PENELE C	1	AP-P1-2-WP-345-311T	operatio n	917.0	102.32	104.12	DC	35.87
7062424	200923	26TENGASVM	PENELE C	235234	01POTTER	AP	1	PN-P1-2-PN-115-108	operatio n	245.0	30.84	105.53	DC	182.98
7062472	200927	26FOURMILE	PENELE C	200820	26ERIE SE	PENELE C	1	PN-P1-2-PN-230-027	operatio n	245.0	76.03	78.06	DC	11.04
7061881	203345	26WELLSBORO +	PENELE C	200672	26MANSFIEL	PENELE C	1	PN-P1-2-PN-115-104T	operatio n	185.0	50.68	149.59	DC	182.98
7062475	235129	01ARMSTRONG	AP	235121	01ARMSTR	AP	2	PN-P1-2-PN-345-107T	operatio n	659.0	96.19	97.29	DC	15.94
7062476	235129	01ARMSTRONG	AP	235121	01ARMSTR	AP	2	ATSI-P1-2-CEI-345-700T	operatio n	659.0	96.19	97.29	DC	15.94
7061962	235197	01KARNSC	AP	235152	01BUTLER	AP	1	PN-P1-2-PN-345-107T	operatio n	179.0	89.92	92.61	DC	10.68

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPAC T
7061963	235197	01KARNSC	AP	235152	01BUTLER	AP	1	ATSI-P1-2-CEI-345-700T	operatio n	179.0	89.92	92.61	DC	10.68
7062179	235234	01POTTER	AP	200663	26TWO MILE	PENELE C	1	PN-P1-2-PN-115-108	operatio n	245.0	46.72	121.41	DC	182.98
2222532	238547	02AT	ATSI	239036	02PERRY	ATSI	1	Base Case	operatio n	1534.0	94.95	95.93	DC	33.91
8762229	238547	02AT	ATSI	239036	02PERRY	ATSI	1	ATSI-P1-3-SYS-345-722	operatio n	1891.0	92.07	92.96	DC	38.09
1527806	903645	W3-099 TAP	PENELE C	200928	26FOUR MILE	PENELE C	1	Base Case	operatio n	488.0	85.55	87.16	DC	17.6
7062079	903645	W3-099 TAP	PENELE C	200928	26FOUR MILE	PENELE C	1	PN-P1-2-PN-345-003	operatio n	592.0	108.76	110.03	DC	18.04
1528050	916200	Z1-069 TAP	PENELE C	200670	26SABIN SVI	PENELE C	1	Base Case	operatio n	135.0	54.07	117.25	DC	85.3
7061753	916200	Z1-069 TAP	PENELE C	200670	26SABIN SVI	PENELE C	1	PN-P1-2-PN-115-104T	operatio n	157.0	72.91	189.46	DC	182.98
7062045	941190	AE2-113 TAP	PENELE C	200582	26RIDGWAY	PENELE C	1	PN-P1-3-PN-115-116	operatio n	160.0	85.53	129.75	DC	70.75

18 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
1527410	13	26WARREN 230.0 kV - 26ERIE S TIE 230.0 kV Ckt 1	PN-0012 (800) : Upgrade 1033 ASCR bus conductor at Glade and Warren substations Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months	\$130,000
1526882	14	26FOURMILE 115.0 kV - 26ERIE SE 115.0 kV Ckt 1	n5174 (808) : New 230kV series reactor and required associated substation equipment at Erie East substation, ISD 4/08/2019 ¹ Project Type : CON Cost : \$0 Time Estimate : 0.0 Months	\$0
1526664	4	26TENGASVM 115.0 kV - 01POTTER 115.0 kV Ckt 1	APS WP-0013 (221) : Reconductor 636 Line Conductor Project Type : FAC Cost : \$6,500,000 Time Estimate : 9.0 Months PENELEC PN-0014 (801) : Reconductor line with 636 ACSS high temperature conductor (2.7 miles) Project Type : FAC Cost : \$5,200,000 Time Estimate : 12.0 Months	\$11,700,000
7061175,7061177,7061176	19	W3-099 TAP 230.0 kV - 26FOURMILE 230.0 kV Ckt 1	n5174 (808) : New 230kV series reactor and required associated substation equipment at Erie East substation, ISD 4/08/2019 ¹ Project Type : CON Cost : \$0 Time Estimate : 0.0 Months	\$0
7062346,7062345	16	01KISSNG 138.0 kV - 01KARNSC 138.0 kV Ckt 1	WP-0008 (183) : Replace 556 Line Conductor Project Type : FAC Cost : \$13,000,000 Time Estimate : 9.0 Months	\$13,000,000

¹ Network Upgrade n5174 for a new series reactor at Erie East Substation is currently in-service. This upgrade may resolve this violation but has not been tested in the Feasibility Study phase. It will be evaluated in the System Impact Study phase. If this upgrade does not resolve this violation when tested, a new system reinforcement will be required.

ID	Index	Facility	Upgrade Description	Cost
7061441,7061443,7061442	9	S RIPLEY 230.0 kV - 26ERIE E 230.0 kV Ckt 1	<p>NYISO NonPJM Area (783) : The external (i.e. Non-PJM) Transmission Owner, NYISO, will not evaluate this violation until the impact study phase. Project Type : FAC Cost : \$0 Time Estimate : N/A Months</p> <p>PENELEC n5174 (808) : New 230kV series reactor and required associated substation equipment at Erie East substation, ISD 4/08/2019¹ Project Type : CON Cost : \$0 Time Estimate : 0.0 Months</p>	\$0
1527267,1527268	11	26TOWANDA 115.0 kV - 26NO MESHO 115.0 kV Ckt 1	<p>PN-0009a (795) : At East Towanda, replace the breaker disconnect, line trap and relaying. At North Meshoppen, replace the relaying and bus conductor. Project Type : FAC Cost : \$650,000 Time Estimate : 12.0 Months</p> <p>PN-0009b (796) : Reconductor line with high temperature conductor (636 ACSS - 2.45 miles; 477 ACSS - 20.12 miles). Project Type : FAC Cost : \$40,300,000 Time Estimate : 36.0 Months</p>	\$40,950,000
7061320,7061321,7061319	1	26ERIE E 230.0 kV - W3-099 TAP 230.0 kV Ckt 1	<p>n5174 (808) : New 230kV series reactor and required associated substation equipment at Erie East substation, ISD 4/08/2019¹ Project Type : CON Cost : \$0 Time Estimate : 0.0 Months</p>	\$0
1527452	6	LACK 230.0 kV - LACKAW 500.0 kV Ckt 3	<p>R-PL-0001 (825) : Re-Terminate LACK T4 500/230kV transformer Project Type : CON Cost : \$4,000,000 Time Estimate : 24.0 Months</p>	\$4,000,000
1526626	3	26GOLD 115.0 kV - 26TENGASVM 115.0 kV Ckt 1	<p>PN-0008 (794) : Reconductor line with 636 ACSS high temperature conductor (13.3 miles). Project Type : FAC Cost : \$24,700,000 Time Estimate : 24.0 Months</p>	\$24,700,000
1527426	5	26FOURMILE 230.0 kV - 26ERIE SE 230.0 kV Ckt 1	<p>n5174 (808) : New 230kV series reactor and required associated substation equipment at Erie East substation, ISD 4/08/2019¹ Project Type : CON Cost : \$0 Time Estimate : 0.0 Months</p>	\$0

ID	Index	Facility	Upgrade Description	Cost
1527015,1527014,1527016	8	AE2-113 TAP 115.0 kV - 26RIDGWAY 115.0 kV Ckt 1	PN-0003 (789) : Reconductor line with 636 ACSS high temperature conductor (22 miles). Project Type : FAC Cost : \$40,300,000 Time Estimate : 36.0 Months	\$40,300,000
1526584	2	26TWO MILE 115.0 kV - 26PIERCEBRK 115.0 kV Ckt 1	PN-0005 (791) : Reconductor line with 636 ACSS high temperature conductor (5.6 miles). At Pierce Brook, replace the wave trap and adjust relay settings. At Two Mile, replace the bus conductor. Project Type : FAC Cost : \$11,700,000 Time Estimate : 20.0 Months	\$11,700,000
1527292	12	26NO MESHO 115.0 kV - 26N.MESHPN 230.0 kV Ckt 4	<u>1527292</u> No violation. Post queue loading less than 100%.	\$0
2222585	17	02PERRY 345.0 kV - 02L.CENTER 345.0 kV Ckt 1	CEI-002A (286) : Reconductor the Leroy Center-Perry S6 345 kV Line (~10 miles from Leroy Center to Perry). The existing conductor is (2) 954 ACSR conductor and the new conductor is (2) 954 kcmil ACSS conductor. Upgrade terminals as required. Project Type : FAC Cost : \$28,600,000 Time Estimate : 30.0 Months	\$28,600,000
7061960,7061961	15	01KARNSC 138.0 kV - 01BUTLER 138.0 kV Ckt 1	WP-0007 (178) : Reconductor 336 ACSR Line Project Type : FAC Cost : \$26,000,000 Time Estimate : 30.0 Months WP-0007a (179) : Replace line and bus side disconnect switches at Butler Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months WP-0007b (180) : Replace Bus Side Disconnect Switches at Butler Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months WP-0007c (181) : Replace Wavetrap at Butler Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months WP-0007d (182) : Replace Wavetrap Leads at Butler Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months	\$26,520,000

ID	Index	Facility	Upgrade Description	Cost
1527894	10	26ERIE W 345.0 kV - 02AT 345.0 kV Ckt 1	<p><u>ATSI</u> CEI-001A (285) : Reconductor the ATSI owned portion of the Erie West-Ashtabula 3-point tap 345 kV Line (~ 15 miles from Ashtabula to structure 13083). The existing conductor is (2) 954 ACSR conductor and the new conductor is (2) 954 kcmil ACSS conductor. Project Type : Facility Cost : \$42,900,000 Time Estimate : 36.0 Months</p> <p><u>PENELEC</u> PN-0004 (790) : Reconductor line with high temperature conductor (MAIT Portion - 7.17 miles) Project Type : FAC Cost : \$20,800,000 Time Estimate : 20.0 Months</p>	\$63,700,000
1526556	7	01POTTER 115.0 kV - 26TWO MILE 115.0 kV Ckt 1	<p><u>APS</u> WP-0015 (187) : Replace Line Conductor Project Type : FAC Cost : \$28,600,000 Time Estimate : 9.0 Months</p> <p>WP-0015a (188) : Replace Breaker Failure Relays at Potter Project Type : FAC Cost : \$195,000 Time Estimate : 9.0 Months</p> <p>WP-0015b (189) : Replace Wavetrap Leads at Potter Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0015c (190) : Replace Potter Line Exit Conductor Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0015d (191) : Replace Two Miles SS Conductor Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0015e (192) : Replace Potter Wavetrap Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p><u>PENELEC</u> PN-0006 (792) : Reconductor line with 636 ACSS high temperature conductor (13.3 miles). At Two Mile, replace the bus conductor. Upgrades will also be required by West Penn (APS). Project Type : FAC Cost : \$24,700,000 Time Estimate : 24.0 Months</p>	\$54,015,000

ID	Index	Facility	Upgrade Description	Cost
2222603	18	02PERRY 345.0 kV - 02EASTLK 345.0 kV Ckt 1	CEI-003A (287) : Reconductor the Eastlake-Perry S8 345 kV Line (~22 miles from Eastlake to Perry). The existing conductor is (2) 954 ACSR conductor and the new conductor is (2) 954 kcmil ACSS conductor. Upgrade terminals as required. Project Type : FAC Cost : \$65,000,000 Time Estimate : 48.0 Months	\$65,000,000
			TOTAL COST	\$384,315,000

19 Flow Gate Details

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, 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.

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19.1 Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7061319	200654	26ERIE E	PENELEC	903645	W3-099 TAP	PENELEC	1	PN-P2-3-PN-345-003A	breaker	592.0	100.02	101.38	DC	18.1

Bus #	Bus	MW Impact
200823	26MHP_X3-003	5.52
200887	26ARMNA MT	0.29
200894	26K02	4.53
200949	26X1-109	10.07
203261	26BLOSSBCT	0.25
203283	26MANOR_T86	0.02
203999	P-047 E	9.48
294573	P-028 E	11.17
915952	Y3-092 FTWR	58.38
915953	Y3-092 NFTWR	58.38
916202	Z1-069 E	5.91
916351	Z1-091	2.55
916361	Z1-092	0.36
918682	AA1-082 E	6.21
919201	AA1-144 O1	17.3
919491	AA2-000	24.06
920341	AA2-132	2.92
923821	AB2-019	3.27
930411	AB1-082	1.81
930511	AB1-092	0.88
931092	AB1-160 E	1.69
932571	AC2-077	2.1
935061	AD1-142	0.02
936421	AD2-055	1.82
940801	AE2-067 C	1.83
940802	AE2-067 E	0.01
940861	AE2-074 C O1	1.37
940862	AE2-074 E O1	1.81
941191	AE2-113 C O1	3.72
941192	AE2-113 E O1	4.0
941421	AE2-139 C O1	6.88
941422	AE2-139 E O1	4.59
941491	AE2-146 C	7.51
941492	AE2-146 E	10.59
942811	AE2-299 C	23.11
942812	AE2-299 E	92.53
AA3-300	AA3-300	18.41
AA3-700	AA3-700	14.21
BLUEG	BLUEG	6.3
CALDERWOOD	CALDERWOOD	0.55

Bus #	Bus	MW Impact
CANNELTON	CANNELTON	0.38
CATAWBA	CATAWBA	0.29
CBM-N	CBM-N	6.12
CHEOAH	CHEOAH	0.5
CHILHOWEE	CHILHOWEE	0.18
COFFEEN	COFFEEN	0.67
COTTONWOOD	COTTONWOOD	2.34
DUCKCREEK	DUCKCREEK	1.51
EDWARDS	EDWARDS	0.69
ELMERSMITH	ELMERSMITH	0.65
FARMERCITY	FARMERCITY	0.44
G-007A	G-007A	3.95
GIBSON	GIBSON	0.26
HAMLET	HAMLET	0.43
NEWTON	NEWTON	1.75
NYISO	NYISO	27.06
PRAIRIE	PRAIRIE	3.18
SANTEETLA	SANTEETLA	0.15
SMITHLAND	SMITHLAND	0.24
TATANKA	TATANKA	0.81
TILTON	TILTON	0.82
TRIMBLE	TRIMBLE	0.7
TVA	TVA	1.9
UNIONPOWER	UNIONPOWER	0.83
VFT	VFT	10.99

19.2 Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
1526584	200663	26TWO MILE	PENELEC	200944	26PIERCEBRK	PENELEC	1	PN-P2-2-PN-115-064	bus	245.0	46.23	120.92	DC	182.98

Bus #	Bus	MW Impact
916201	Z1-069 C	1.62
916202	Z1-069 E	56.69
930411	AB1-082	19.9
931091	AB1-160 C	0.46
931092	AB1-160 E	16.2
932571	AC2-077	20.0
940861	AE2-074 C O1	15.11
940862	AE2-074 E O1	19.89
941491	AE2-146 C	75.94
941492	AE2-146 E	107.04
BLUEG	BLUEG	0.05
CALDERWOOD	CALDERWOOD	0.0
CANNELTON	CANNELTON	0.0
CARR	CARR	0.0
CATAWBA	CATAWBA	0.0
CHEOAH	CHEOAH	0.0
CHILHOWEE	CHILHOWEE	0.0
COFFEEN	COFFEEN	0.0
COTTONWOOD	COTTONWOOD	0.02
DUCKCREEK	DUCKCREEK	0.01
EDWARDS	EDWARDS	0.0
ELMERSMITH	ELMERSMITH	0.0
FARMERCITY	FARMERCITY	0.0
G-007	G-007	0.01
GIBSON	GIBSON	0.0
HAMLET	HAMLET	0.01
NEWTON	NEWTON	0.01
O-066	O-066	0.06
PRAIRIE	PRAIRIE	0.02
RENSELAER	RENSELAER	0.0
SANTEETLA	SANTEETLA	0.0
SMITHLAND	SMITHLAND	0.0
TATANKA	TATANKA	0.01
TILTON	TILTON	0.01
TRIMBLE	TRIMBLE	0.01
TVA	TVA	0.02
UNIONPOWER	UNIONPOWER	0.01

19.3 Index 3

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
1526626	200669	26GOLD	PENELEC	200923	26TENGASVM	PENELEC	1	PN-P2-2-PN-115-064	bus	245.0	39.33	114.02	DC	182.98

Bus #	Bus	MW Impact
916201	Z1-069 C	1.62
916202	Z1-069 E	56.69
931091	AB1-160 C	0.46
931092	AB1-160 E	16.2
932571	AC2-077	20.0
941491	AE2-146 C	75.94
941492	AE2-146 E	107.04
BLUEG	BLUEG	0.05
CALDERWOOD	CALDERWOOD	0.0
CANNELTON	CANNELTON	0.0
CARR	CARR	0.0
CATAWBA	CATAWBA	0.0
CHEOAH	CHEOAH	0.0
CHILHOWEE	CHILHOWEE	0.0
COFFEEN	COFFEEN	0.0
COTTONWOOD	COTTONWOOD	0.02
DUCKCREEK	DUCKCREEK	0.01
EDWARDS	EDWARDS	0.0
ELMERSMITH	ELMERSMITH	0.0
FARMERCITY	FARMERCITY	0.0
G-007	G-007	0.01
GIBSON	GIBSON	0.0
HAMLET	HAMLET	0.01
NEWTON	NEWTON	0.01
O-066	O-066	0.06
PRAIRIE	PRAIRIE	0.02
RENSELAER	RENSELAER	0.0
SANTEETLA	SANTEETLA	0.0
SMITHLAND	SMITHLAND	0.0
TATANKA	TATANKA	0.01
TILTON	TILTON	0.01
TRIMBLE	TRIMBLE	0.01
TVA	TVA	0.02
UNIONPOWER	UNIONPOWER	0.01

19.4 Index 4

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
1526664	200923	26TENGASVM	PENELEC	235234	01POTTER	AP	1	PN-P2-2-PN-115-064	bus	245.0	35.78	110.47	DC	182.98

Bus #	Bus	MW Impact
916201	Z1-069 C	1.62
916202	Z1-069 E	56.69
931091	AB1-160 C	0.46
931092	AB1-160 E	16.2
932571	AC2-077	20.0
941491	AE2-146 C	75.94
941492	AE2-146 E	107.04
BLUEG	BLUEG	0.05
CALDERWOOD	CALDERWOOD	0.0
CANNELTON	CANNELTON	0.0
CARR	CARR	0.0
CATAWBA	CATAWBA	0.0
CHEOAH	CHEOAH	0.0
CHILHOWEE	CHILHOWEE	0.0
COFFEEN	COFFEEN	0.0
COTTONWOOD	COTTONWOOD	0.02
DUCKCREEK	DUCKCREEK	0.01
EDWARDS	EDWARDS	0.0
ELMERSMITH	ELMERSMITH	0.0
FARMERCITY	FARMERCITY	0.0
G-007	G-007	0.01
GIBSON	GIBSON	0.0
HAMLET	HAMLET	0.01
NEWTON	NEWTON	0.01
O-066	O-066	0.06
PRAIRIE	PRAIRIE	0.02
RENSELAER	RENSELAER	0.0
SANTEETLA	SANTEETLA	0.0
SMITHLAND	SMITHLAND	0.0
TATANKA	TATANKA	0.01
TILTON	TILTON	0.01
TRIMBLE	TRIMBLE	0.01
TVA	TVA	0.02
UNIONPOWER	UNIONPOWER	0.01

19.5 Index 5

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
1527426	200928	26FOURMILE	PENELEC	200819	26ERIE SE	PENELEC	1	PN-P2-3-PN-345-003A	breaker	666.0	85.48	86.62	DC	16.84

Bus #	Bus	MW Impact
200823	26MHP_X3-003	4.93
200887	26ARMNA MT	0.26
200894	26K02	4.19
203999	P-047 E	8.49
294573	P-028 E	9.97
903643	W3-099 C OP1	8.25
903644	W3-099 E OP1	55.19
915952	Y3-092 FTWR	58.69
915953	Y3-092 NFTWR	58.69
916202	Z1-069 E	5.44
916351	Z1-091	2.25
916361	Z1-092	0.32
918682	AA1-082 E	5.55
919201	AA1-144 O1	15.49
919491	AA2-000	23.91
920341	AA2-132	2.57
923821	AB2-019	3.29
930411	AB1-082	1.71
930511	AB1-092	0.88
931092	AB1-160 E	1.55
932571	AC2-077	1.93
935061	AD1-142	0.02
936421	AD2-055	1.81
940801	AE2-067 C	1.63
940802	AE2-067 E	0.01
940861	AE2-074 C O1	1.3
940862	AE2-074 E O1	1.71
941191	AE2-113 C O1	3.81
941192	AE2-113 E O1	4.1
941421	AE2-139 C O1	6.14
941422	AE2-139 E O1	4.09
941491	AE2-146 C	6.99
941492	AE2-146 E	9.85
942811	AE2-299 C	19.72
942812	AE2-299 E	78.96
AA3-300	AA3-300	15.61
AA3-700	AA3-700	12.14
BLUEG	BLUEG	6.12
CALDERWOOD	CALDERWOOD	0.54
CANNELTON	CANNELTON	0.37

Bus #	Bus	MW Impact
CATAWBA	CATAWBA	0.28
CBM-N	CBM-N	5.41
CHEOAH	CHEOAH	0.49
CHILHOWEE	CHILHOWEE	0.18
COFFEEN	COFFEEN	0.65
COTTONWOOD	COTTONWOOD	2.27
DUCKCREEK	DUCKCREEK	1.47
EDWARDS	EDWARDS	0.68
ELMERSMITH	ELMERSMITH	0.63
FARMERCITY	FARMERCITY	0.43
G-007A	G-007A	3.72
GIBSON	GIBSON	0.26
HAMLET	HAMLET	0.41
NEWTON	NEWTON	1.7
NYISO	NYISO	23.9
PRAIRIE	PRAIRIE	3.09
SANTEETLA	SANTEETLA	0.14
SMITHLAND	SMITHLAND	0.24
TATANKA	TATANKA	0.79
TILTON	TILTON	0.8
TRIMBLE	TRIMBLE	0.68
TVA	TVA	1.84
UNIONPOWER	UNIONPOWER	0.81
VFT	VFT	10.34

19.6 Index 6

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
1527452	208009	LACK	PPL	200074	LACKAW	PJM	3	PL:02:P42:001057	breaker	1165.0	99.56	100.36	DC	20.33

Bus #	Bus	MW Impact
200823	26MHP_X3-003	17.38
200894	26K02	9.79
203999	P-047 E	14.14
208055	LAEN	75.67
209009	PEIP 2	2.41
210706	HOLD	9.02
294573	P-028 E	35.17
916202	Z1-069 E	6.92
916351	Z1-091	4.83
917661	WAYM E	25.2
918601	AA1-077 C	1.88
918602	AA1-077 E	35.81
918682	AA1-082 E	13.51
919201	AA1-144 O1	37.59
919491	AA2-000	52.68
920341	AA2-132	4.29
930511	AB1-092	1.93
931092	AB1-160 E	1.98
931942	AB1-182 E	4.7
932571	AC2-077	2.48
936421	AD2-055	3.98
938331	AE1-051	2.4
938401	AE1-059 C O1	86.89
938402	AE1-059 E O1	86.89
940801	AE2-067 C	5.86
940802	AE2-067 E	0.03
941421	AE2-139 C O1	12.95
941422	AE2-139 E O1	8.63
941491	AE2-146 C	8.44
941492	AE2-146 E	11.89
942301	AE2-243 C	1.04
942302	AE2-243 E	6.44
942311	AE2-244 C	1.04
942312	AE2-244 E	6.44
CBM-N	CBM-N	0.34
CBM-S1	CBM-S1	0.78
CBM-S2	CBM-S2	0.04
CBM-W1	CBM-W1	2.33
CBM-W2	CBM-W2	6.56
CIN	CIN	0.85
G-007	G-007	4.66
HAMLET	HAMLET	0.01
IPL	IPL	0.55

Bus #	Bus	MW Impact
LGEE	LGEE	0.23
MEC	MEC	1.52
MECS	MECS	1.83
NYISO	NYISO	1.23
O-066	O-066	32.38
WEC	WEC	0.24

19.7 Index 7

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
1526556	235234	01POTTER	AP	200663	26TWOMILE	PENELEC	1	PN-P2-2-PN-115-064	bus	245.0	51.7	126.39	DC	182.98

Bus #	Bus	MW Impact
916201	Z1-069 C	1.62
916202	Z1-069 E	56.69
930411	AB1-082	19.9
931091	AB1-160 C	0.46
931092	AB1-160 E	16.2
932571	AC2-077	20.0
940861	AE2-074 C O1	15.11
940862	AE2-074 E O1	19.89
941491	AE2-146 C	75.94
941492	AE2-146 E	107.04
BLUEG	BLUEG	0.05
CALDERWOOD	CALDERWOOD	0.0
CANNELTON	CANNELTON	0.0
CARR	CARR	0.0
CATAWBA	CATAWBA	0.0
CHEOAH	CHEOAH	0.0
CHILHOWEE	CHILHOWEE	0.0
COFFEEN	COFFEEN	0.0
COTTONWOOD	COTTONWOOD	0.02
DUCKCREEK	DUCKCREEK	0.01
EDWARDS	EDWARDS	0.0
ELMERSMITH	ELMERSMITH	0.0
FARMERCITY	FARMERCITY	0.0
G-007	G-007	0.01
GIBSON	GIBSON	0.0
HAMLET	HAMLET	0.01
NEWTON	NEWTON	0.01
O-066	O-066	0.06
PRAIRIE	PRAIRIE	0.02
RENSELAER	RENSELAER	0.0
SANTEETLA	SANTEETLA	0.0
SMITHLAND	SMITHLAND	0.0
TATANKA	TATANKA	0.01
TILTON	TILTON	0.01
TRIMBLE	TRIMBLE	0.01
TVA	TVA	0.02
UNIONPOWER	UNIONPOWER	0.01

19.8 Index 8

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
1527016	941190	AE2-113 TAP	PENELEC	200582	26RIDGWAY	PENELEC	1	PN-P2-3-PN-230-26B2	breaker	160.0	85.79	129.9	DC	70.57

Bus #	Bus	MW Impact
203999	P-047 E	5.92
916201	Z1-069 C	0.51
916202	Z1-069 E	17.67
930411	AB1-082	9.91
931091	AB1-160 C	0.14
931092	AB1-160 E	5.05
932571	AC2-077	5.99
940861	AE2-074 C O1	7.53
940862	AE2-074 E O1	9.91
941191	AE2-113 C O1	47.25
941192	AE2-113 E O1	50.87
941491	AE2-146 C	29.29
941492	AE2-146 E	41.28
BLUEG	BLUEG	0.34
CALDERWOOD	CALDERWOOD	0.03
CANNELTON	CANNELTON	0.02
CATAWBA	CATAWBA	0.02
CBM-N	CBM-N	0.65
CHEOAH	CHEOAH	0.03
CHILHOWEE	CHILHOWEE	0.01
COFFEEN	COFFEEN	0.04
COTTONWOOD	COTTONWOOD	0.13
DUCKCREEK	DUCKCREEK	0.08
EDWARDS	EDWARDS	0.04
ELMERSMITH	ELMERSMITH	0.03
FARMERCITY	FARMERCITY	0.02
G-007A	G-007A	0.34
GIBSON	GIBSON	0.01
HAMLET	HAMLET	0.03
NEWTON	NEWTON	0.09
NYISO	NYISO	2.77
PRAIRIE	PRAIRIE	0.17
SANTEETLA	SANTEETLA	0.01
SMITHLAND	SMITHLAND	0.01
TATANKA	TATANKA	0.04
TILTON	TILTON	0.04
TRIMBLE	TRIMBLE	0.04
TVA	TVA	0.11
UNIONPOWER	UNIONPOWER	0.05
VFT	VFT	0.98

19.9 Index 9

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
7061441	135251	S RIPLEY	NYISO	200654	26ERIE E	PENELEC	1	PN-P2-3-PN-345-003A	breaker	607.0	101.98	103.32	DC	18.1

Bus #	Bus	MW Impact
200823	26MHP_X3-003	5.52
200887	26ARMNA MT	0.29
200894	26K02	4.53
200949	26X1-109	10.07
203261	26BLOSSBCT	0.25
203283	26MANOR_T86	0.02
203999	P-047 E	9.48
294573	P-028 E	11.17
915952	Y3-092 FTWR	58.38
915953	Y3-092 NFTWR	58.38
916201	Z1-069 C	0.17
916202	Z1-069 E	5.91
916351	Z1-091	2.55
916361	Z1-092	0.36
918682	AA1-082 E	6.21
919201	AA1-144 O1	17.3
919491	AA2-000	24.06
920341	AA2-132	2.92
923821	AB2-019	3.27
930411	AB1-082	1.81
930511	AB1-092	0.88
931091	AB1-160 C	0.05
931092	AB1-160 E	1.69
932571	AC2-077	2.1
935061	AD1-142	0.02
936421	AD2-055	1.82
940801	AE2-067 C	1.83
940802	AE2-067 E	0.01
940861	AE2-074 C O1	1.37
940862	AE2-074 E O1	1.81
941191	AE2-113 C O1	3.72
941192	AE2-113 E O1	4.0
941421	AE2-139 C O1	6.88
941422	AE2-139 E O1	4.59
941491	AE2-146 C	7.51
941492	AE2-146 E	10.59
942813	AE2-299 BAT	44.43
AA3-300	AA3-300	18.41
AA3-700	AA3-700	14.21
BLUEG	BLUEG	6.3

Bus #	Bus	MW Impact
CALDERWOOD	CALDERWOOD	0.55
CANNELTON	CANNELTON	0.38
CATAWBA	CATAWBA	0.29
CBM-N	CBM-N	6.12
CHEOAH	CHEOAH	0.5
CHILHOWEE	CHILHOWEE	0.18
COFFEEN	COFFEEN	0.67
COTTONWOOD	COTTONWOOD	2.34
DUCKCREEK	DUCKCREEK	1.51
EDWARDS	EDWARDS	0.69
ELMERSMITH	ELMERSMITH	0.65
FARMERCITY	FARMERCITY	0.44
G-007A	G-007A	3.95
GIBSON	GIBSON	0.26
HAMLET	HAMLET	0.43
NEWTON	NEWTON	1.75
NYISO	NYISO	27.06
PRAIRIE	PRAIRIE	3.18
SANTEETLA	SANTEETLA	0.15
SMITHLAND	SMITHLAND	0.24
TATANKA	TATANKA	0.81
TILTON	TILTON	0.82
TRIMBLE	TRIMBLE	0.7
TVA	TVA	1.9
UNIONPOWER	UNIONPOWER	0.83
VFT	VFT	10.99

19.10 Index 10

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
1527894	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	Base Case	single	1560.0	110.5	110.97	DC	16.18

Bus #	Bus	MW Impact
200608	26PINEY #1	0.86
200642	26SENECA#1	8.33
200643	26SENECA#2	8.88
200644	26SENECA#3	0.67
200662	26SCRUB GR	3.35
200805	26COLVER13	14.89
200823	26MHP_X3-003	7.81
200828	26HNSMLK 1	2.31
200829	26HNSMLK 2	2.31
200830	26HNSMLK 3	2.31
200831	26HNSMLK 4	2.31
200832	26HNSMLK 5	2.31
200849	26LAKVU GN	0.29
201201	26WRREN CT	2.4
903643	W3-099 C OP1	5.82
914101	Y2-055	10.02
915951	Y3-092 FTIR	566.29
916351	Z1-091	3.19
919201	AA1-144 O1	25.26
919491	AA2-000	77.21
920341	AA2-132	3.5
930411	AB1-082	4.46
930511	AB1-092	2.83
932571	AC2-077	4.09
935191	AD1-154	3.67
936421	AD2-055	5.84
936991	AD2-133 C	2.51
938951	AE1-123	3.96
939171	AE1-147 C	1.72
939291	AE1-160 C	4.43
939381	AE1-169 C O1	17.22
940201	AE2-001 C	1.72
940681	AE2-055 C	1.66
940801	AE2-067 C	2.6
940861	AE2-074 C O1	3.39
941191	AE2-113 C O1	14.31
941251	AE2-119 C	1.99
941261	AE2-120 C	1.71
941271	AE2-121 C	0.92
941321	AE2-126 C	2.26
941331	AE2-129 C	1.81
941351	AE2-131 C	1.81

Bus #	Bus	MW Impact
941421	AE2-139 C O1	9.84
941491	AE2-146 C	16.18
942351	AE2-248 C	1.35
942491	AE2-262 C	7.95
942501	AE2-263 C	7.48
942811	AE2-299 C	14.06
942961	AE2-316 C	7.77
943151	AE2-344 C O1	33.47
BLUEG	BLUEG	19.12
CALDERWOOD	CALDERWOOD	1.64
CANNELTON	CANNELTON	1.14
CATAWBA	CATAWBA	0.84
CBM-N	CBM-N	7.61
CHEOAH	CHEOAH	1.5
CHILHOWEE	CHILHOWEE	0.54
COFFEEN	COFFEEN	2.05
COTTONWOOD	COTTONWOOD	7.02
DUCKCREEK	DUCKCREEK	4.63
EDWARDS	EDWARDS	2.13
ELMERSMITH	ELMERSMITH	1.95
FARMERCITY	FARMERCITY	1.34
G-007A	G-007A	9.61
GIBSON	GIBSON	0.8
HAMLET	HAMLET	1.24
NEWTON	NEWTON	5.34
NYISO	NYISO	33.32
PRAIRIE	PRAIRIE	9.67
SANTEETLA	SANTEETLA	0.44
SMITHLAND	SMITHLAND	0.73
TATANKA	TATANKA	2.46
TILTON	TILTON	2.52
TRIMBLE	TRIMBLE	2.13
TVA	TVA	5.69
UNIONPOWER	UNIONPOWER	2.49
VFT	VFT	26.4

19.11 Index 11

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
1527267	200674	26TOWANDA	PENELEC	200677	26NO MESH0	PENELEC	1	PN-P2-3-PN-230-3C	breaker	172.0	113.38	117.99	DC	17.47

Bus #	Bus	MW Impact
200887	26ARMNA MT	0.41
200894	26K02	8.27
200949	26X1-109	18.42
203261	26BLOSSBCT	0.34
203283	26MANOR_T86	0.04
203999	P-047 E	13.55
916201	Z1-069 C	0.17
916202	Z1-069 E	6.01
916361	Z1-092	0.42
916541	Z1-110	0.4
917072	Z2-011	0.4
918682	AA1-082 E	11.36
919201	AA1-144 O1	31.63
919491	AA2-000	44.62
930411	AB1-082	1.58
930511	AB1-092	1.64
931091	AB1-160 C	0.05
931092	AB1-160 E	1.72
932571	AC2-077	2.15
934801	AD1-108	0.03
934811	AD1-109	0.02
935061	AD1-142	0.02
936421	AD2-055	3.37
940861	AE2-074 C O1	1.2
940862	AE2-074 E O1	1.58
941191	AE2-113 C O1	3.45
941192	AE2-113 E O1	3.72
941421	AE2-139 C O1	13.76
941422	AE2-139 E O1	9.17
941491	AE2-146 C	7.25
941492	AE2-146 E	10.22
942491	AE2-262 C	2.54
942492	AE2-262 E	1.71
942501	AE2-263 C	2.39
942502	AE2-263 E	1.59
CBM-N	CBM-N	1.27
CBM-S1	CBM-S1	1.96
CBM-S2	CBM-S2	0.76
CBM-W1	CBM-W1	4.16
CBM-W2	CBM-W2	14.95
CIN	CIN	1.66

Bus #	Bus	MW Impact
CPLE	CPLE	0.27
G-007	G-007	1.95
IPL	IPL	1.07
LGEE	LGEE	0.47
MEC	MEC	3.09
MECS	MECS	2.8
NYISO	NYISO	5.43
O-066	O-066	13.54
WEC	WEC	0.46

19.12 Index 12

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
1527292	200677	26NO MESH0	PENELEC	200706	26N.MESH0N	PENELEC	4	PN-P2-3-PN-230-17B19	breaker	189.0	106.24	110.52	DC	18.55

Bus #	Bus	MW Impact
200823	26MHP_X3-003	29.39
200851	26MEHOOP3	3.56
200894	26K02	7.48
200917	26MTNTP_P28	1.81
203999	P-047 E	12.87
294573	P-028 E	59.48
913191	Y1-047 OP1	1.2
916202	Z1-069 E	6.31
916351	Z1-091	7.25
918682	AA1-082 E	10.12
919201	AA1-144 O1	28.2
919491	AA2-000	41.45
920341	AA2-132	5.85
920351	AA2-133	0.72
930411	AB1-082	1.72
930511	AB1-092	1.52
931092	AB1-160 E	1.8
932571	AC2-077	2.26
934821	AD1-110	0.09
936421	AD2-055	3.13
940801	AE2-067 C	7.39
940802	AE2-067 E	0.04
940861	AE2-074 C O1	1.3
940862	AE2-074 E O1	1.72
941421	AE2-139 C O1	11.88
941422	AE2-139 E O1	7.92
941491	AE2-146 C	7.7
941492	AE2-146 E	10.85
CBM-N	CBM-N	2.19
CBM-S1	CBM-S1	2.2
CBM-S2	CBM-S2	0.84
CBM-W1	CBM-W1	4.71
CBM-W2	CBM-W2	16.81
CIN	CIN	1.88
CPLE	CPLE	0.3
G-007	G-007	2.28
IPL	IPL	1.21
LGEE	LGEE	0.53
MEC	MEC	3.48
MECS	MECS	3.19

Bus #	Bus	MW Impact
NYISO	NYISO	9.25
O-066	O-066	15.8
WEC	WEC	0.52

19.13 Index 13

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
1527410	200811	26WARREN	PENELEC	200918	26ERIE S TIE	PENELEC	1	PN-P2-3-PN-345-003A	breaker	621.0	100.38	101.53	DC	15.86

Bus #	Bus	MW Impact
200642	26SENECA#1	7.63
200643	26SENECA#2	8.12
200644	26SENECA#3	0.61
200649	26PENNTech	0.71
200894	26K02	2.99
201201	26WRREN CT	2.23
236828	01GRAYMONT	0.29
290086	Q-036 E	2.39
914101	Y2-055	9.33
915952	Y3-092 FTWR	51.58
915953	Y3-092 NFTWR	51.58
916202	Z1-069 E	4.25
919491	AA2-000	35.13
923821	AB2-019	2.89
925512	AC1-025 E	0.11
930411	AB1-082	2.08
930511	AB1-092	1.29
931092	AB1-160 E	1.22
932571	AC2-077	1.46
936421	AD2-055	2.66
936991	AD2-133 C	1.08
936992	AD2-133 E	4.92
939171	AE1-147 C	0.89
939172	AE1-147 E	0.59
940201	AE2-001 C	0.89
940202	AE2-001 E	0.59
940681	AE2-055 C	0.85
940682	AE2-055 E	0.56
940861	AE2-074 C O1	1.58
940862	AE2-074 E O1	2.08
941191	AE2-113 C O1	8.24
941192	AE2-113 E O1	8.87
941251	AE2-119 C	1.02
941252	AE2-119 E	0.68
941261	AE2-120 C	0.88
941262	AE2-120 E	0.59
941271	AE2-121 C	0.47
941272	AE2-121 E	0.32
941321	AE2-126 C	1.31
941322	AE2-126 E	0.88

Bus #	Bus	MW Impact
941331	AE2-129 C	0.86
941332	AE2-129 E	0.57
941351	AE2-131 C	0.86
941352	AE2-131 E	0.57
941491	AE2-146 C	6.58
941492	AE2-146 E	9.28
942351	AE2-248 C	0.69
942352	AE2-248 E	0.46
942491	AE2-262 C	4.23
942492	AE2-262 E	2.84
942501	AE2-263 C	3.98
942502	AE2-263 E	2.66
942813	AE2-299 BAT	17.61
942961	AE2-316 C	3.27
942962	AE2-316 E	4.66
BLUEG	BLUEG	5.17
CALDERWOOD	CALDERWOOD	0.45
CANNELTON	CANNELTON	0.31
CATAWBA	CATAWBA	0.24
CBM-N	CBM-N	1.01
CHEOAH	CHEOAH	0.41
CHILHOWEE	CHILHOWEE	0.15
COFFEEN	COFFEEN	0.55
COTTONWOOD	COTTONWOOD	1.91
DUCKCREEK	DUCKCREEK	1.24
EDWARDS	EDWARDS	0.57
ELMERSMITH	ELMERSMITH	0.53
FARMERCITY	FARMERCITY	0.36
G-007A	G-007A	2.38
GIBSON	GIBSON	0.22
HAMLET	HAMLET	0.35
NEWTON	NEWTON	1.44
NYISO	NYISO	4.33
PRAIRIE	PRAIRIE	2.61
SANTEETLA	SANTEETLA	0.12
SMITHLAND	SMITHLAND	0.2
TATANKA	TATANKA	0.66
TILTON	TILTON	0.68
TRIMBLE	TRIMBLE	0.57
TVA	TVA	1.55
UNIONPOWER	UNIONPOWER	0.68
VFT	VFT	6.5

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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
1526882	200927	26FOURMILE	PENELEC	200820	26ERIE SE	PENELEC	1	PN-P2-3-PN-230-6G	breaker	245.0	126.55	129.23	DC	14.55

Bus #	Bus	MW Impact
200642	26SENECA#1	3.09
200643	26SENECA#2	3.29
200644	26SENECA#3	0.25
200823	26MHP_X3-003	3.14
200894	26K02	3.21
201201	26WRREN CT	1.05
203999	P-047 E	5.52
294573	P-028 E	6.36
903643	W3-099 C OP1	4.3
903644	W3-099 E OP1	28.79
914101	Y2-055	4.38
916202	Z1-069 E	4.37
916351	Z1-091	1.39
918682	AA1-082 E	3.6
919201	AA1-144 O1	10.15
919491	AA2-000	23.96
920341	AA2-132	1.57
930411	AB1-082	1.65
930511	AB1-092	0.88
931092	AB1-160 E	1.25
932571	AC2-077	1.54
936421	AD2-055	1.81
940801	AE2-067 C	1.04
940802	AE2-067 E	0.01
940861	AE2-074 C O1	1.25
940862	AE2-074 E O1	1.65
941191	AE2-113 C O1	4.94
941192	AE2-113 E O1	5.32
941321	AE2-126 C	0.64
941322	AE2-126 E	0.43
941421	AE2-139 C O1	3.96
941422	AE2-139 E O1	2.64
941491	AE2-146 C	6.04
941492	AE2-146 E	8.51
942811	AE2-299 C	10.31
942812	AE2-299 E	41.29
AA3-300	AA3-300	8.07
AA3-700	AA3-700	6.92
BLUEG	BLUEG	4.04
CALDERWOOD	CALDERWOOD	0.36
CANNELTON	CANNELTON	0.24

Bus #	Bus	MW Impact
CATAWBA	CATAWBA	0.19
CBM-N	CBM-N	3.25
CHEOAH	CHEOAH	0.33
CHILHOWEE	CHILHOWEE	0.12
COFFEEN	COFFEEN	0.43
COTTONWOOD	COTTONWOOD	1.51
DUCKCREEK	DUCKCREEK	0.96
EDWARDS	EDWARDS	0.44
ELMERSMITH	ELMERSMITH	0.41
FARMERCITY	FARMERCITY	0.28
G-007A	G-007A	2.38
GIBSON	GIBSON	0.17
HAMLET	HAMLET	0.29
NEWTON	NEWTON	1.12
NYISO	NYISO	14.36
PRAIRIE	PRAIRIE	2.04
SANTEETLA	SANTEETLA	0.1
SMITHLAND	SMITHLAND	0.16
TATANKA	TATANKA	0.52
TILTON	TILTON	0.53
TRIMBLE	TRIMBLE	0.45
TVA	TVA	1.23
UNIONPOWER	UNIONPOWER	0.54
VFT	VFT	6.62

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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
7061961	235197	01KARNSC	AP	235152	01BUTLER	AP	1	ATSI-P1-2-CEI-345-700T	single	179.0	128.32	129.44	DC	4.43

Bus #	Bus	MW Impact
200608	26PINEY #1	0.63
200642	26SENECA#1	2.06
200643	26SENECA#2	2.2
200644	26SENECA#3	0.17
200662	26SCRUB GR	1.32
200805	26COLVER13	7.31
200828	26HNSMLK 1	0.62
200829	26HNSMLK 2	0.62
200830	26HNSMLK 3	0.62
200831	26HNSMLK 4	0.62
200832	26HNSMLK 5	0.62
200849	26LAKVU GN	0.05
201201	26WRREN CT	0.53
235030	01MHNG-T155	0.14
903643	W3-099 C OP1	1.03
914101	Y2-055	2.21
915951	Y3-092 FTIR	85.82
919491	AA2-000	26.52
930411	AB1-082	1.22
930511	AB1-092	0.97
932571	AC2-077	1.12
935191	AD1-154	2.38
936421	AD2-055	2.0
936991	AD2-133 C	0.92
938951	AE1-123	2.87
939171	AE1-147 C	0.62
939291	AE1-160 C	1.54
939381	AE1-169 C O1	6.35
940201	AE2-001 C	0.62
940861	AE2-074 C O1	0.93
941191	AE2-113 C O1	4.25
941251	AE2-119 C	0.75
941261	AE2-120 C	0.62
941271	AE2-121 C	0.33
941321	AE2-126 C	0.8
941331	AE2-129 C	0.67
941351	AE2-131 C	0.67
941491	AE2-146 C	4.43
942351	AE2-248 C	0.48
942491	AE2-262 C	2.91

Bus #	Bus	MW Impact
942501	AE2-263 C	2.74
942811	AE2-299 C	2.52
942961	AE2-316 C	4.42
943151	AE2-344 C O1	6.23
BLUEG	BLUEG	3.44
CALDERWOOD	CALDERWOOD	0.32
CANNELTON	CANNELTON	0.21
CATAWBA	CATAWBA	0.18
CBM-N	CBM-N	1.7
CHEOAH	CHEOAH	0.29
CHILHOWEE	CHILHOWEE	0.11
COFFEEN	COFFEEN	0.36
COTTONWOOD	COTTONWOOD	1.31
DUCKCREEK	DUCKCREEK	0.8
EDWARDS	EDWARDS	0.37
ELMERSMITH	ELMERSMITH	0.35
FARMERCITY	FARMERCITY	0.24
G-007A	G-007A	1.67
GIBSON	GIBSON	0.14
HAMLET	HAMLET	0.27
NEWTON	NEWTON	0.94
NYISO	NYISO	7.42
PRAIRIE	PRAIRIE	1.73
SANTEETLA	SANTEETLA	0.09
SMITHLAND	SMITHLAND	0.13
TATANKA	TATANKA	0.43
TILTON	TILTON	0.44
TRIMBLE	TRIMBLE	0.38
TVA	TVA	1.08
UNIONPOWER	UNIONPOWER	0.47
VFT	VFT	4.64

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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
7062346	235203	01KISSNG	AP	235197	01KARNSC	AP	1	PN-P1-2-PN-345-107T	single	268.0	103.17	103.96	DC	4.67

Bus #	Bus	MW Impact
200608	26PINEY #1	0.66
200642	26SENECA#1	2.17
200643	26SENECA#2	2.32
200644	26SENECA#3	0.17
200662	26SCRUB GR	1.39
200805	26COLVER13	7.71
200828	26HNSMLK 1	0.65
200829	26HNSMLK 2	0.65
200830	26HNSMLK 3	0.65
200831	26HNSMLK 4	0.65
200832	26HNSMLK 5	0.65
200849	26LAKVU GN	0.05
201201	26WRREN CT	0.56
903643	W3-099 C OP1	1.09
914101	Y2-055	2.33
915951	Y3-092 FTIR	90.39
919491	AA2-000	27.96
930411	AB1-082	1.29
930511	AB1-092	1.03
932571	AC2-077	1.18
935191	AD1-154	2.51
936421	AD2-055	2.11
936991	AD2-133 C	0.97
938951	AE1-123	3.02
939171	AE1-147 C	0.65
939291	AE1-160 C	1.62
939381	AE1-169 C O1	6.69
940201	AE2-001 C	0.65
940681	AE2-055 C	0.63
940861	AE2-074 C O1	0.98
941191	AE2-113 C O1	4.48
941251	AE2-119 C	0.79
941261	AE2-120 C	0.65
941271	AE2-121 C	0.35
941321	AE2-126 C	0.84
941331	AE2-129 C	0.71
941351	AE2-131 C	0.71
941491	AE2-146 C	4.67
942351	AE2-248 C	0.51
942491	AE2-262 C	3.07

Bus #	Bus	MW Impact
942501	AE2-263 C	2.89
942811	AE2-299 C	2.66
942961	AE2-316 C	4.65
943151	AE2-344 C O1	6.56
BLUEG	BLUEG	3.7
CALDERWOOD	CALDERWOOD	0.35
CANNELTON	CANNELTON	0.22
CATAWBA	CATAWBA	0.19
CBM-N	CBM-N	1.8
CHEOAH	CHEOAH	0.32
CHILHOWEE	CHILHOWEE	0.11
COFFEEN	COFFEEN	0.39
COTTONWOOD	COTTONWOOD	1.41
DUCKCREEK	DUCKCREEK	0.86
EDWARDS	EDWARDS	0.39
ELMERSMITH	ELMERSMITH	0.38
FARMERCITY	FARMERCITY	0.25
G-007A	G-007A	1.8
GIBSON	GIBSON	0.15
HAMLET	HAMLET	0.29
NEWTON	NEWTON	1.01
NYISO	NYISO	7.87
PRAIRIE	PRAIRIE	1.85
SANTEETLA	SANTEETLA	0.09
SMITHLAND	SMITHLAND	0.14
TATANKA	TATANKA	0.46
TILTON	TILTON	0.47
TRIMBLE	TRIMBLE	0.41
TVA	TVA	1.16
UNIONPOWER	UNIONPOWER	0.51
VFT	VFT	5.0

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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
2222585	239036	02PERRY	ATSI	239334	02L.CENTER	ATSI	1	ATSI-P7-1-CEI-345-012	tower	1667.0	126.62	127.38	DC	28.59

Bus #	Bus	MW Impact
200805	26COLVER13	10.93
200823	26MHP_X3-003	5.73
200828	26HNSMLK 1	1.69
200829	26HNSMLK 2	1.69
200830	26HNSMLK 3	1.69
200831	26HNSMLK 4	1.69
200832	26HNSMLK 5	1.69
200849	26LAKVU GN	0.22
200894	26K02	6.61
203999	P-047 E	10.43
236828	01GRAYMONT	0.42
239035	02PERRG1	844.93
290086	Q-036 E	4.08
294573	P-028 E	11.59
903643	W3-099 C OP1	4.27
903644	W3-099 E OP1	28.55
914101	Y2-055	7.35
915951	Y3-092 FTIR	415.19
916202	Z1-069 E	8.55
916351	Z1-091	2.34
918682	AA1-082 E	6.52
919201	AA1-144 O1	18.53
919491	AA2-000	56.63
920341	AA2-132	2.57
925512	AC1-025 E	0.15
930411	AB1-082	3.27
930511	AB1-092	2.08
931092	AB1-160 E	2.44
932571	AC2-077	3.0
935191	AD1-154	2.69
936421	AD2-055	4.28
936991	AD2-133 C	1.84
936992	AD2-133 E	8.4
938951	AE1-123	2.91
939171	AE1-147 C	1.26
939172	AE1-147 E	0.84
939291	AE1-160 C	3.25
939292	AE1-160 E	1.87
939381	AE1-169 C O1	12.63
939382	AE1-169 E O1	8.42
940201	AE2-001 C	1.26

Bus #	Bus	MW Impact
940202	AE2-001 E	0.84
940681	AE2-055 C	1.22
940682	AE2-055 E	0.81
940801	AE2-067 C	1.91
940802	AE2-067 E	0.01
940861	AE2-074 C O1	2.48
940862	AE2-074 E O1	3.27
941191	AE2-113 C O1	10.49
941192	AE2-113 E O1	11.3
941251	AE2-119 C	1.46
941252	AE2-119 E	0.97
941261	AE2-120 C	1.26
941262	AE2-120 E	0.84
941271	AE2-121 C	0.67
941272	AE2-121 E	0.45
941321	AE2-126 C	1.66
941322	AE2-126 E	1.11
941331	AE2-129 C	1.33
941332	AE2-129 E	0.89
941351	AE2-131 C	1.33
941352	AE2-131 E	0.89
941421	AE2-139 C O1	7.22
941422	AE2-139 E O1	4.81
941491	AE2-146 C	11.87
941492	AE2-146 E	16.72
942351	AE2-248 C	0.99
942352	AE2-248 E	0.66
942491	AE2-262 C	5.83
942492	AE2-262 E	3.92
942501	AE2-263 C	5.48
942502	AE2-263 E	3.66
942811	AE2-299 C	10.31
942812	AE2-299 E	41.27
942961	AE2-316 C	5.7
942962	AE2-316 E	8.13
943151	AE2-344 C O1	24.54
943152	AE2-344 E O1	16.36
BLUEG	BLUEG	14.06
CALDERWOOD	CALDERWOOD	1.21
CANNELTON	CANNELTON	0.84
CATAWBA	CATAWBA	0.62
CBM-N	CBM-N	5.58
CHEOAH	CHEOAH	1.1
CHILHOWEE	CHILHOWEE	0.4
COFFEEN	COFFEEN	1.51
COTTONWOOD	COTTONWOOD	5.16
DUCKCREEK	DUCKCREEK	3.4
EDWARDS	EDWARDS	1.56
ELMERSMITH	ELMERSMITH	1.44
FARMERCITY	FARMERCITY	0.98
G-007A	G-007A	7.06
GIBSON	GIBSON	0.59

Bus #	Bus	MW Impact
HAMLET	HAMLET	0.91
NEWTON	NEWTON	3.93
NYISO	NYISO	24.45
PRAIRIE	PRAIRIE	7.11
SANTEETLA	SANTEETLA	0.32
SMITHLAND	SMITHLAND	0.54
TATANKA	TATANKA	1.81
TILTON	TILTON	1.85
TRIMBLE	TRIMBLE	1.56
TVA	TVA	4.19
UNIONPOWER	UNIONPOWER	1.83
VFT	VFT	19.4

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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
2222603	239036	02PERRY	ATSI	238684	02EASTLK	ATSI	1	ATSI-P7-1-CEI-345-016	tower	1667.0	119.63	120.37	DC	27.69

Bus #	Bus	MW Impact
200805	26COLVER13	10.57
200823	26MHP_X3-003	5.55
200828	26HNSMLK 1	1.64
200829	26HNSMLK 2	1.64
200830	26HNSMLK 3	1.64
200831	26HNSMLK 4	1.64
200832	26HNSMLK 5	1.64
200849	26LAKVU GN	0.21
200894	26K02	6.4
203999	P-047 E	10.1
236828	01GRAYMONT	0.41
239035	02PERRG1	804.58
290086	Q-036 E	3.95
294573	P-028 E	11.22
903643	W3-099 C OP1	4.13
903644	W3-099 E OP1	27.67
914101	Y2-055	7.12
915951	Y3-092 FTIR	402.42
916202	Z1-069 E	8.28
916351	Z1-091	2.27
918682	AA1-082 E	6.31
919201	AA1-144 O1	17.94
919491	AA2-000	54.83
920341	AA2-132	2.49
925512	AC1-025 E	0.15
930411	AB1-082	3.17
930511	AB1-092	2.01
931092	AB1-160 E	2.37
932571	AC2-077	2.9
935191	AD1-154	2.61
936421	AD2-055	4.15
936991	AD2-133 C	1.78
936992	AD2-133 E	8.13
938951	AE1-123	2.81
939171	AE1-147 C	1.22
939172	AE1-147 E	0.81
939291	AE1-160 C	3.15
939292	AE1-160 E	1.81
939381	AE1-169 C O1	12.23
939382	AE1-169 E O1	8.16
940201	AE2-001 C	1.22

Bus #	Bus	MW Impact
940202	AE2-001 E	0.81
940681	AE2-055 C	1.18
940682	AE2-055 E	0.79
940801	AE2-067 C	1.85
940802	AE2-067 E	0.01
940861	AE2-074 C O1	2.41
940862	AE2-074 E O1	3.17
941191	AE2-113 C O1	10.16
941192	AE2-113 E O1	10.94
941251	AE2-119 C	1.41
941252	AE2-119 E	0.94
941261	AE2-120 C	1.22
941262	AE2-120 E	0.81
941271	AE2-121 C	0.65
941272	AE2-121 E	0.44
941321	AE2-126 C	1.61
941322	AE2-126 E	1.07
941331	AE2-129 C	1.29
941332	AE2-129 E	0.86
941351	AE2-131 C	1.29
941352	AE2-131 E	0.86
941421	AE2-139 C O1	6.99
941422	AE2-139 E O1	4.66
941491	AE2-146 C	11.49
941492	AE2-146 E	16.2
942351	AE2-248 C	0.96
942352	AE2-248 E	0.64
942491	AE2-262 C	5.65
942492	AE2-262 E	3.8
942501	AE2-263 C	5.31
942502	AE2-263 E	3.54
942811	AE2-299 C	9.99
942812	AE2-299 E	39.99
942961	AE2-316 C	5.52
942962	AE2-316 E	7.87
943151	AE2-344 C O1	23.78
943152	AE2-344 E O1	15.85
BLUEG	BLUEG	13.55
CALDERWOOD	CALDERWOOD	1.16
CANNELTON	CANNELTON	0.81
CATAWBA	CATAWBA	0.6
CBM-N	CBM-N	5.4
CHEOAH	CHEOAH	1.06
CHILHOWEE	CHILHOWEE	0.38
COFFEEN	COFFEEN	1.45
COTTONWOOD	COTTONWOOD	4.97
DUCKCREEK	DUCKCREEK	3.28
EDWARDS	EDWARDS	1.51
ELMERSMITH	ELMERSMITH	1.39
FARMERCITY	FARMERCITY	0.95
G-007A	G-007A	6.81
GIBSON	GIBSON	0.57

Bus #	Bus	MW Impact
HAMLET	HAMLET	0.88
NEWTON	NEWTON	3.78
NYISO	NYISO	23.65
PRAIRIE	PRAIRIE	6.85
SANTEETLA	SANTEETLA	0.31
SMITHLAND	SMITHLAND	0.52
TATANKA	TATANKA	1.75
TILTON	TILTON	1.78
TRIMBLE	TRIMBLE	1.51
TVA	TVA	4.04
UNIONPOWER	UNIONPOWER	1.77
VFT	VFT	18.7

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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
7061175	903645	W3-099 TAP	PENELEC	200928	26FOURMILE	PENELEC	1	PN-P2-3-PN-345-003A	breaker	592.0	110.04	111.31	DC	18.1

Bus #	Bus	MW Impact
200823	26MHP_X3-003	5.52
200887	26ARMNA MT	0.29
200894	26K02	4.53
200949	26X1-109	10.07
203261	26BLOSSBCT	0.25
203283	26MANOR_T86	0.02
203999	P-047 E	9.48
294573	P-028 E	11.17
903643	W3-099 C OP1	9.67
903644	W3-099 E OP1	64.7
915952	Y3-092 FTWR	58.38
915953	Y3-092 NFTWR	58.38
916202	Z1-069 E	5.91
916351	Z1-091	2.55
916361	Z1-092	0.36
918682	AA1-082 E	6.21
919201	AA1-144 O1	17.3
920341	AA2-132	2.92
923821	AB2-019	3.27
930411	AB1-082	1.81
931092	AB1-160 E	1.69
932571	AC2-077	2.1
935061	AD1-142	0.02
940801	AE2-067 C	1.83
940802	AE2-067 E	0.01
940861	AE2-074 C O1	1.37
940862	AE2-074 E O1	1.81
941191	AE2-113 C O1	3.72
941192	AE2-113 E O1	4.0
941421	AE2-139 C O1	6.88
941422	AE2-139 E O1	4.59
941491	AE2-146 C	7.51
941492	AE2-146 E	10.59
942811	AE2-299 C	23.11
942812	AE2-299 E	92.53
AA3-300	AA3-300	18.41
AA3-700	AA3-700	14.21
BLUEG	BLUEG	6.3
CALDERWOOD	CALDERWOOD	0.55
CANNELTON	CANNELTON	0.38

Bus #	Bus	MW Impact
CATAWBA	CATAWBA	0.29
CBM-N	CBM-N	6.12
CHEOAH	CHEOAH	0.5
CHILHOWEE	CHILHOWEE	0.18
COFFEEN	COFFEEN	0.67
COTTONWOOD	COTTONWOOD	2.34
DUCKCREEK	DUCKCREEK	1.51
EDWARDS	EDWARDS	0.69
ELMERSMITH	ELMERSMITH	0.65
FARMERCITY	FARMERCITY	0.44
G-007A	G-007A	3.95
GIBSON	GIBSON	0.26
HAMLET	HAMLET	0.43
NEWTON	NEWTON	1.75
NYISO	NYISO	27.06
PRAIRIE	PRAIRIE	3.18
SANTEETLA	SANTEETLA	0.15
SMITHLAND	SMITHLAND	0.24
TATANKA	TATANKA	0.81
TILTON	TILTON	0.82
TRIMBLE	TRIMBLE	0.7
TVA	TVA	1.9
UNIONPOWER	UNIONPOWER	0.83
VFT	VFT	10.99

Affected Systems

20 Affected Systems

20.1 LG&E

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

20.2 MISO

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

20.3 TVA

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

20.4 Duke Energy Progress

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

20.5 NYISO

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

21 Contingency Descriptions

Contingency Name	Contingency Definition
PN-P2-3-PN-345-003A	CONTINGENCY 'PN-P2-3-PN-345-003A' /* WAYNE 345KV STUCK BREAKER DISCONNECT BUS 200595 /* 26WAYNE 345 END
PN-P1-2-PN-115-104T	CONTINGENCY 'PN-P1-2-PN-115-104T' /* PIERCE BROOK - POTTER 115KV DISCONNECT BRANCH FROM BUS 200944 TO BUS 200663 CKT 1 /* 26PIERCEBRK 115 26TWOMILE 115 DISCONNECT BRANCH FROM BUS 200663 TO BUS 235234 CKT 1 /* 26TWOMILE 115 01POTTER 115 DISCONNECT BRANCH FROM BUS 200663 TO BUS 200664 CKT 1 /* 26TWOMILE 115 26TWOMILE 35 DISCONNECT BRANCH FROM BUS 235234 TO BUS 236796 CKT 1 /* 01POTTER 115 01POTTER 46 DISCONNECT BUS 200663 /* 26TWOMILE 115 END
PN-P2-2-PN-115-064	CONTINGENCY 'PN-P2-2-PN-115-064' /* NILES VALLEY 115KV BUS FAULT DISCONNECT BUS 200671 /* 26NILES VA 115 END
PN-P2-3-PN-230-26B2	CONTINGENCY 'PN-P2-3-PN-230-26B2' /* PIERCE BROOK 230KV SB (115 XFMR/LEWIS RUN) DISCONNECT BRANCH FROM BUS 200943 TO BUS 200944 CKT 2 /* 26PIERCEBRK 230 26PIERCEBRK 115 DISCONNECT BRANCH FROM BUS 200943 TO BUS 200704 CKT 1 /* 26PIERCEBRK 230 26LEWIS RN 230 END
PN-P2-3-PN-230-3C	CONTINGENCY 'PN-P2-3-PN-230-3C' /* EAST TOWANDA 230KV SB62 OR SB44 (SAME AS LINE) DISCONNECT BRANCH FROM BUS 200675 TO BUS 200924 CKT 1 /* 26E.TWANDA 230 26CANYON 230 DISCONNECT BRANCH FROM BUS 200706 TO BUS 200924 CKT 1 /* 26N.MESHPN 230 26CANYON 230 END
PN-P1-2-PN-230-013	CONTINGENCY 'PN-P1-2-PN-230-013' /* EAST TOWANDA - NORTH MESHOPPEN 230KV DISCONNECT BRANCH FROM BUS 200675 TO BUS 200924 CKT 1 /* 26E.TWANDA 230 26CANYON 230 DISCONNECT BRANCH FROM BUS 200924 TO BUS 200706 CKT 1 /* 26CANYON 230 26N.MESHPN 230 DISCONNECT BRANCH FROM BUS 200706 TO BUS 200677 CKT 4 /* 26N.MESHPN 230 26NO MESHO 115 END
ATSI-P7-1-CEI-345-012	CONTINGENCY 'ATSI-P7-1-CEI-345-012' /* PERRY-EASTLAKE AND PERRY-NORTHFIELD 345KV LINE OUTAGES DISCONNECT BRANCH FROM BUS 238684 TO BUS 239036 CKT 1 /* 02EASTLK 345 02PERRY 345 DISCONNECT BRANCH FROM BUS 239358 TO BUS 239036 CKT 1 /* 02NFIELD 345 02PERRY 345 END

Contingency Name	Contingency Definition
235104 01CABOT 500 239280 02CRNBRY 500 1	CONTINGENCY '235104 01CABOT 500 239280 02CRNBRY 500 1' / 8388 OPEN BRANCH FROM BUS 235104 TO BUS 239280 CKT 1 / 235104 01CABOT 500 239280 02CRNBRY 500 1 END
ATSI-P7-1-CEI-345-016	CONTINGENCY 'ATSI-P7-1-CEI-345-016' /* PERRY-NORTHFEILD AND PERRY-LC 345KV LINE OUTAGES DISCONNECT BRANCH FROM BUS 239036 TO BUS 239358 CKT 1 /* 02PERRY 345 02NFIELD 345 DISCONNECT BRANCH FROM BUS 239036 TO BUS 239334 CKT 1 /* 02PERRY 345 02L.CENTER 345 END
PL:02:P42:001057	CONTINGENCY 'PL:02:P42:001057' /* LACK-PAUP 230KV; PAUP_E CB @ LACK DISCONNECT BRANCH FROM BUS 208009 TO BUS 925950 CKT 1 /* LACK-AC1-071 TAP 230 /* CONTINGENCY LINE ADDED FOR AE1 BUILD DISCONNECT BRANCH FROM BUS 208009 TO BUS 211681 CKT 2 /* LACK-LACK 230/69KV T2 DISCONNECT BRANCH FROM BUS 208009 TO BUS 200074 CKT 4 /* LACK-LACKAW 500/230KV T4 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
PN-P2-3-PN-230-17B25	CONTINGENCY 'PN-P2-3-PN-230-17B25' /* NORTH MESHOPPEN 230KV SB 25 DISCONNECT BRANCH FROM BUS 200677 TO BUS 200706 CKT 4 /* 26NO MESH0 115 26N.MESHPN 230 DISCONNECT BRANCH FROM BUS 200706 TO BUS 200924 CKT 1 /* 26N.MESHPN 230 26CANYON 230 DISCONNECT BRANCH FROM BUS 200675 TO BUS 200924 CKT 1 /* 26E.TWANDA 230 26CANYON 230 END
ATSI-P1-3-SYS-345-722	CONTINGENCY 'ATSI-P1-3-SYS-345-722' /* TRAN 02S8-ATT 345 TO 02ASH_3 138 CK 8 DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /* 02S8-ATT 345 02ASH_3 138 END
PN-P2-3-PN-345-002A	CONTINGENCY 'PN-P2-3-PN-345-002A' /* HANDSOME LAKE 345KV STUCK BREAKER DISCONNECT BUS 200826 /* 26HANDSMLK 345 DISCONNECT BUS 200830 /* 26HNSMLK 3 14 DISCONNECT BUS 200828 /* 26HNSMLK 1 14 DISCONNECT BUS 200829 /* 26HNSMLK 2 14 DISCONNECT BUS 200831 /* 26HNSMLK 4 14 DISCONNECT BUS 200832 /* 26HNSMLK 5 14 END

Contingency Name	Contingency Definition
PN-P2-3-PN-230-17B19	CONTINGENCY 'PN-P2-3-PN-230-17B19' /* NORTH MESHOPPEN 230KV SB 19 DISCONNECT BRANCH FROM BUS 200677 TO BUS 200706 CKT 3 /* 26NO MESHO 115 26N.MESHPN 230 DISCONNECT BRANCH FROM BUS 200706 TO BUS 200924 CKT 1 /* 26N.MESHPN 230 26CANYON 230 DISCONNECT BRANCH FROM BUS 200675 TO BUS 200924 CKT 1 /* 26E.TWANDA 230 26CANYON 230 END
PN-P2-3-PN-230-6G	CONTINGENCY 'PN-P2-3-PN-230-6G' /* ERIE SOUTH 230KV SB 35 OPEN BUS 200819 /*ERIE SOUTH 1 230KV BUS OPEN BUS 200918 /*ERIE SOUTH 230 KV BUS TIE END
Base Case	
PN-P2-3-PN-230-26A1	CONTINGENCY 'PN-P2-3-PN-230-26A1' /* PIERCE BROOK 230KV SB (345 XFMR/115 XFMR) DISCONNECT BRANCH FROM BUS 200943 TO BUS 200942 CKT 1 /* 26PIERCEBRK 230 26PIERCEBRK 345 DISCONNECT BRANCH FROM BUS 200943 TO BUS 200944 CKT 2 /* 26PIERCEBRK 230 26PIERCEBRK 115 END
PN-P1-2-PN-230-027	CONTINGENCY 'PN-P1-2-PN-230-027' /* ERIE SOUTH - FOUR MILE JCT. 230KV LINE DISCONNECT BRANCH FROM BUS 200928 TO BUS 200819 CKT 1 /* 26FOURMILE 230 26ERIE SE 230 END
PN-P2-3-PN-230-26A2	CONTINGENCY 'PN-P2-3-PN-230-26A2' /* PIERCE BROOK 230KV SB (345 XFMR/LEWIS RN) DISCONNECT BRANCH FROM BUS 200943 TO BUS 200942 CKT 1 /* 26PIERCEBRK 230 26PIERCEBRK 345 DISCONNECT BRANCH FROM BUS 200704 TO BUS 200943 CKT 1 /* 26LEWIS RN 230 26PIERCEBRK 230 END
PN-P1-2-PN-345-003	CONTINGENCY 'PN-P1-2-PN-345-003' /* HANDSOME LAKE - WAYNE 345KV DISCONNECT BRANCH FROM BUS 200826 TO BUS 200595 CKT 1 /* 26HANDSMLK 345 26WAYNE 345 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

Contingency Name	Contingency Definition
AP-P1-2-WP-345-311T	CONTINGENCY 'AP-P1-2-WP-345-311T' /* ARMSTRONG -HOMERCITY 345KV DISCONNECT BRANCH FROM BUS 235129 TO BUS 200769 CKT 1 /* 01ARMSTRONG 345 26HOMER CY 345 END
PN-P1-3-PN-115-116	CONTINGENCY 'PN-P1-3-PN-115-116' /* PIERCE BROOK 230/115KV XFMR FAULT DISCONNECT BRANCH FROM BUS 200943 TO BUS 200944 CKT 2 /* 26PIERCEBRK 230 26PIERCEBRK 115 END
PN-P1-2-PN-115-108	CONTINGENCY 'PN-P1-2-PN-115-108' /* NILES VALLEY - Z1-069 115KV DISCONNECT BRANCH FROM BUS 916200 TO BUS 200670 CKT 1 /* Z1-069 TAP 115 26SABINSVI 115 DISCONNECT BRANCH FROM BUS 200670 TO BUS 200671 CKT 1 /* 26SABINSVI 115 26NILES VA 115 DISCONNECT BRANCH FROM BUS 200670 TO BUS 200694 CKT 1 /* 26SABINSVI 115 26SABNSVL 35 DISCONNECT BRANCH FROM BUS 200670 TO BUS 200694 CKT 2 /* 26SABINSVI 115 26SABNSVL 35 DISCONNECT BUS 200670 /* 26SABINSVI 115 END
PN-P2-3-PN-345-3A	CONTINGENCY 'PN-P2-3-PN-345-3A' /* 724 DISCONNECT BRANCH FROM BUS 200826 TO BUS 200828 TO BUS 200829 CKT 1/* 26HANDSMLK 345 26HNSMLK 1 14 26HNSMLK 2 13.80 DISCONNECT BRANCH FROM BUS 200826 TO BUS 200830 CKT 1 /* 26HANDSMLK 345 26HNSMLK 3 14 DISCONNECT BRANCH FROM BUS 200826 TO BUS 200831 TO BUS 200832 CKT 1/* 26HANDSMLK 345 26HNSMLK 4 14 26HNSMLK 5 13.80 DISCONNECT BRANCH FROM BUS 200595 TO BUS 200826 CKT 1 /* 26WAYNE 345 26HANDSMLK 345 REMOVE MACHINE 1 FROM BUS 200828 /* 26HNSMLK 1 14 REMOVE MACHINE 2 FROM BUS 200829 /* 26HNSMLK 2 14 REMOVE MACHINE 3 FROM BUS 200830 /* 26HNSMLK 3 14 REMOVE MACHINE 4 FROM BUS 200831 /* 26HNSMLK 4 14 REMOVE MACHINE 5 FROM BUS 200832 /* 26HNSMLK 5 14 END

Short Circuit

22 Short Circuit

The following Breakers are overduty:

None

23 Attachment 1 – One Line

24 Attachment 2 – Project Location