Generation Interconnection

Feasibility Study Report

for

Queue Project AE2-113

FARMERS VALLEY-RIDGEWAY 115 KV

62.6 MW Capacity / 130 MW Energy

July, 2019

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1 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.

2 General

The Interconnection Customer (IC) has proposed a Solar generating facility located in McKean County, Pennsylvania. The installed facilities will have a total capability of 130 MW with 62.6 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is December 31, 2020. This study does not imply a Transmission Owner (TO) commitment to this in-service date.

Queue Number	AE2-113
Project Name	FARMERS VALLEY-RIDGEWAY 115 KV
Interconnection Customer	
State	PA
County	McKean
Transmission Owner	APS
MFO	130
MWE	130
MWC	62.6
Fuel	Solar
Basecase Study Year	2022

3 Point of Interconnection

3.1 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 Farmers Valley - Ridgway 115 kV line into the new station. The new substation will be located approximately 12.3 miles from Farmers Valley 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 Farmers Valley, Pierce Brook, and Ridgway substations.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AE2-113 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 Secondary POI

The interconnection of the project at a Secondary POI can be accomplished by constructing a new 115 kV three (3) breaker ring bus substation and looping the Farmers Valley - Ridgway 115 kV line into the new station. The new substation would be located approximately 25.3 miles from Farmers Valley substation. A full scope of work or estimated cost is not provided for the proposed Secondary POI.

4 Cost Summary

The AE2-113 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$456,540
Direct Connection Network Upgrade	$6,804,860
Non Direct Connection Network Upgrades	$412,500
Total Costs	$7,673,900

In addition, the AE2-113 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	$161,720,000

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 AE2-113 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.

5 Transmission Owner Scope of Work

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 Farmers Valley - Ridgway 115 kV line into the new station. The new substation will be located approximately 12.3 miles from Farmers Valley 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 Farmers Valley, Pierce Brook, and Ridgway substations.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AE2-113 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.

6 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.	$456,540
Total Attachment Facility Costs	$456,540

7 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 a new interconnection substation with 3-115 kV breakers in a ring bus arrangement and associated facilities.	$4,108,860
Loop the Farmers Valley-Ridgway 115kV line into the proposed AE2-113 substation.	$2,696,000
Total Direct Connection Facility Costs	$6,804,860

8 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
Install anti-islanding (transfer trip) equipment at Farmers Valley.	$136,400
Install anti-islanding (transfer trip) equipment at Pierce Brook.	$140,500
Install anti-islanding (transfer trip) equipment at Ridgeway.	$135,600
Total Non-Direct Connection Facility Costs	$412,500

8.1 System Reinforcements Cost Estimate

Facility	Upgrade Description	Cost
01GAR RN 138.0 kV - 01COLMBGPN 138.0 kV Ckt 1	**WP-0006 (19) : Reconductor 4/0 Cu Line** **Project Type : FAC** **Cost : $20,150,000** **Time Estimate : 22.0 Months**	$20,150,000
01KISSNG 138.0 kV - 01KARNSC 138.0 kV Ckt 1	**WP-0008 (25) : Replace 556 Line Conductor** **Project Type : FAC** **Cost : $13,000,000** **Time Estimate : 9.0 Months**	$13,000,000
02PERRY 345.0 kV - 02EASTLK 345.0 kV Ckt 1	**CEI-003A (106) : 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 : Facility** **Cost : $65,000,000** **Time Estimate : 48.0 Months**	$65,000,000
02PERRY 345.0 kV - 02L.CENTER 345.0 kV Ckt 1	**CEI-002A (105) : 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 : Facility** **Cost : $28,600,000** **Time Estimate : 30.0 Months**	$28,600,000
01KARNSC 138.0 kV - 01BUTLER 138.0 kV Ckt 1	**WP-0007 (20) : Reconductor 336 ACSR Line** **Project Type : FAC** **Cost : $26,000,000** **Time Estimate : 30.0 Months** **WP-0007a (21) : Replace line and bus side disconect switches at Butler** **Project Type : FAC** **Cost : $130,000** **Time Estimate : 9.0 Months** **WP-0007b (22) : Replace Bus Side Disconnect Switches at Butler** **Project Type : FAC** **Cost : $130,000** **Time Estimate : 9.0 Months** **WP-0007c (23) : Replace Wavetrap at Butler** **Project Type : FAC** **Cost : $130,000** **Time Estimate : 9.0 Months** **WP-0007d (24) : Replace Wavetrap Leads at Butler** **Project Type : FAC** **Cost : $130,000** **Time Estimate : 9.0 Months**	$26,520,000

01COLMBGPN 138.0 kV - 01KISKIV 138.0 kV Ckt 1	**WP-0004 (16) : Reconductor 4/0 Cu Line** **Project Type : FAC** **Cost : $7,800,000** **Time Estimate : 18.0 Months** **WP-0004a (17) : Replace KD-4** **Project Type : FAC** **Cost : $325,000** **Time Estimate : 12.0 Months** **WP-0004b (18) : Replace KD-41 Line Relays** **Project Type : FAC** **Cost : $325,000** **Time Estimate : 12.0 Months**	$8,450,000
	TOTAL COST	**$161,720,000**

10 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 14 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 AE2-113 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 AE2-113 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 AE2-113 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 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.

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 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.

14 Network Impacts – Primary Point of Interconnection

The Queue Project AE2-113 was evaluated as a 130.0 MW (Capacity 62.6 MW) injection tapping the Farmers Valley to Ridgeway 115kV line in the APS area. Project AE2-113 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-113 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	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
6989202	135251	S RIPLEY	NYISO	200654	26ERIE E	PENELEC	1	PN-P2-3-PN-345-003A	breaker	607.0	99.48	100.05	DC	7.72
6989203	135251	S RIPLEY	NYISO	200654	26ERIE E	PENELEC	1	PN-P2-3-PN-345-3A	breaker	607.0	98.26	98.83	DC	7.66
6989204	135251	S RIPLEY	NYISO	200654	26ERIE E	PENELEC	1	PN-P2-3-PN-345-002A	breaker	607.0	98.26	98.83	DC	7.66
6989080	200654	26ERIE E	PENELEC	903645	W3-099 TAP	PENELEC	1	PN-P2-3-PN-345-003A	breaker	592.0	97.48	98.07	DC	7.72
6989081	200654	26ERIE E	PENELEC	903645	W3-099 TAP	PENELEC	1	PN-P2-3-PN-345-3A	breaker	592.0	96.25	96.83	DC	7.66
6989082	200654	26ERIE E	PENELEC	903645	W3-099 TAP	PENELEC	1	PN-P2-3-PN-345-002A	breaker	592.0	96.25	96.83	DC	7.66
1464772	200674	26TOWANDA	PENELEC	200677	26NO MESHO	PENELEC	1	PN-P2-3-PN-230-3C	breaker	172.0	98.09	99.98	DC	7.17
1464915	200811	26WARREN	PENELEC	200918	26ERIE S TIE	PENELEC	1	PN-P2-3-PN-345-003A	breaker	621.0	96.76	99.52	DC	17.1
1464931	200928	26FOURMILE	PENELEC	200819	26ERIE SE	PENELEC	1	PN-P2-3-PN-345-003A	breaker	666.0	83.38	83.92	DC	7.9
1464519	941190	AE2-113 TAP	PENELEC	200582	26RIDGWAY	PENELEC	1	PN-P2-3-PN-230-26A2	breaker	160.0	24.47	85.79	DC	98.12
1464520	941190	AE2-113 TAP	PENELEC	200582	26RIDGWAY	PENELEC	1	PN-P2-3-PN-230-26A1	breaker	160.0	24.47	85.79	DC	98.12
1464521	941190	AE2-113 TAP	PENELEC	200582	26RIDGWAY	PENELEC	1	PN-P2-3-PN-230-26B2	breaker	160.0	24.47	85.79	DC	98.12
6989271	941190	AE2-113 TAP	PENELEC	200668	26FARM VLY	PENELEC	1	PN-P2-3-PN-230-8M_SUM_WIN	breaker	160.0	50.47	97.13	DC	74.66

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	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
1464387	200927	26FOURMILE	PENELEC	200820	26ERIE SE	PENELEC	1	PN-P2-3-PN-230-6G	breaker	245.0	123.21	125.1	DC	10.26
6989721	235197	01KARNSC	AP	235152	01BUTLER	AP	1	PN-P1-2-PN-345-107T	single	179.0	126.23	127.3	DC	4.25
6989722	235197	01KARNSC	AP	235152	01BUTLER	AP	1	ATSI-P1-2-CEI-345-700T	single	179.0	126.23	127.3	DC	4.25
6990106	235203	01KISSNG	AP	235197	01KARNSC	AP	1	ATSI-P1-2-CEI-	single	268.0	101.69	102.45	DC	4.48

								345-700T						
6990107	235203	01KISSNG	AP	235197	01KARNSC	AP	1	PN-P1-2-PN-345-107T	single	268.0	101.69	102.45	DC	4.48
6989777	235240	01COLMBGPN	AP	235202	01KISKIV	AP	1	PN-P1-2-PN-345-107T	single	151.0	124.19	125.24	DC	3.53
6989778	235240	01COLMBGPN	AP	235202	01KISKIV	AP	1	ATSI-P1-2-CEI-345-700T	single	151.0	124.19	125.24	DC	3.53
6989702	235282	01GAR RN	AP	235240	01COLMBGPN	AP	1	ATSI-P1-2-CEI-345-700T	single	151.0	132.33	133.39	DC	3.53
6989703	235282	01GAR RN	AP	235240	01COLMBGPN	AP	1	PN-P1-2-PN-345-107T	single	151.0	132.33	133.39	DC	3.53
2192367	239036	02PERRY	ATSI	239334	02L.CENTER	ATSI	1	ATSI-P7-1-CEI-345-012	tower	1667.0	125.36	125.94	DC	21.79
2192385	239036	02PERRY	ATSI	238684	02EASTLK	ATSI	1	ATSI-P7-1-CEI-345-016	tower	1667.0	118.42	118.98	DC	21.11
6988936	903645	W3-099 TAP	PENELEC	200928	26FOURMILE	PENELEC	1	PN-P2-3-PN-345-003A	breaker	592.0	107.67	108.22	DC	7.72
6988937	903645	W3-099 TAP	PENELEC	200928	26FOURMILE	PENELEC	1	PN-P2-3-PN-345-3A	breaker	592.0	106.48	107.02	DC	7.66
6988938	903645	W3-099 TAP	PENELEC	200928	26FOURMILE	PENELEC	1	PN-P2-3-PN-345-002A	breaker	592.0	106.48	107.02	DC	7.66

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	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
6990128	135251	S RIPLEY	NYISO	200654	26ERIE E	PENELEC	1	PN-P1-2-PN-345-003	operation	607.0	98.19	98.76	DC	7.66
1465398	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	Base Case	operation	1560.0	114.01	114.86	DC	29.72
2481316	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	235104 01CABOT 500 239280 02CRNBRY 500 1	operation	1900.0	102.47	103.19	DC	30.81
6989967	200654	26ERIE E	PENELEC	903645	W3-099 TAP	PENELEC	1	PN-P1-2-PN-345-003	operation	592.0	96.17	96.74	DC	7.66
1465538	200670	26SABINSVI	PENELEC	200671	26NILES VA	PENELEC	1	Base Case	operation	137.0	53.06	56.14	DC	9.38
6990049	200674	26TOWANDA	PENELEC	200677	26NO MESHO	PENELEC	1	PN-P1-2-PN-230-013	operation	172.0	95.09	96.87	DC	6.79
6990110	200767	26HOMER CT	PENELEC	200795	26SHELOCTA	PENELEC	1	AP-P1-2-WP-345-311T	operation	917.0	99.42	100.54	DC	22.31
6990236	235129	01ARMSTRONG	AP	235121	01ARMSTR	AP	2	PN-P1-2-PN-345-107T	operation	659.0	95.17	95.72	DC	7.84
6990237	235129	01ARMSTRONG	AP	235121	01ARMSTR	AP	2	ATSI-P1-2-CEI-345-700T	operation	659.0	95.17	95.72	DC	7.84
6989723	235197	01KARNSC	AP	235152	01BUTLER	AP	1	PN-P1-2-PN-345-107T	operation	179.0	86.03	88.26	DC	8.83
6989724	235197	01KARNSC	AP	235152	01BUTLER	AP	1	ATSI-P1-2-CEI-345-700T	operation	179.0	86.03	88.26	DC	8.83
2192314	238547	02AT	ATSI	239036	02PERRY	ATSI	1	Base Case	operation	1534.0	93.32	94.07	DC	25.85
8718526	238547	02AT	ATSI	239036	02PERRY	ATSI	1	ATSI-P1-3-SYS-345-722	operation	1891.0	90.59	91.27	DC	29.04
1465311	903645	W3-099 TAP	PENELEC	200928	26FOURMILE	PENELEC	1	Base Case	operation	488.0	82.56	83.24	DC	7.49
6989840	903645	W3-099 TAP	PENELEC	200928	26FOURMILE	PENELEC	1	PN-P1-2-PN-345-003	operation	592.0	106.4	106.94	DC	7.66
1465555	916200	Z1-069 TAP	PENELEC	200670	26SABINSVI	PENELEC	1	Base Case	operation	135.0	50.94	54.07	DC	9.38
6989806	941190	AE2-113 TAP	PENELEC	200582	26RIDGWAY	PENELEC	1	PN-P1-3-PN-115-116	operation	160.0	23.95	85.53	DC	98.53

14.5 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
6989702,6989703	12	01GAR RN 138.0 kV - 01COLMBGPN 138.0 kV Ckt 1	WP-0006 (19) : Reconductor 4/0 Cu Line Project Type : FAC Cost : $20,150,000 Time Estimate : 22.0 Months	$20,150,000
1464915	4	26WARREN 230.0 kV - 26ERIE S TIE 230.0 kV Ckt 1	1464915 No Violation - No Overload[1]	$0
1464387	8	26FOURMILE 115.0 kV - 26ERIE SE 115.0 kV Ckt 1	n5174 (480) : New 230kV series reactor and required associated substation equipment at Erie East substation, ISD 4/08/2019[2] Project Type : CON Cost : $0 Time Estimate : 0.0 Months	$0
6990106,6990107	10	01KISSNG 138.0 kV - 01KARNSC 138.0 kV Ckt 1	WP-0008 (25) : Replace 556 Line Conductor Project Type : FAC Cost : $13,000,000 Time Estimate : 9.0 Months	$13,000,000
6989271	7	AE2-113 TAP 115.0 kV - 26FARM VLY 115.0 kV Ckt 1	6989271 No Violation - No Overload[1]	$0
6989203,6989202,6989204	1	S RIPLEY 230.0 kV - 26ERIE E 230.0 kV Ckt 1	NonPJMArea (455) : 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 n5174 (480) : New 230kV series reactor and required associated substation equipment at Erie East substation, ISD 4/08/2019[2] Project Type : CON	$0

[1] If "No Reinforcement Needed. Not a valid violation" was provided as the Upgrade Description for a facility in the System Reinforcements table then that facility met one of the following conditions:

a. The loading on the facility at your queue position was less than 100%; therefore, the facility is not yet overloaded, but may be overloaded by end of the AE2 queue.
b. The TO reviewed their ratings on the facility and determined that the current rating was greater than the rating in PJM's model. This new rating was greater than the loading at your queue position making the violation invalid.
c. The TO reviewed the contingency and determined that contingency was not valid; therefore the violation is invalid. Any contingency corrections will be assessed and corrected in the AE2 impact study phase.

[2] This system reinforcement has recently been placed in-service and may or may not resolve the overload identified. This will be further evaluated in the System Impact Study phase. If a new reinforcement is still required, it will be identified in the System Impact Study Report.

			Cost : $0 **Time Estimate : 0.0 Months**	
6988936,6988937,6988938	15	**W3-099 TAP 230.0 kV - 26FOURMILE 230.0 kV Ckt 1**	**n5174 (480) : New 230kV series reactor and required associated substation equipment at Erie East substation, ISD 4/08/2019[2]** **Project Type : CON** **Cost : $0** **Time Estimate : 0.0 Months**	$0
1464772	3	**26TOWANDA 115.0 kV - 26NO MESHO 115.0 kV Ckt 1**	**1464772** **No Violation - No Overload[1]**	$0
6989081,6989080,6989082	2	**26ERIE E 230.0 kV - W3-099 TAP 230.0 kV Ckt 1**	**n5174 (480) : New 230kV series reactor and required associated substation equipment at Erie East substation, ISD 4/08/2019[2]** **Project Type : CON** **Cost : $0** **Time Estimate : 0.0 Months**	$0
2192385	14	**02PERRY 345.0 kV - 02EASTLK 345.0 kV Ckt 1**	**CEI-003A (106) : 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 : Facility** **Cost : $65,000,000** **Time Estimate : 48.0 Months**	$65,000,000
1464931	5	**26FOURMILE 230.0 kV - 26ERIE SE 230.0 kV Ckt 1**	**n5174 (480) : New 230kV series reactor and required associated substation equipment at Erie East substation, ISD 4/08/2019[2]** **Project Type : CON** **Cost : $0** **Time Estimate : 0.0 Months**	$0
1464521,1464519,1464520	6	**AE2-113 TAP 115.0 kV - 26RIDGWAY 115.0 kV Ckt 1**	**1464519,1464520,1464521** **No Violation - No Overload[1]**	$0
2192367	13	**02PERRY 345.0 kV - 02L.CENTER 345.0 kV Ckt 1**	**CEI-002A (105) : 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 : Facility** **Cost : $28,600,000** **Time Estimate : 30.0 Months**	$28,600,000
6989721,6989722	9	**01KARNSC 138.0 kV - 01BUTLER 138.0 kV Ckt 1**	**WP-0007 (20) : Reconductor 336 ACSR Line** **Project Type : FAC** **Cost : $26,000,000** **Time Estimate : 30.0 Months** **WP-0007a (21) : Replace line and bus side disconect switches at Butler**	$26,520,000

			Project Type : FAC **Cost : $130,000** **Time Estimate : 9.0 Months** **WP-0007b (22) : Replace Bus Side Disconnect Switches at Butler** **Project Type : FAC** **Cost : $130,000** **Time Estimate : 9.0 Months** **WP-0007c (23) : Replace Wavetrap at Butler** **Project Type : FAC** **Cost : $130,000** **Time Estimate : 9.0 Months** **WP-0007d (24) : Replace Wavetrap Leads at Butler** **Project Type : FAC** **Cost : $130,000** **Time Estimate : 9.0 Months**	
6989778,6989777	11	**01COLMBGPN 138.0 kV - 01KISKIV 138.0 kV Ckt 1**	**WP-0004 (16) : Reconductor 4/0 Cu Line** **Project Type : FAC** **Cost : $7,800,000** **Time Estimate : 18.0 Months** **WP-0004a (17) : Replace KD-4** **Project Type : FAC** **Cost : $325,000** **Time Estimate : 12.0 Months** **WP-0004b (18) : Replace KD-41 Line Relays** **Project Type : FAC** **Cost : $325,000** **Time Estimate : 12.0 Months**	$8,450,000
			TOTAL COST	**$161,720,000**

14.6 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.

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
6989202	135251	S RIPLEY	NYISO	200654	26ERIE E	PENELEC	1	PN-P2-3-PN-345-003A	breaker	607.0	99.48	100.05	DC	7.72

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	24.05
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	4.58
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

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

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
6989080	200654	26ERIE E	PENELEC	903645	W3-099 TAP	PENELEC	1	PN-P2-3-PN-345-003A	breaker	592.0	97.48	98.07	DC	7.72

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	24.05
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	4.58
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
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

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
1464772	200674	26TOWANDA	PENELEC	200677	26NO MESHO	PENELEC	1	PN-P2-3-PN-230-3C	breaker	172.0	98.09	99.98	DC	7.17

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

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

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
1464915	200811	26WARREN	PENELEC	200918	26ERIE S TIE	PENELEC	1	PN-P2-3-PN-345-003A	breaker	621.0	96.76	99.52	DC	17.1

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

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	2.37
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

14.11 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
1464931	200928	26FOURMILE	PENELEC	200819	26ERIE SE	PENELEC	1	PN-P2-3-PN-345-003A	breaker	666.0	83.38	83.92	DC	7.9

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

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

14.12 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
1464521	941190	AE2-113 TAP	PENELEC	200582	26RIDGWAY	PENELEC	1	PN-P2-3-PN-230-26B2	breaker	160.0	24.47	85.79	DC	98.12

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

14.13 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
6989271	941190	AE2-113 TAP	PENELEC	200668	26FARM VLY	PENELEC	1	PN-P2-3-PN-230-8M_SUM_WIN	breaker	160.0	50.47	97.13	DC	74.66

Bus #	Bus	MW Impact
200649	26PENNTECH	1.29
236828	01GRAYMONT	0.26
290086	Q-036 E	2.13
919491	AA2-000	27.18
925512	AC1-025 E	0.09
930511	AB1-092	1.0
936421	AD2-055	2.05
936991	AD2-133 C	0.96
936992	AD2-133 E	4.37
939171	AE1-147 C	0.77
939172	AE1-147 E	0.52
940201	AE2-001 C	0.77
940202	AE2-001 E	0.51
940681	AE2-055 C	0.73
940682	AE2-055 E	0.49
941191	AE2-113 C O1	35.95
941192	AE2-113 E O1	38.71
941251	AE2-119 C	1.08
941252	AE2-119 E	0.72
941261	AE2-120 C	0.77
941262	AE2-120 E	0.51
941271	AE2-121 C	0.41
941272	AE2-121 E	0.28
941321	AE2-126 C	1.96
941322	AE2-126 E	1.31
941331	AE2-129 C	0.84
941332	AE2-129 E	0.56
941351	AE2-131 C	0.84
941352	AE2-131 E	0.56
942351	AE2-248 C	0.6
942352	AE2-248 E	0.4
942491	AE2-262 C	3.74
942492	AE2-262 E	2.51
942501	AE2-263 C	3.52
942502	AE2-263 E	2.35
942961	AE2-316 C	2.67
942962	AE2-316 E	3.81
BLUEG	BLUEG	0.96
CALDERWOOD	CALDERWOOD	0.08
CANNELTON	CANNELTON	0.06
CARR	CARR	0.27

CATAWBA	CATAWBA	0.04
CHEOAH	CHEOAH	0.07
CHILHOWEE	CHILHOWEE	0.03
COFFEEN	COFFEEN	0.1
COTTONWOOD	COTTONWOOD	0.35
DUCKCREEK	DUCKCREEK	0.23
EDWARDS	EDWARDS	0.11
ELMERSMITH	ELMERSMITH	0.1
FARMERCITY	FARMERCITY	0.07
G-007A	G-007A	0.58
GIBSON	GIBSON	0.04
HAMLET	HAMLET	0.06
NEWTON	NEWTON	0.27
PRAIRIE	PRAIRIE	0.48
RENSSELAER	RENSSELAER	0.2
SANTEETLA	SANTEETLA	0.02
SMITHLAND	SMITHLAND	0.04
TATANKA	TATANKA	0.12
TILTON	TILTON	0.13
TRIMBLE	TRIMBLE	0.11
TVA	TVA	0.28
UNIONPOWER	UNIONPOWER	0.12
VFT	VFT	1.55

14.14 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
1464387	200927	26FOURMILE	PENELEC	200820	26ERIE SE	PENELEC	1	PN-P2-3-PN-230-6G	breaker	245.0	123.21	125.1	DC	10.26

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

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

14.15 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
6989722	235197	01KARNSC	AP	235152	01BUTLER	AP	1	ATSI-P1-2-CEI-345-700T	single	179.0	126.23	127.3	DC	4.25

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

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	3.45
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	0.28
NEWTON	NEWTON	0.95
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	4.63

14.16 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
6990107	235203	01KISSNG	AP	235197	01KARNSC	AP	1	PN-P1-2-PN-345-107T	single	268.0	101.69	102.45	DC	4.48

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

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

14.17 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
6989778	235240	01COLMBGPN	AP	235202	01KISKIV	AP	1	ATSI-P1-2-CEI-345-700T	single	151.0	124.19	125.24	DC	3.53

Bus #	Bus	MW Impact
200608	26PINEY #1	0.38
200642	26SENECA#1	1.73
200643	26SENECA#2	1.84
200644	26SENECA#3	0.14
200662	26SCRUB GR	0.92
200828	26HNSMLK 1	0.58
200829	26HNSMLK 2	0.58
200830	26HNSMLK 3	0.58
200831	26HNSMLK 4	0.58
200832	26HNSMLK 5	0.58
200849	26LAKVU GN	0.04
201201	26WRREN CT	0.45
235030	01MHNG-T155	0.15
235134	01AL&D6	0.27
903643	W3-099 C OP1	0.89
914101	Y2-055	1.86
915951	Y3-092 FTIR	74.81
930411	AB1-082	1.04
935191	AD1-154	1.43
938951	AE1-123	1.74
939291	AE1-160 C	1.09
939381	AE1-169 C O1	4.42
940861	AE2-074 C O1	0.79
941191	AE2-113 C O1	3.53
941321	AE2-126 C	0.63
942811	AE2-299 C	2.16
942961	AE2-316 C	4.19
943151	AE2-344 C O1	5.25
BLUEG	BLUEG	2.71
CALDERWOOD	CALDERWOOD	0.26
CANNELTON	CANNELTON	0.16
CATAWBA	CATAWBA	0.15
CBM-N	CBM-N	1.46
CHEOAH	CHEOAH	0.24
CHILHOWEE	CHILHOWEE	0.09
COFFEEN	COFFEEN	0.28
COTTONWOOD	COTTONWOOD	1.05
DUCKCREEK	DUCKCREEK	0.62
EDWARDS	EDWARDS	0.28
ELMERSMITH	ELMERSMITH	0.28

FARMERCITY	FARMERCITY	0.18
G-007A	G-007A	1.44
GIBSON	GIBSON	0.11
HAMLET	HAMLET	0.23
NEWTON	NEWTON	0.74
NYISO	NYISO	6.37
PRAIRIE	PRAIRIE	1.36
SANTEETLA	SANTEETLA	0.07
SMITHLAND	SMITHLAND	0.11
TATANKA	TATANKA	0.34
TILTON	TILTON	0.34
TRIMBLE	TRIMBLE	0.3
TVA	TVA	0.86
UNIONPOWER	UNIONPOWER	0.38
VFT	VFT	3.99

14.18 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
6989703	235282	01GARRN	AP	235240	01COLMBGPN	AP	1	PN-P1-2-PN-345-107T	single	151.0	132.33	133.39	DC	3.53

Bus #	Bus	MW Impact
200608	26PINEY #1	0.38
200642	26SENECA#1	1.73
200643	26SENECA#2	1.84
200644	26SENECA#3	0.14
200662	26SCRUB GR	0.92
200828	26HNSMLK 1	0.58
200829	26HNSMLK 2	0.58
200830	26HNSMLK 3	0.58
200831	26HNSMLK 4	0.58
200832	26HNSMLK 5	0.58
200849	26LAKVU GN	0.04
201201	26WRREN CT	0.45
235030	01MHNG-T155	0.15
235134	01AL&D6	0.27
903643	W3-099 C OP1	0.89
914101	Y2-055	1.86
915951	Y3-092 FTIR	74.81
930411	AB1-082	1.04
935191	AD1-154	1.43
938951	AE1-123	1.74
939291	AE1-160 C	1.09
939381	AE1-169 C O1	4.42
940861	AE2-074 C O1	0.79
941191	AE2-113 C O1	3.53
941321	AE2-126 C	0.63
942811	AE2-299 C	2.16
942961	AE2-316 C	4.19
943151	AE2-344 C O1	5.25
BLUEG	BLUEG	2.71
CALDERWOOD	CALDERWOOD	0.26
CANNELTON	CANNELTON	0.16
CATAWBA	CATAWBA	0.15
CBM-N	CBM-N	1.46
CHEOAH	CHEOAH	0.24
CHILHOWEE	CHILHOWEE	0.09
COFFEEN	COFFEEN	0.28
COTTONWOOD	COTTONWOOD	1.05
DUCKCREEK	DUCKCREEK	0.62
EDWARDS	EDWARDS	0.28
ELMERSMITH	ELMERSMITH	0.28

FARMERCITY	FARMERCITY	0.18
G-007A	G-007A	1.44
GIBSON	GIBSON	0.11
HAMLET	HAMLET	0.23
NEWTON	NEWTON	0.74
NYISO	NYISO	6.37
PRAIRIE	PRAIRIE	1.36
SANTEETLA	SANTEETLA	0.07
SMITHLAND	SMITHLAND	0.11
TATANKA	TATANKA	0.34
TILTON	TILTON	0.34
TRIMBLE	TRIMBLE	0.3
TVA	TVA	0.86
UNIONPOWER	UNIONPOWER	0.38
VFT	VFT	3.99

14.19 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
2192367	239036	02PERRY	ATSI	239334	02L.CENTER	ATSI	1	ATSI-P7-1-CEI-345-012	tower	1667.0	125.36	125.94	DC	21.79

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

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	11.86
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
HAMLET	HAMLET	0.91

NEWTON	NEWTON	3.93
NYISO	NYISO	24.44
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	19.39

14.20 Index 14

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
2192385	239036	02PERRY	ATSI	238684	02EASTLK	ATSI	1	ATSI-P7-1-CEI-345-016	tower	1667.0	118.42	118.98	DC	21.11

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	10.09
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	4.14
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

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	13.54
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	1.38
FARMERCITY	FARMERCITY	0.95
G-007A	G-007A	6.81
GIBSON	GIBSON	0.57
HAMLET	HAMLET	0.88

NEWTON	NEWTON	3.78
NYISO	NYISO	23.65
PRAIRIE	PRAIRIE	6.84
SANTEETLA	SANTEETLA	0.31
SMITHLAND	SMITHLAND	0.52
TATANKA	TATANKA	1.74
TILTON	TILTON	1.78
TRIMBLE	TRIMBLE	1.51
TVA	TVA	4.04
UNIONPOWER	UNIONPOWER	1.77
VFT	VFT	18.71

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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
6988936	903645	W3-099 TAP	PENELEC	200928	26FOURMILE	PENELEC	1	PN-P2-3-PN-345-003A	breaker	592.0	107.67	108.22	DC	7.72

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	4.58
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

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

14.22 Affected Systems

14.22.1 LG&E

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

14.22.2 MISO

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

14.22.3 TVA

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

14.22.4 Duke Energy Progress

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

14.22.5 NYISO

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

14.23 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-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
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
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
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
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
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
PN-P2-3-PN-230-8M_SUM_WIN	CONTINGENCY 'PN-P2-3-PN-230-8M_SUM_WIN' /* GLADE STUCK BREAKER B42 (FOREST/SENECA) DISCONNECT BRANCH FROM BUS 200581 TO BUS 200593 CKT 1 /* 26FOREST 230 26GLADE 230 DISCONNECT BRANCH FROM BUS 200593 TO BUS 200594 CKT 1 /* 26GLADE 230 26SENECA 230 DISCONNECT BRANCH FROM BUS 200594 TO BUS 200642 CKT 1 /* 26SENECA 230 26SENECA#1 14

	DISCONNECT BRANCH FROM BUS 200594 TO BUS 200643 CKT 1 /* 26SENECA 230 26SENECA#2 14 DISCONNECT BRANCH FROM BUS 200594 TO BUS 200644 CKT 1 /* 26SENECA 230 26SENECA#3 14 REMOVE MACHINE 1G FROM BUS 200642 /* 26SENECA#1 14 REMOVE MACHINE 2G FROM BUS 200643 /* 26SENECA#2 14 REMOVE MACHINE 3 FROM BUS 200644 /* 26SENECA#3 14 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
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-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
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-230-26B2	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-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

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-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-230-3C	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-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

Short Circuit

14.24 Short Circuit

The following Breakers are overduty:

None

15 Network Impacts – Secondary Point of Interconnection

The Queue Project AE2-113 was evaluated as a 130.0 MW (Capacity 62.6 MW) injection tapping the Farmers Valley to Ridgeway 115kV line in the APS area. Project AE2-113 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-113 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	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
1464772	200674	26TOWANDA	PENELEC	200677	26NO MESHO	PENELEC	1	PN-P2-3-PN-230-3C	breaker	172.0	98.09	99.89	DC	6.84
1464915	200811	26WARREN	PENELEC	200918	26ERIE S TIE	PENELEC	1	PN-P2-3-PN-345-003A	breaker	621.0	96.76	99.59	DC	17.5
6988539	235248	01SHINGL	AP	200513	26LEWISTWN	PENELEC	1	AP-P2-2-WP-230-001T	bus	554.0	77.9	78.94	DC	12.81
6989311	235248	01SHINGL	AP	200513	26LEWISTWN	PENELEC	1	AP-P2-3-WP-230-446T	breaker	554.0	78.08	79.12	DC	12.81
6989312	235248	01SHINGL	AP	200513	26LEWISTWN	PENELEC	1	AP-P2-3-WP-230-443T *	breaker	554.0	77.92	78.96	DC	12.81
6989313	235248	01SHINGL	AP	200513	26LEWISTWN	PENELEC	1	AP-P2-2-WP-230-001T	breaker	554.0	77.9	78.94	DC	12.81
6988438	938380	AE1-071 TAP	PENELEC	200520	26ROXBURY	PENELEC	1	PL:10:P22:100582	bus	160.0	82.87	84.8	DC	6.85
6988439	938380	AE1-071 TAP	PENELEC	200520	26ROXBURY	PENELEC	1	PN-P2-2-PN-230-006AT	bus	160.0	81.51	83.44	DC	6.84
1464519	941190	AE2-113 TAP	PENELEC	200582	26RIDGWAY	PENELEC	1	PN-P2-3-PN-230-26A2	breaker	160.0	24.47	93.05	DC	109.72
1464520	941190	AE2-113 TAP	PENELEC	200582	26RIDGWAY	PENELEC	1	PN-P2-3-PN-230-26A1	breaker	160.0	24.47	93.05	DC	109.72
1464521	941190	AE2-113 TAP	PENELEC	200582	26RIDGWAY	PENELEC	1	PN-P2-3-PN-230-26B2	breaker	160.0	24.47	93.05	DC	109.72

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	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
1464387	200927	26FOURMILE	PENELEC	200820	26ERIE SE	PENELEC	1	PN-P2-3-PN-230-6G	breaker	245.0	123.21	124.92	DC	9.3
6989721	235197	01KARNSC	AP	235152	01BUTLER	AP	1	PN-P1-2-PN-345-107T	single	179.0	126.23	127.34	DC	4.38
6989722	235197	01KARNSC	AP	235152	01BUTLER	AP	1	ATSI-P1-2-CEI-345-700T	single	179.0	126.23	127.34	DC	4.38
6989725	235197	01KARNSC	AP	235152	01BUTLER	AP	1	PJM_P1_APS_B_G692	single	179.0	103.02	104.84	DC	3.27
6990106	235203	01KISSNG	AP	235197	01KARNSC	AP	1	ATSI-P1-2-CEI-345-700T	single	268.0	101.69	102.47	DC	4.62
6990107	235203	01KISSNG	AP	235197	01KARNSC	AP	1	PN-P1-2-PN-345-107T	single	268.0	101.69	102.47	DC	4.62
6989777	235240	01COLMBGPN	AP	235202	01KISKIV	AP	1	PN-P1-2-PN-345-107T	single	151.0	124.19	125.26	DC	3.58
6989778	235240	01COLMBGPN	AP	235202	01KISKIV	AP	1	ATSI-P1-2-CEI-345-700T	single	151.0	124.19	125.26	DC	3.58
6989702	235282	01GAR RN	AP	235240	01COLMBGPN	AP	1	ATSI-P1-2-CEI-345-700T	single	151.0	132.33	133.4	DC	3.58
6989703	235282	01GAR RN	AP	235240	01COLMBGPN	AP	1	PN-P1-2-PN-345-107T	single	151.0	132.33	133.4	DC	3.58

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
2192367	239036	02PERRY	ATSI	239334	02L.CENTER	ATSI	1	ATSI-P7-1-CEI-345-012	tower	1667.0	125.36	125.92	DC	20.97
2192385	239036	02PERRY	ATSI	238684	02EASTLK	ATSI	1	ATSI-P7-1-CEI-345-016	tower	1667.0	118.42	118.96	DC	20.31

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	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
1465398	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	Base Case	operation	1560.0	114.01	114.83	DC	28.59
2481316	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	235104 01CABOT 500 239280 02CRNBRY 500 1	operation	1900.0	102.47	103.17	DC	29.71
6990110	200767	26HOMER CT	PENELEC	200795	26SHELOCTA	PENELEC	1	AP-P1-2-WP-345-311T	operation	917.0	99.42	100.4	DC	19.47
6989723	235197	01KARNSC	AP	235152	01BUTLER	AP	1	PN-P1-2-PN-345-107T	operation	179.0	86.03	88.33	DC	9.1
6989724	235197	01KARNSC	AP	235152	01BUTLER	AP	1	ATSI-P1-2-CEI-345-700T	operation	179.0	86.03	88.33	DC	9.1
2192314	238547	02AT	ATSI	239036	02PERRY	ATSI	1	Base Case	operation	1534.0	93.32	94.05	DC	24.87
8718526	238547	02AT	ATSI	239036	02PERRY	ATSI	1	ATSI-P1-3-SYS-345-722	operation	1891.0	90.59	91.25	DC	27.94
6989806	941190	AE2-113 TAP	PENELEC	200582	26RIDGWAY	PENELEC	1	PN-P1-3-PN-115-116	operation	160.0	23.95	92.83	DC	110.2

15.5 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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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
1464772	200674	26TOWANDA	PENELEC	200677	26NO MESHO	PENELEC	1	PN-P2-3-PN-230-3C	breaker	172.0	98.09	99.89	DC	6.84

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 O2	1.2
940862	AE2-074 E O2	1.58
941191	AE2-113 C O2	3.29
941192	AE2-113 E O2	3.55
941421	AE2-139 C O2	10.83
941422	AE2-139 E O2	7.22
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

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
1464915	200811	26WARREN	PENELEC	200918	26ERIE S TIE	PENELEC	1	PN-P2-3-PN-345-003A	breaker	621.0	96.76	99.59	DC	17.5

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 O2	1.58
940862	AE2-074 E O2	2.08
941191	AE2-113 C O2	8.43
941192	AE2-113 E O2	9.07
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	2.37
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

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
6989311	235248	01SHINGL	AP	200513	26LEWISTWN	PENELEC	1	AP-P2-3-WP-230-446T	breaker	554.0	78.08	79.12	DC	12.81

Bus #	Bus	MW Impact
200665	26SHAWVL 3	9.75
200666	26SHAWVL 4	9.52
200715	26SHAWVL 1	6.01
200722	26SHAWVL 2	6.15
200894	26K02	13.02
200905	26Q36	0.24
200913	26SHAW-D	0.25
236828	01GRAYMONT	2.38
290086	Q-036 E	7.81
917072	Z2-011	0.38
918682	AA1-082 E	6.13
919201	AA1-144 O1	18.82
919491	AA2-000	169.28
925512	AC1-025 E	0.92
930511	AB1-092	6.22
936421	AD2-055	12.8
936991	AD2-133 C	3.51
936992	AD2-133 E	16.06
939171	AE1-147 C	7.1
939172	AE1-147 E	4.74
940201	AE2-001 C	7.12
940202	AE2-001 E	4.75
940681	AE2-055 C	7.38
940682	AE2-055 E	4.92
941191	AE2-113 C O2	6.17
941192	AE2-113 E O2	6.64
941251	AE2-119 C	4.08
941252	AE2-119 E	2.72
941261	AE2-120 C	7.13
941262	AE2-120 E	4.75
941271	AE2-121 C	3.76
941272	AE2-121 E	2.51
941321	AE2-126 C	2.78
941322	AE2-126 E	1.86
941331	AE2-129 C	3.12
941332	AE2-129 E	2.08
941351	AE2-131 C	3.12
941352	AE2-131 E	2.08
941421	AE2-139 C O2	9.12
941422	AE2-139 E O2	6.08

Bus #	Bus	MW Impact
942351	AE2-248 C	5.82
942352	AE2-248 E	3.88
942491	AE2-262 C	26.05
942492	AE2-262 E	17.5
942501	AE2-263 C	24.48
942502	AE2-263 E	16.35
CATAWBA	CATAWBA	0.01
CBM-N	CBM-N	1.32
CBM-S1	CBM-S1	0.38
CBM-W1	CBM-W1	1.36
CBM-W2	CBM-W2	3.4
CIN	CIN	0.47
G-007	G-007	0.89
HAMLET	HAMLET	0.04
IPL	IPL	0.31
LGEE	LGEE	0.13
MEC	MEC	0.84
MECS	MECS	1.13
NYISO	NYISO	5.67
O-066	O-066	5.22
WEC	WEC	0.14

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
6988438	938380	AE1-071 TAP	PENELEC	200520	26ROXBURY	PENELEC	1	PL:10:P22:100582	bus	160.0	82.87	84.8	DC	6.85

Bus #	Bus	MW Impact
200812	26ALY HYDR	0.31
200852	26WARR RDG	0.09
236828	01GRAYMONT	0.45
290086	Q-036 E	2.36
293301	N-039 E	3.84
293802	O-038 E	2.4
294515	P-022 E	0.96
919491	AA2-000	29.82
925512	AC1-025 E	0.17
930511	AB1-092	1.09
936421	AD2-055	2.25
936991	AD2-133 C	1.06
936992	AD2-133 E	4.85
938381	AE1-071 C	41.88
938382	AE1-071 E	25.63
939171	AE1-147 C	1.34
939172	AE1-147 E	0.89
940201	AE2-001 C	1.35
940202	AE2-001 E	0.9
940681	AE2-055 C	1.41
940682	AE2-055 E	0.94
941191	AE2-113 C O2	3.3
941192	AE2-113 E O2	3.55
941231	AE2-117 C	1.47
941232	AE2-117 E	0.98
941241	AE2-118 C	1.47
941242	AE2-118 E	0.98
941251	AE2-119 C	0.84
941252	AE2-119 E	0.56
941261	AE2-120 C	1.35
941262	AE2-120 E	0.9
941271	AE2-121 C	0.71
941272	AE2-121 E	0.47
941321	AE2-126 C	0.77
941322	AE2-126 E	0.51
941331	AE2-129 C	0.77
941332	AE2-129 E	0.51
941351	AE2-131 C	0.77
941352	AE2-131 E	0.51
942031	AE2-215 C	13.9
942032	AE2-215 E	9.27

Bus #	Bus	MW Impact
942351	AE2-248 C	1.11
942352	AE2-248 E	0.74
942491	AE2-262 C	4.67
942492	AE2-262 E	3.14
942501	AE2-263 C	4.39
942502	AE2-263 E	2.93
942511	AE2-264 C	4.79
942512	AE2-264 E	3.19
CATAWBA	CATAWBA	0.02
CBM-N	CBM-N	0.51
CBM-S1	CBM-S1	0.34
CBM-W1	CBM-W1	1.35
CBM-W2	CBM-W2	3.23
CIN	CIN	0.47
G-007	G-007	0.35
HAMLET	HAMLET	0.07
IPL	IPL	0.31
LGEE	LGEE	0.13
MEC	MEC	0.83
MECS	MECS	1.12
NYISO	NYISO	2.21
O-066	O-066	2.01
WEC	WEC	0.14

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
1464521	941190	AE2-113 TAP	PENELEC	200582	26RIDGWAY	PENELEC	1	PN-P2-3-PN-230-26B2	breaker	160.0	24.47	93.05	DC	109.72

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 O2	7.53
940862	AE2-074 E O2	9.91
941191	AE2-113 C O2	52.83
941192	AE2-113 E O2	56.88
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

15.11 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
1464387	200927	26FOURMILE	PENELEC	200820	26ERIE SE	PENELEC	1	PN-P2-3-PN-230-6G	breaker	245.0	123.21	124.92	DC	9.3

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 O2	1.25
940862	AE2-074 E O2	1.65
941191	AE2-113 C O2	4.48
941192	AE2-113 E O2	4.82
941321	AE2-126 C	0.64
941322	AE2-126 E	0.43
941421	AE2-139 C O2	3.67
941422	AE2-139 E O2	2.44
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

15.12 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
6989722	235197	01KARNSC	AP	235152	01BUTLER	AP	1	ATSI-P1-2-CEI-345-700T	single	179.0	126.23	127.34	DC	4.38

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 O2	0.93
941191	AE2-113 C O2	4.38
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 O2	6.25
BLUEG	BLUEG	3.45
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	0.28
NEWTON	NEWTON	0.95
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	4.63

15.13 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
6990107	235203	01KISSNG	AP	235197	01KARNSC	AP	1	PN-P1-2-PN-345-107T	single	268.0	101.69	102.47	DC	4.62

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 O2	0.98
941191	AE2-113 C O2	4.62
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 O2	6.58
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
6989778	235240	01COLMBGPN	AP	235202	01KISKIV	AP	1	ATSI-P1-2-CEI-345-700T	single	151.0	124.19	125.26	DC	3.58

Bus #	Bus	MW Impact
200608	26PINEY #1	0.38
200642	26SENECA#1	1.73
200643	26SENECA#2	1.84
200644	26SENECA#3	0.14
200662	26SCRUB GR	0.92
200828	26HNSMLK 1	0.58
200829	26HNSMLK 2	0.58
200830	26HNSMLK 3	0.58
200831	26HNSMLK 4	0.58
200832	26HNSMLK 5	0.58
200849	26LAKVU GN	0.04
201201	26WRREN CT	0.45
235030	01MHNG-T155	0.15
235134	01AL&D6	0.27
903643	W3-099 C OP1	0.89
914101	Y2-055	1.86
915951	Y3-092 FTIR	74.81
930411	AB1-082	1.04
935191	AD1-154	1.43
938951	AE1-123	1.74
939291	AE1-160 C	1.09
939381	AE1-169 C O1	4.42
940861	AE2-074 C O2	0.79
941191	AE2-113 C O2	3.58
941321	AE2-126 C	0.63
942811	AE2-299 C	2.16
942961	AE2-316 C	4.19
943151	AE2-344 C O2	5.26
BLUEG	BLUEG	2.71
CALDERWOOD	CALDERWOOD	0.26
CANNELTON	CANNELTON	0.16
CATAWBA	CATAWBA	0.15
CBM-N	CBM-N	1.46
CHEOAH	CHEOAH	0.24
CHILHOWEE	CHILHOWEE	0.09
COFFEEN	COFFEEN	0.28
COTTONWOOD	COTTONWOOD	1.05
DUCKCREEK	DUCKCREEK	0.62
EDWARDS	EDWARDS	0.28
ELMERSMITH	ELMERSMITH	0.28

Bus #	Bus	MW Impact
FARMERCITY	FARMERCITY	0.18
G-007A	G-007A	1.44
GIBSON	GIBSON	0.11
HAMLET	HAMLET	0.23
NEWTON	NEWTON	0.74
NYISO	NYISO	6.37
PRAIRIE	PRAIRIE	1.36
SANTEETLA	SANTEETLA	0.07
SMITHLAND	SMITHLAND	0.11
TATANKA	TATANKA	0.34
TILTON	TILTON	0.34
TRIMBLE	TRIMBLE	0.3
TVA	TVA	0.86
UNIONPOWER	UNIONPOWER	0.38
VFT	VFT	3.99

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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
6989703	235282	01GARRN	AP	235240	01COLMBGPN	AP	1	PN-P1-2-PN-345-107T	single	151.0	132.33	133.4	DC	3.58

Bus #	Bus	MW Impact
200608	26PINEY #1	0.38
200642	26SENECA#1	1.73
200643	26SENECA#2	1.84
200644	26SENECA#3	0.14
200662	26SCRUB GR	0.92
200828	26HNSMLK 1	0.58
200829	26HNSMLK 2	0.58
200830	26HNSMLK 3	0.58
200831	26HNSMLK 4	0.58
200832	26HNSMLK 5	0.58
200849	26LAKVU GN	0.04
201201	26WRREN CT	0.45
235030	01MHNG-T155	0.15
235134	01AL&D6	0.27
903643	W3-099 C OP1	0.89
914101	Y2-055	1.86
915951	Y3-092 FTIR	74.81
930411	AB1-082	1.04
935191	AD1-154	1.43
938951	AE1-123	1.74
939291	AE1-160 C	1.09
939381	AE1-169 C O1	4.42
940861	AE2-074 C O2	0.79
941191	AE2-113 C O2	3.58
941321	AE2-126 C	0.63
942811	AE2-299 C	2.16
942961	AE2-316 C	4.19
943151	AE2-344 C O2	5.26
BLUEG	BLUEG	2.71
CALDERWOOD	CALDERWOOD	0.26
CANNELTON	CANNELTON	0.16
CATAWBA	CATAWBA	0.15
CBM-N	CBM-N	1.46
CHEOAH	CHEOAH	0.24
CHILHOWEE	CHILHOWEE	0.09
COFFEEN	COFFEEN	0.28
COTTONWOOD	COTTONWOOD	1.05
DUCKCREEK	DUCKCREEK	0.62
EDWARDS	EDWARDS	0.28
ELMERSMITH	ELMERSMITH	0.28

Bus #	Bus	MW Impact
FARMERCITY	FARMERCITY	0.18
G-007A	G-007A	1.44
GIBSON	GIBSON	0.11
HAMLET	HAMLET	0.23
NEWTON	NEWTON	0.74
NYISO	NYISO	6.37
PRAIRIE	PRAIRIE	1.36
SANTEETLA	SANTEETLA	0.07
SMITHLAND	SMITHLAND	0.11
TATANKA	TATANKA	0.34
TILTON	TILTON	0.34
TRIMBLE	TRIMBLE	0.3
TVA	TVA	0.86
UNIONPOWER	UNIONPOWER	0.38
VFT	VFT	3.99

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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
2192367	239036	02PERRY	ATSI	239334	02L.CENTER	ATSI	1	ATSI-P7-1-CEI-345-012	tower	1667.0	125.36	125.92	DC	20.97

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 O2	2.48
940862	AE2-074 E O2	3.27
941191	AE2-113 C O2	10.1
941192	AE2-113 E O2	10.87
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 O2	6.94
941422	AE2-139 E O2	4.63
941491	AE2-146 C	11.86
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 O2	24.55
943152	AE2-344 E O2	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	24.44
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	19.39

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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
2192385	239036	02PERRY	ATSI	238684	02EASTLK	ATSI	1	ATSI-P7-1-CEI-345-016	tower	1667.0	118.42	118.96	DC	20.31

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	10.09
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	4.14
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 O2	2.41
940862	AE2-074 E O2	3.17
941191	AE2-113 C O2	9.78
941192	AE2-113 E O2	10.53
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 O2	6.72
941422	AE2-139 E O2	4.48
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 O2	23.79
943152	AE2-344 E O2	15.86
BLUEG	BLUEG	13.54
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	1.38
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	6.84
SANTEETLA	SANTEETLA	0.31
SMITHLAND	SMITHLAND	0.52
TATANKA	TATANKA	1.74
TILTON	TILTON	1.78
TRIMBLE	TRIMBLE	1.51
TVA	TVA	4.04
UNIONPOWER	UNIONPOWER	1.77
VFT	VFT	18.71

Affected Systems

15.18 Affected Systems

15.18.1 LG&E

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

15.18.2 MISO

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

15.18.3 TVA

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

15.18.4 Duke Energy Progress

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

15.18.5 NYISO

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

15.19 Contingency Descriptions

Contingency Name	Contingency Definition
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
PN-P2-3-PN-345-003A	CONTINGENCY 'PN-P2-3-PN-345-003A' /* WAYNE 345KV STUCK BREAKER DISCONNECT BUS 200595 /* 26WAYNE 345 END
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
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
PL:10:P22:100582	CONTINGENCY 'PL:10:P22:100582' /* JUNIATA 230KV BUS 2 DISCONNECT BUS 208005 /* 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
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
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

Contingency Name	Contingency Definition
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
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
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
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-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-P2-2-PN-230-006AT	CONTINGENCY 'PN-P2-2-PN-230-006AT' /* LEWISTOWN #1 230KV BUS / PJM FIXED DISCONNECT BRANCH FROM BUS 200513 TO BUS 208005 CKT 1 /* 26LEWISTWN 230 JUNI BU2 230 /UPDATED JUNI BUS # DISCONNECT BRANCH FROM BUS 200513 TO BUS 200531 CKT 1 /* 26LEWISTWN 230 26YEAGRTWN 230 DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 TO BUS 200548 CKT 1/* 26LEWISTWN 230 26LEWISTWN 115 26LEWISTWN 46.00 REDUCE BUS 200513 SHUNT BY 100 PERCENT /* 26LEWISTWN 230 END

Contingency Name	Contingency Definition
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-230-26A1	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
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
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-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

Short Circuit

15.20 Short Circuit

The following Breakers are overduty:

None

16 Attachment 1 – One Line

17 Attachment 2 – Project Location