Generation Interconnection

Feasibility Study Report

for

Queue Project AE2-174

SENECA 138 KV

34.85 MW Capacity / 198 MW Energy

December, 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.

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 Wind generating facility located in Seneca County, Ohio. The installed facilities will have a total capability of 198 MW with 34.85 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is 10/31/21. This study does not imply a TO commitment to this in-service date.

Queue Number	AE2-174
Project Name	SENECA 138 KV
State	OH
County	Seneca
Transmission Owner	AEP
MFO	198
MWE	198
MWC	34.85
Fuel	Wind
Basecase Study Year	2022

2.1 Point of Interconnection

AE2-174 will interconnect with the AEP transmission system at the Seneca 138 kV substation.

To accommodate the interconnection at Seneca 138 kV substation, Seneca substation will have to be expanded to a new four (4) circuit breaker 138 kV substation physically configured in a breaker and half bus arrangement (see Figure 1). Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 kV revenue metering will also be required. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.

Note: Assumptions were made to prepare the cost estimates and scope of work. AEP will evaluate the existing substation during the Impact Study phase.

2.2 Cost Summary

The AE2-174 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$250,000
Direct Connection Network Upgrade	$6,000,000
Non Direct Connection Network Upgrades	$1,250,000
Total Costs	$7,500,000

In addition, the AE2-174 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	$265,714,700

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

3 Transmission Owner Scope of Work

4 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
138kV Revenue Metering	$ 250,000
Total Attachment Facility Costs	$250,000

5 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
Expand Seneca 138 kV substation to a new four (4) circuit breaker 138 kV substation physically configured in a breaker and half bus arrangement (see Figure 1). Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 kV revenue metering will also be required. (See Figure 1).	$ 6,000,000
Total Direct Connection Facility Costs	$ 6,000,000

6 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
138kV circuit cut into Seneca	$500,000
Upgrade line Protection and Controls at the proposed expanded Seneca 138kV substation	$ 250,000
Upgrade line Protection and Controls at the remote end substation 1 to coordinate with the expanded Seneca 138kV substation	$ 250,000
Upgrade line Protection and Controls at the remote end substation 2 to coordinate with the expanded Seneca 138kV substation	$ 250,000
Total Non-Direct Connection Facility Costs	$1,250,000

7 Incremental Capacity Transfer Rights (ICTRs)

Will be determined at a later study phase

8 Schedule

It is anticipated that the time between receipt of executed Agreements and Commercial Operation may range from 12 to 18 months if no line work is required. If line work is required, construction time would generally be between 24 to 36 months after Agreement execution.

9 Interconnection Customer Requirements

It is understood that the Interconnection Customer is responsible for all costs associated with this interconnection. The costs above are reimbursable to AEP. The cost of the Interconnection Customer's generating plant and the costs for the line connecting the generating plant at the Stockton138kV station are not included in this report; these are assumed to be the Interconnection Customer's responsibility.

The Generation Interconnection Agreement does not in or by itself establish a requirement for American Electric Power to provide power for consumption at the developer's facilities. A separate agreement may be reached with the local utility that provides service in the area to ensure that infrastructure is in place to meet this demand and proper metering equipment is installed. It is the responsibility of the developer to contact the local service provider to determine if a local service agreement is required.

Requirement from the PJM Open Access Transmission Tariff:

1. An Interconnection Customer entering the New Services Queue on or after October 1, 2012 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.

The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Section 4 of PJM Manual 14D for additional information.

10 Revenue Metering and SCADA Requirements

10.1 PJM Requirements

The Interconnection Customer will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Section 8 of Attachment O.

10.2 AEP Requirements

The Interconnection Customer will be required to comply with all AEP Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "Requirements for Connection of New Facilities or Changes to Existing Facilities Connected to the AEP Transmission System" document located at the following link:

http://www.pjm.com/~/media/planning/plan-standards/private-aep/aep-interconnection-requirements.ashx

11 Network Impacts

The Queue Project AE2-174 was evaluated as a 198.0 MW (Capacity 34.8 MW) injection at the V4-010 138 kV switching station in the AEP area. Project AE2-174 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-174 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

Summer Peak Load Flow

12 Generation Deliverability

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

None

13 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
1580514	243009	05FRMNT	AEP	239154	02W.FREM	ATSI	1	AEP_P2-2_#7118_05HOWARD 138_1	bus	361.0	83.45	111.8	DC	102.35
1581097	243009	05FRMNT	AEP	239154	02W.FREM	ATSI	1	AEP_P4_#7110_05MELMOR 138_B	breaker	361.0	85.72	116.14	DC	109.84
1581098	243009	05FRMNT	AEP	239154	02W.FREM	ATSI	1	AEP_P4_#10133_05HOWARD 138_H	breaker	361.0	83.47	111.83	DC	102.35
1582344	243009	05FRMNT	AEP	239154	02W.FREM	ATSI	1	AEP_P7-1_#10929	tower	361.0	77.02	106.97	DC	108.09
1582345	243009	05FRMNT	AEP	239154	02W.FREM	ATSI	1	AEP_P7-1_#10933	tower	361.0	76.57	103.91	DC	98.71
1582297	243024	05HOWARD	AEP	238586	02BRKSID	ATSI	1	AEP_P7-1_#10931	tower	245.0	98.35	111.0	DC	30.98
1582298	243024	05HOWARD	AEP	238586	02BRKSID	ATSI	1	AEP_P7-1_#10932	tower	245.0	98.29	110.91	DC	30.93

14 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
2248629	238524	02AD Q-2	ATSI	241928	02AVQ2	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	332.0	126.39	127.98	DC	11.66
2248140	238569	02BEAVER	ATSI	239725	02LAKEAVE	ATSI	2	ATSI-P2-3-OEC-345-023	breaker	1742.0	106.42	107.25	DC	32.12
2248690	238569	02BEAVER	ATSI	238607	02CARLIL	ATSI	1	ATSI-P7-1-OEC-345-001	tower	1243.0	106.31	107.25	DC	25.75
2248613	238915	02LRN Q2	ATSI	238524	02AD Q-2	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	316.0	132.79	134.45	DC	11.66
2248077	239176	02WOOD+	ATSI	238890	02LEMOYN	ATSI	1	AEP_P4_#3141_05FOSTOR 345_B2	breaker	223.0	102.87	115.41	DC	27.94
2248078	239176	02WOOD+	ATSI	238890	02LEMOYN	ATSI	1	ATSI-P2-3-TE-345-010T	breaker	223.0	107.97	116.96	DC	20.04
2248659	239176	02WOOD+	ATSI	238890	02LEMOYN	ATSI	1	ATSI-P7-1-TE-138-026	tower	223.0	102.93	115.09	DC	27.07
2248662	239728	02BLKRVR	ATSI	239734	02USSTEEL	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	659.0	101.95	103.03	DC	15.79
2248638	239734	02USSTEEL	ATSI	238915	02LRN Q2	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	593.0	108.88	110.08	DC	15.79
1580902	242953	05AIRCO8	AEP	243137	05W.END	AEP	1	AEP_P4_#7110_05MELMOR 138_B	breaker	167.0	117.5	135.62	DC	30.27
1580829	242984	05CHATFL	AEP	932050	AC2-015 TAP	AEP	1	AEP_P4_#7110_05MELMOR 138_B	breaker	167.0	123.65	141.03	DC	29.03

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
1580830	242984	05CHATFL	AEP	932050	AC2-015 TAP	AEP	1	AEP_SUBT_P4_#1208_05HOWARD 69.0_U	breaker	167.0	123.51	138.04	DC	24.26
1580317	243008	05FREMCT	AEP	243009	05FRMNT	AEP	1	AEP_SUBT_P2-2_#1175_05FREMNT C 69.0_1	bus	251.0	120.43	157.8	DC	93.78
1580318	243008	05FREMCT	AEP	243009	05FRMNT	AEP	1	AEP_P2-2_#7118_05HOWARD 138_1	bus	251.0	114.64	149.19	DC	86.74
1580742	243008	05FREMCT	AEP	243009	05FRMNT	AEP	1	AEP_SUBT_P4_#1176_05FREMNT C 69.0_L	breaker	251.0	121.11	158.47	DC	93.78
1580743	243008	05FREMCT	AEP	243009	05FRMNT	AEP	1	AEP_SUBT_P4_#2200_05FREMNT C 69.0_E	breaker	251.0	120.43	157.8	DC	93.78
1582165	243008	05FREMCT	AEP	243009	05FRMNT	AEP	1	AEP_P7-1_#10929	tower	251.0	107.44	143.92	DC	91.57
1580495	243024	05HOWARD	AEP	238586	02BRKSID	ATSI	1	AEP_P2-2_#7725_05FREMCT 138_1	bus	245.0	102.6	115.32	DC	31.15
1581092	243024	05HOWARD	AEP	238586	02BRKSID	ATSI	1	AEP_P4_#7725_05FREMCT 138_M	breaker	245.0	102.6	115.32	DC	31.15
1581093	243024	05HOWARD	AEP	238586	02BRKSID	ATSI	1	AEP_P4_#7728_05FREMCT 138_C	breaker	245.0	101.03	114.05	DC	31.91
1580290	243039	05MELMOR	AEP	243006	05FOSTOR	AEP	1	AEP_P2-2_#7725_05FREMCT 138_1	bus	167.0	185.97	223.94	DC	63.41
1580337	243039	05MELMOR	AEP	243110	05STIFFI	AEP	1	AEP_P2-2_#7725_05FREMCT 138_1	bus	167.0	122.04	145.45	DC	39.08
1580358	243039	05MELMOR	AEP	243024	05HOWARD	AEP	1	AEP_P2-2_#9521_05CHATFL 138_2	bus	167.0	125.99	139.78	DC	23.04
1580643	243039	05MELMOR	AEP	243006	05FOSTOR	AEP	1	AEP_P4_#7725_05FREMCT 138_M	breaker	167.0	185.97	223.94	DC	63.41
1580644	243039	05MELMOR	AEP	243006	05FOSTOR	AEP	1	AEP_P4_#7728_05FREMCT 138_C	breaker	167.0	182.07	220.65	DC	64.43
1580695	243039	05MELMOR	AEP	242984	05CHATFL	AEP	1	AEP_P4_#7110_05MELMOR 138_B	breaker	167.0	157.06	175.75	DC	31.2
1580752	243039	05MELMOR	AEP	243110	05STIFFI	AEP	1	AEP_P4_#7110_05MELMOR 138_B	breaker	167.0	139.89	158.94	DC	31.82
1580753	243039	05MELMOR	AEP	243110	05STIFFI	AEP	1	AEP_P4_#7728_05FREMCT 138_C	breaker	167.0	122.24	145.59	DC	39.0
1580754	243039	05MELMOR	AEP	243110	05STIFFI	AEP	1	AEP_P4_#7725_05FREMCT 138_M	breaker	167.0	122.04	145.45	DC	39.08
1580793	243039	05MELMOR	AEP	243024	05HOWARD	AEP	1	AEP_P4_#7112_05MELMOR 138_C	breaker	167.0	135.31	150.83	DC	25.92
1580794	243039	05MELMOR	AEP	243024	05HOWARD	AEP	1	AEP_P4_#10729_05CHATFL 138_E	breaker	167.0	126.09	140.26	DC	23.67
1580795	243039	05MELMOR	AEP	243024	05HOWARD	AEP	1	AEP_P4_#9521_05CHATFL 138_F	breaker	167.0	125.99	139.78	DC	23.04
1582112	243039	05MELMOR	AEP	243006	05FOSTOR	AEP	1	AEP_P7-1_#10932	tower	167.0	167.97	204.56	DC	61.1
1582113	243039	05MELMOR	AEP	243006	05FOSTOR	AEP	1	AEP_P7-1_#10931	tower	167.0	167.93	204.49	DC	61.05
1580897	243110	05STIFFI	AEP	242953	05AIRCO8	AEP	1	AEP_P4_#7110_05MELMOR 138_B	breaker	167.0	117.56	135.68	DC	30.27
2248142	907060	X1-027A_AT12	ATSI	238569	02BEAVER	ATSI	1	ATSI-P2-3-OEC-345-034	breaker	1742.0	105.68	106.16	DC	18.5
2248143	907060	X1-027A_AT12	ATSI	238569	02BEAVER	ATSI	1	ATSI-P2-3-OEC-345-032	breaker	1742.0	105.64	106.13	DC	18.5
1580690	932050	AC2-015 TAP	AEP	243024	05HOWARD	AEP	1	AEP_P4_#7110_05MELMOR 138_B	breaker	167.0	159.02	176.41	DC	29.03
1580691	932050	AC2-015 TAP	AEP	243024	05HOWARD	AEP	1	AEP_SUBT_P4_#1208_05HOWARD 69.0_U	breaker	167.0	155.27	169.8	DC	24.26

15 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
2248478	239176	02WOOD+	ATSI	238890	02LEMOYN	ATSI	1	AEP_P1-3_#744_05FOSTOR 345_1	operation	223.0	98.88	111.96	DC	29.14
1581758	242953	05AIRCO8	AEP	243137	05W.END	AEP	1	AEP_P1-2_#7104	operation	167.0	106.02	122.4	DC	27.35
1581736	242984	05CHATFL	AEP	932050	AC2-015 TAP	AEP	1	AEP_P1-2_#7105	operation	167.0	108.69	122.58	DC	23.2
1581623	243008	05FREMCT	AEP	243009	05FRMNT	AEP	1	AEP_P1-2_#7104	operation	251.0	104.21	139.63	DC	88.91
1581628	243008	05FREMCT	AEP	243009	05FRMNT	AEP	1	Base Case	operation	251.0	89.56	121.69	DC	80.66
1581995	243009	05FRMNT	AEP	239154	02W.FREM	ATSI	1	Base Case	operation	296.0	75.24	107.37	DC	95.09
1581997	243009	05FRMNT	AEP	239154	02W.FREM	ATSI	1	AEP_P1-2_#7104	operation	361.0	74.23	103.27	DC	104.82
1581747	243024	05HOWARD	AEP	238586	02BRKSID	ATSI	1	Base Case	operation	167.0	116.62	121.08	DC	16.53
1581748	243024	05HOWARD	AEP	238586	02BRKSID	ATSI	1	AEP_P1-2_#5249	operation	245.0	98.04	110.67	DC	30.93
1581416	243039	05MELMOR	AEP	243006	05FOSTOR	AEP	1	AEP_P1-2_#5249	operation	167.0	167.19	203.78	DC	61.1
1581421	243039	05MELMOR	AEP	243006	05FOSTOR	AEP	1	Base Case	operation	167.0	129.6	148.37	DC	31.34
1581530	243039	05MELMOR	AEP	242984	05CHATFL	AEP	1	AEP_P1-2_#7105	operation	167.0	142.92	157.45	DC	24.26
1581535	243039	05MELMOR	AEP	242984	05CHATFL	AEP	1	Base Case	operation	167.0	96.41	100.98	DC	16.92
1581587	243039	05MELMOR	AEP	243110	05STIFFI	AEP	1	AEP_P1-2_#7104	operation	167.0	125.95	142.89	DC	28.29
1581606	243039	05MELMOR	AEP	243024	05HOWARD	AEP	1	AEP_P1-2_#7709	operation	167.0	125.96	139.69	DC	22.92
1581611	243039	05MELMOR	AEP	243024	05HOWARD	AEP	1	Base Case	operation	136.0	97.29	102.78	DC	16.56
1581756	243110	05STIFFI	AEP	242953	05AIRCO8	AEP	1	AEP_P1-2_#7104	operation	167.0	106.02	122.4	DC	27.35
1581536	932050	AC2-015 TAP	AEP	243024	05HOWARD	AEP	1	AEP_P1-2_#7105	operation	167.0	142.14	156.03	DC	23.2
1581539	932050	AC2-015 TAP	AEP	243024	05HOWARD	AEP	1	Base Case	operation	136.0	128.48	133.91	DC	16.41
1581789	940150	V4-010 TAP	AEP	243008	05FREMCT	AEP	1	Base Case	operation	257.0	80.05	118.73	DC	99.41
1581790	940150	V4-010 TAP	AEP	243008	05FREMCT	AEP	1	AEP_P1-2_#7161-B	operation	360.0	55.56	110.56	DC	198.0
1581960	940150	V4-010 TAP	AEP	243130	05TIFFIN	AEP	1	AEP_P1-2_#7161-A	operation	360.0	55.56	110.56	DC	198.0

16 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
1580643,1580644,1580290,1582113,1582112	13	05MELMOR 138.0 kV - 05FOSTOR 138.0 kV Ckt 1	**AEP** **AEPO0019a (220) : Reconfigure Fremont 138kV station into 5 breaker ring .This upgrade will be tested during the System Impact studies. If not adequate, additional mitigation may be required including :** **1) Rebuild 18 mile double circuit line between Melmore and Fostoria Central with 1590 ACSR (Replacing current 397.5 ACSR conductor) [$54,000,000]** **2) Upgrade Relay Compliance Trip Limit 1540 Amps at Fostoria central [$25,000]** **Project Type : CON** **Cost : $10,000,000** **Time Estimate : 24-36 months**	$10,000,000
1582344,1582345,1581097,1581098,1580514	1	05FRMNT 138.0 kV - 02W.FREM 138.0 kV Ckt 1	**AEP** **AEPO0026a (248) : Relocate Fostoria Central- Melmore or the Howard- Melmore #1 line into a new breaker string at Melmore. This upgrade will be tested during the System Impact studies. If not adequate, additional mitigation may be required including :** **1) Replace 1200 A Switch at Fremont [$200,000]** **2) Replace three Sub Cond 1590 AAC 61 Str at Fremont [$300,000]** **3) Rebuild 7 miles of 138 kV line between Fremont Center and First Energy's West Fremont station with a bundled 795 ACSR conductor (Replacing ACSR ~ 1033.5 ~ 45/7 ~ ORTOLAN conductor). First Energy will need to be consulted due to the fact that they own a portion of the line conductor that limits the branch. [$10,500,000]** **Project Type : CON** **Cost : $4,000,000** **Time Estimate : 24-36 months** **ATSI** **TE-002B (406) : Reconductor the 0.8 miles of transmission line between West Fremont-Fremont 138 kV line. Existing transmission line conductor size 954 ACSR should be replaced with 954 ACSS** **AEP would need to replace their section of limiting conductor and provide estimates for their replacement.** **Project Type : Facility** **Cost : $1,950,000** **Time Estimate : 18.0 Months**	$5,950,000

ID	Index	Facility	Upgrade Description	Cost
1580897	17	05STIFFI 138.0 kV - 05AIRCO8 138.0 kV Ckt 1	**AEP** **AEPO0024a (238) : Relocate Fostoria Central - Melmore or the Howard- Melmore #1 line into a new breaker string at Melmore. This upgrade will be tested during the System Impact studies. If not adequate, additional mitigation may be required including :** **1) Sag Study - A Sag Study will be required on the 10 miles of Conductor Section 1, ACSR ~ 397.5 ~ 30/7 ~ LARK. Depending on the sag study results, cost for this upgrade is expected to be between $50,000 (no remediations required just sag study, new ratings : S/N: 167 S/E: 245 and $30 million (complete line rebuild). Time Estimate: a) Sag Study: 18-24 months b) Rebuild: The standard time required for construction differs from state to state. An approximate construction time would be 24 to 36 months after signing an interconnection agreement. [$]** **2) Upgrade CT Thermal Limit 749 Amps at West End Fostoria [$]** **3) Upgrade Relay Thermal Limit 749 Amps at West End Fostoria [$]** **4) Upgrade Relay Compliance Trip Limit 975 Amps at West End Fostoria [$]** **Project Type : CON** **Cost : $4,000,000** **Time Estimate : 24-36 months**	$4,000,000
2248142,2248143	18	X1-027A_AT12 345.0 kV - 02BEAVER 345.0 kV Ckt 1	**ATSI** **OEC-003A (415) : Reconductor the line with 954 kcmill ACSS conductor** **Project Type : Facility** **Cost : $18,992,000** **Time Estimate : 14.0 Months**	$18,992,000
1580902	10	05AIRCO8 138.0 kV - 05W.END 138.0 kV Ckt 1	**AEP** **AEPO0025a (243) : Relocate Fostoria Central- Melmore or the Howard- Melmore #1 line into a new breaker string at Melmore.This upgrade will be tested during the System Impact studies. If not adequate, additional mitigation may be required including :** **1) Sag Study - A Sag Study will be required on the 2 miles of Conductor Section 1, ACSR ~ 397.5 ~ 30/7 ~ LARK. Depending on the sag study results, cost for this upgrade is expected to be between $20,000 (no remediations required just sag study, new ratings : S/N: 167 S/E: 245 and $6 million (complete line rebuild). Time Estimate: a) Sag Study: 18-24 months b) Rebuild: The standard time required for construction differs from state to state. An approximate construction time would be 24 to 36 months after signing an interconnection agreement. [$]** **2) Upgrade CT Thermal Limit 749 Amps at West End Fostoria [$]** **3) Upgrade Relay Thermal Limit 749 Amps at West End Fostoria [$]** **4) Upgrade Relay Compliance Trip Limit 975 Amps at West End Fostoria [$]** **Project Type : CON** **Cost : $4,000,000** **Time Estimate : 24-36 months**	$4,000,000

ID	Index	Facility	Upgrade Description	Cost
2248629	3	02AD Q-2 138.0 kV - 02AVQ2 138.0 kV Ckt 1	**ATSI** OEC-002A (414) : Build a new 138 kV line from Black River to Astor substation Project Type : Facility Cost : $20,152,700 Time Estimate : 30.0 Months	$20,152,700
2248662	8	02BLKRVR 138.0 kV - 02USSTEEL 138.0 kV Ckt 1		
2248638	9	02USSTEEL 138.0 kV - 02LRN Q2 138.0 kV Ckt 1		
2248613	6	02LRN Q2 138.0 kV - 02AD Q-2 138.0 kV Ckt 1		
1580795,1580794,1580358,1580793	15	05MELMOR 138.0 kV - 05HOWARD 138.0 kV Ckt 1	**AEP** AEPO0023a (234) : Relocate West End Fostoria- Melmore or the Howard- Melmore #2 line into a new breaker string at Melmore. This upgrade will be tested during the System Impact studies. If not adequate, additional mitigation may be required including : 1) Rebuild 27 mile double circuit line between Melmore and Howard with 1033 ACSR (Replacing ACSR ~ 397.5 ~ 30/7 ~ LARK). [$81,000,000] 2) Replace two sub Cond 300 MCM CU 37 Str at Howard [$200,000] 3) Replace Bus 0.75" CU Tubular at Howard [$100,000] Project Type : CON Cost : $4,000,000 Time Estimate : 24-36 months	$4,000,000
2248690	5	02BEAVER 345.0 kV - 02CARLIL 345.0 kV Ckt 1	**ATSI** ATSI Rating Correction: [Rate A: 1380, Rate B: 1646, Rate C: 1730]	$0
2248140	4	02BEAVER 345.0 kV - 02LAKEAVE 345.0 kV Ckt 2	**ATSI** ATSI Rating Correction: [Rate A: 1534, Rate B: 1878, Rate C: 2120]	$0
1582297,1580495,1581093,1582298,1581092	2	05HOWARD 138.0 kV - 02BRKSID 138.0 kV Ckt 1	**AEP** AEP_AE1_REF_r0043 (196) : 1) 8 miles of ACSR ~ 397.5 ~ 30/7 ~ LARK - Conductor Section 1 will need to be rebuilt/reconductored. Estimated cost: $12 million. 2) Replace five Sub cond 795 AAC 37 Str at Howard.. Estimated cost: $100,000. Project Type : FAC Cost : $12,100,000 Time Estimate : 24-36 Months **ATSI** Line Ratings limited by AEP equipment	$12,100,000

ID	Index	Facility	Upgrade Description	Cost
1580337,1580753,1580752,1580754	14	05MELMOR 138.0 kV - 05STIFFI 138.0 kV Ckt 1	**AEP** **AEPO0022a (231)** : Relocate Fostoria Central- Melmore or the Howard- Melmore #1 line into a new breaker string at Melmore. This upgrade will be tested during the System Impact studies. If not adequate, additional mitigation may be required including: 1) Rebuild 6 mile double circuit line between Melmore and South Tiffin with 1590 ACSR (Replacing current 397.5 ACSR conductor) [$18,000,000] 2) Replace four sub Cond 500 MCM CU 37 Str at South Tiffin [$400,000] **Project Type** : CON **Cost** : $4,000,000 **Time Estimate** : 24-36 months Months	$16,000,000
1580695	16	05MELMOR 138.0 kV - 05CHATFL 138.0 kV Ckt 1	**AEP** **AEPO0021a (227)** : Relocate Fostoria Central- Melmore or the Howard- Melmore #1 line into a new breaker string at Melmore.This upgrade will be tested during the System Impact studies. If not adequate, additional mitigation may be required including: 1) Rebuild 11 mile double circuit line between Melmore and Chatfield with 1590 ACSR (Replacing current 397.5 ACSR conductor) [$33,000,000] 2) Replace 600A switch at Chatfield [$200,000] 3) Replace two Sub Cond 795 AAC 37 Str at Chatfield [$200,000] **Project Type** : CON **Cost** : $33,000,000 **Time Estimate** : 24-36 months Months	$33,000,000
2248078,2248659,2248077	7	02WOOD+ 138.0 kV - 02LEMOYN 138.0 kV Ckt 1	**ATSI** ATSI Rating Correction: [Rate A: 282, Rate B: 347, Rate C: 347]	$0
1580830,1580829	11	05CHATFL 138.0 kV - AC2-015 TAP 138.0 kV Ckt 1	**AEP** **AEP_AE1_REF_r0025 (139)** : 1) A sag study will be required on the 4.5 miles of ACSR ~ 397.5 ~ 30/7 ~ LARK - Conductor Section 1 to mitigate the overload. Depending on the sag study results, the cost for this upgrade is expected to be between $20,000 (no remediation required, just sag study) and $6.75 million (complete line reconductor/rebuild). New rating after sag study: S/N:167 S/E: 245. Time Estimate: a) Sag Study: 6-12 months b) Rebuild: The standard time required for construction differs from state to state. An approximate construction time would be 24 to 36 months after signing an interconnection agreement. 2) Replace 600A Switch at Chatfield. Estimated cost: $500,000. **Project Type** : FAC **Cost** : $520,000 **Time Estimate** : 12-18 Months	$520,000

ID	Index	Facility	Upgrade Description	Cost
1580690,1580691	19	AC2-015 TAP 138.0 kV - 05HOWARD 138.0 kV Ckt 1	**AEP** **AEPO0027a (254) : Relocate Fostoria Central- Melmore or the Howard- Melmore #1 line into a new breaker string at Melmore. This upgrade will be tested during the System Impact studies. If not adequate, additional mitigation may be required including:** **Project Type : CON** **Cost : $4,000,000** **Time Estimate : 24-36 months Months** **AEPO0027b (255) : Rebuild 11.5 mile double circuit line between AC2-015 TAP and Howard with 1590 ACSR (replacing ACSR ~ 397.5 ~ 30/7 ~ LARK conductor)** **Project Type : FAC** **Cost : $34,500,000** **Time Estimate : 24-36 months Months** **AEPO0027c (256) : Replace sub Cond 300 MCM CU 37 Str at Howard** **Project Type : FAC** **Cost : $100,000** **Time Estimate : 12-18 months Months** **AEPO0027d (257) : Upgrade CT Thermal Limit 749 Amps & Relay Thermal Limit 749 Amps at Howard** **Project Type : FAC** **Cost : $25,000** **Time Estimate : 12-18 months Months** **AEPO0027e (258) : Replace Sub cond 397.5 ACSR 26/7 at Howard** **Project Type :** **Cost : $100,000** **Time Estimate : 12-18 months Months** **AEPO0027f (259) : Upgrade Relay Compliance Trip Limit 975 Amps at Howard** **Project Type : FAC** **Cost : $25,000** **Time Estimate : 12-18 months Months** **AEPO0027g (260) : Replace five Sub cond 795 AAC 37 Str at Howard** **Project Type : FAC** **Cost : $500,000** **Time Estimate : 12-18 months Months**	$78,500,000

ID	Index	Facility	Upgrade Description	Cost
1580318,1580742,1580743,1580317,1582165	12	05FREMCT 138.0 kV - 05FRMNT 138.0 kV Ckt 1	**AEP** **AEPO0020a (223) : Reconfigure Fremont Center 69kV yard into 8 breaker ring for $12,000,000.This upgrade will be tested during the System Impact studies. If not adequate, additional mitigation may be required including :** **1) Rebuild 7 miles of single circuit line (ACSR ~ 795 ~ 45/7 ~ TERN conductor) between Fremont and Fremont Center with 1590 ACSR. [$10,500,000]** **2) Replace 1200A switch at Fremont [$200,000]** **3) Replace two Sub Cond 1590 AAC 61 Str at Fremont [$200,000]** **Project Type : con** **Cost : $12,000,000** **Time Estimate : 24-36 months Months** **AEPO0020b (224) : Rebuild 7 miles of single circuit line (ACSR ~ 795 ~ 45/7 ~ TERN conductor) between Fremont and Fremont Center with 1590 ACSR.** **Project Type : fac** **Cost : $10,500,000** **Time Estimate : 24-36 months Months**	$58,500,000
			TOTAL COST	**$265,714,700**

17 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.

17.1 Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1581097	243009	05FRMNT	AEP	239154	02W.FREM	ATSI	1	AEP_P4_#7110_05MELMOR 138_B	breaker	361.0	85.72	116.14	DC	109.84

Bus #	Bus	MW Impact
247548	V4-010 C	14.42
247551	U4-028 C	0.63
247552	U4-029 C	0.63
247940	U4-028 E	34.41
247941	U4-029 E	34.41
247947	V4-010 E	96.52
925751	AC1-051 C	1.8
925752	AC1-051 E	12.06
932051	AC2-015 C	13.26
932052	AC2-015 E	15.72
934461	AD1-070 C O1	1.94
934462	AD1-070 E O1	9.12
937021	AD2-136 C O1	18.51
937022	AD2-136 E O1	123.86
937381	AD2-191 C	8.74
937382	AD2-191 E	58.49
941741	AE2-174 C	19.33
941742	AE2-174 E	90.5
CARR	CARR	0.04
CBM-S1	CBM-S1	0.88
CBM-S2	CBM-S2	0.39
CBM-W2	CBM-W2	5.45
CIN	CIN	0.61
CPLE	CPLE	0.14
G-007	G-007	0.02
IPL	IPL	0.42
LGEE	LGEE	0.23
MEC	MEC	0.76
O-066	O-066	0.15
RENSSELAER	RENSSELAER	0.03
WEC	WEC	0.08

17.2 Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1581092	247024	05HOWARD	AEP	238586	02BRKSID	ATSI	1	AEP_P4_#7725_05FREMCT 138_M	breaker	245.0	102.6	115.32	DC	31.15

Bus #	Bus	MW Impact
247548	V4-010 C	4.09
247551	U4-028 C	0.25
247552	U4-029 C	0.25
247926	U1-059 E	2.57
247940	U4-028 E	13.98
247941	U4-029 E	13.98
247942	W1-056 E	0.94
247947	V4-010 E	27.37
925751	AC1-051 C	1.9
925752	AC1-051 E	12.72
932051	AC2-015 C	13.2
932052	AC2-015 E	15.64
934461	AD1-070 C O1	1.93
934462	AD1-070 E O1	9.07
934791	AD1-106 C O1	1.57
934792	AD1-106 E O1	2.56
937021	AD2-136 C O1	7.52
937022	AD2-136 E O1	50.34
937381	AD2-191 C	3.55
937382	AD2-191 E	23.77
941741	AE2-174 C	5.48
941742	AE2-174 E	25.66
CARR	CARR	0.14
CBM-S1	CBM-S1	1.31
CBM-S2	CBM-S2	0.31
CBM-W1	CBM-W1	3.71
CBM-W2	CBM-W2	11.01
CIN	CIN	1.36
CPLE	CPLE	0.08
G-007	G-007	0.34
IPL	IPL	0.88
LGEE	LGEE	0.36
MEC	MEC	2.51
MECS	MECS	2.81
O-066	O-066	2.21
RENSSELAER	RENSSELAER	0.11
WEC	WEC	0.4

17.3 Index 3

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
2248629	238524	02AD Q-2	ATSI	241928	02AVQ2	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	332.0	126.39	127.98	DC	11.66

Bus #	Bus	MW Impact
238571	02BEAVGA	0.89
238572	02BEAVGB	0.91
238670	02DVBSG1	66.42
238979	02NAPMUN	2.0
239174	02WLORG-5	1.06
239175	02WLORG-6	1.38
240968	02BG2 GEN	0.42
240969	02BG4 G1	0.11
240973	02BG6 AMPO	1.66
240975	02PGE GEN	2.19
241908	02LLF_W4-004	0.3
247548	V4-010 C	1.53
247940	U4-028 E	4.44
247941	U4-029 E	4.44
247947	V4-010 E	10.24
931951	AB1-107 1	16.62
931961	AB1-107 2	36.47
932791	AC2-103 C	3.56
932792	AC2-103 E	23.82
934251	AD1-052 C1	0.85
934261	AD1-052 C2	0.85
934761	AD1-103 C O1	5.98
934762	AD1-103 E O1	40.05
934891	AD1-118	4.17
937021	AD2-136 C O1	2.39
937022	AD2-136 E O1	16.0
937381	AD2-191 C	1.13
937382	AD2-191 E	7.56
938911	AE1-119	32.73
941741	AE2-174 C	2.05
941742	AE2-174 E	9.6
941761	AE2-176 C	6.55
941762	AE2-176 E	4.37
941781	AE2-181 C	1.58
941782	AE2-181 E	1.05
942661	AE2-282 C O1	2.36
942662	AE2-282 E O1	1.24
CARR	CARR	0.55
CBM-S1	CBM-S1	3.74
CBM-S2	CBM-S2	0.86

Bus #	Bus	MW Impact
CBM-W1	CBM-W1	15.22
CBM-W2	CBM-W2	32.92
CIN	CIN	4.01
CPLE	CPLE	0.23
G-007	G-007	1.12
IPL	IPL	2.57
LGEE	LGEE	0.99
MEC	MEC	7.91
MECS	MECS	15.46
O-066	O-066	7.27
RENSSELAER	RENSSELAER	0.43
WEC	WEC	1.28

17.4 Index 4

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
2248140	238569	02BEAVER	ATSI	239725	02LAKEAVE	ATSI	2	ATSI-P2-3-OEC-345-023	breaker	1742.0	106.42	107.25	DC	32.12

Bus #	Bus	MW Impact
238564	02BAYSG1	3.86
238670	02DVBSG1	246.72
238979	02NAPMUN	6.72
239171	02WLORG-2	4.45
239172	02WLORG-3	4.52
239173	02WLORG-4	4.53
239174	02WLORG-5	4.55
239293	02BS-PKR	0.34
240968	02BG2 GEN	1.4
240969	02BG4 G1	0.35
240973	02BG6 AMPO	5.46
240975	02PGE GEN	7.21
241902	Y1-069 GE	22.19
247548	V4-010 C	4.22
247567	V2-006 C	2.24
247940	U4-028 E	12.38
247941	U4-029 E	12.38
247947	V4-010 E	28.22
247961	V2-006 E	15.02
900041	V4-011	0.44
925751	AC1-051 C	0.88
925752	AC1-051 E	5.89
931951	AB1-107 1	55.01
931961	AB1-107 2	127.69
932051	AC2-015 C	6.11
932052	AC2-015 E	7.24
932791	AC2-103 C	14.44
932792	AC2-103 E	96.62
934251	AD1-052 C1	2.31
934261	AD1-052 C2	2.31
934461	AD1-070 C O1	5.41
934462	AD1-070 E O1	25.39
934761	AD1-103 C O1	24.27
934762	AD1-103 E O1	162.43
934891	AD1-118	14.45
937021	AD2-136 C O1	6.66
937022	AD2-136 E O1	44.58
937381	AD2-191 C	3.15
937382	AD2-191 E	21.05
938911	AE1-119	113.52

Bus #	Bus	MW Impact
939161	AE1-146 C O1	11.4
939162	AE1-146 E O1	5.42
940841	AE2-072 C	11.38
940842	AE2-072 E	7.59
941741	AE2-174 C	5.65
941742	AE2-174 E	26.46
941761	AE2-176 C	15.5
941762	AE2-176 E	10.33
941781	AE2-181 C	5.32
941782	AE2-181 E	3.55
942661	AE2-282 C O1	7.94
942662	AE2-282 E O1	4.18
CARR	CARR	1.57
CBM-S1	CBM-S1	11.05
CBM-S2	CBM-S2	2.24
CBM-W1	CBM-W1	49.77
CBM-W2	CBM-W2	99.7
CIN	CIN	12.26
CPLE	CPLE	0.54
G-007	G-007	3.48
IPL	IPL	7.85
LGEE	LGEE	2.97
MEC	MEC	24.54
MECS	MECS	52.64
O-066	O-066	22.51
RENSSELAER	RENSSELAER	1.23
WEC	WEC	4.0
Z1-043	Z1-043	15.41

17.5 Index 5

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
2248690	238569	02BEAVER	ATSI	238607	02CARLIL	ATSI	1	ATSI-P7-1-OEC-345-001	tower	1243.0	106.31	107.25	DC	25.75

Bus #	Bus	MW Impact
238572	02BEAVGB	1.21
238670	02DVBSG1	194.55
238979	02NAPMUN	5.29
239171	02WLORG-2	3.49
239172	02WLORG-3	3.55
239173	02WLORG-4	3.56
239174	02WLORG-5	3.57
239175	02WLORG-6	1.83
240968	02BG2 GEN	1.11
240969	02BG4 G1	0.28
240973	02BG6 AMPO	4.32
240975	02PGE GEN	5.7
247548	V4-010 C	3.38
247567	V2-006 C	1.74
247940	U4-028 E	9.85
247941	U4-029 E	9.85
247947	V4-010 E	22.63
247961	V2-006 E	11.65
900041	V4-011	0.34
925751	AC1-051 C	0.7
925752	AC1-051 E	4.67
931951	AB1-107 1	43.58
931961	AB1-107 2	100.67
932051	AC2-015 C	4.85
932052	AC2-015 E	5.74
932791	AC2-103 C	11.36
932792	AC2-103 E	76.02
934251	AD1-052 C1	1.87
934261	AD1-052 C2	1.87
934461	AD1-070 C O1	4.26
934462	AD1-070 E O1	19.98
934761	AD1-103 C O1	19.1
934762	AD1-103 E O1	127.79
934891	AD1-118	11.39
937021	AD2-136 C O1	5.3
937022	AD2-136 E O1	35.46
937381	AD2-191 C	2.5
937382	AD2-191 E	16.74
938911	AE1-119	89.46
939161	AE1-146 C O1	8.94
939162	AE1-146 E O1	4.26

Bus #	Bus	MW Impact
940841	AE2-072 C	8.86
940842	AE2-072 E	5.91
941741	AE2-174 C	4.53
941742	AE2-174 E	21.22
941761	AE2-176 C	12.78
941762	AE2-176 E	8.52
941781	AE2-181 C	4.19
941782	AE2-181 E	2.79
942661	AE2-282 C O1	6.25
942662	AE2-282 E O1	3.29
950241	J419	8.28
953321	J799	15.58
953781	J833	8.28
CARR	CARR	1.08
CBM-S1	CBM-S1	7.8
CBM-S2	CBM-S2	1.34
CBM-W1	CBM-W1	37.97
CBM-W2	CBM-W2	72.04
CIN	CIN	8.97
CPLE	CPLE	0.27
G-007	G-007	2.64
IPL	IPL	5.74
LGEE	LGEE	2.13
MEC	MEC	18.1
MECS	MECS	41.13
O-066	O-066	17.07
RENSSELAER	RENSSELAER	0.86
WEC	WEC	2.98
Z1-043	Z1-043	11.45

17.6 Index 6

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
2248613	238915	02LRN Q2	ATSI	238524	02AD Q-2	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	316.0	132.79	134.45	DC	11.66

Bus #	Bus	MW Impact
238571	02BEAVGA	0.89
238572	02BEAVGB	0.91
238670	02DVBSG1	66.42
238979	02NAPMUN	2.0
239174	02WLORG-5	1.06
239175	02WLORG-6	1.38
240968	02BG2 GEN	0.42
240969	02BG4 G1	0.11
240973	02BG6 AMPO	1.66
240975	02PGE GEN	2.19
241908	02LLF_W4-004	0.3
247548	V4-010 C	1.53
247940	U4-028 E	4.44
247941	U4-029 E	4.44
247947	V4-010 E	10.24
931951	AB1-107 1	16.62
931961	AB1-107 2	36.47
932791	AC2-103 C	3.56
932792	AC2-103 E	23.82
934251	AD1-052 C1	0.85
934261	AD1-052 C2	0.85
934761	AD1-103 C O1	5.98
934762	AD1-103 E O1	40.05
934891	AD1-118	4.17
937021	AD2-136 C O1	2.39
937022	AD2-136 E O1	16.0
937381	AD2-191 C	1.13
937382	AD2-191 E	7.56
938911	AE1-119	32.73
941741	AE2-174 C	2.05
941742	AE2-174 E	9.6
941761	AE2-176 C	6.55
941762	AE2-176 E	4.37
941781	AE2-181 C	1.58
941782	AE2-181 E	1.05
942661	AE2-282 C O1	2.36
942662	AE2-282 E O1	1.24
CARR	CARR	0.55
CBM-S1	CBM-S1	3.74
CBM-S2	CBM-S2	0.86

Bus #	Bus	MW Impact
CBM-W1	CBM-W1	15.22
CBM-W2	CBM-W2	32.92
CIN	CIN	4.01
CPLE	CPLE	0.23
G-007	G-007	1.12
IPL	IPL	2.57
LGEE	LGEE	0.99
MEC	MEC	7.91
MECS	MECS	15.46
O-066	O-066	7.27
RENSSELAER	RENSSELAER	0.43
WEC	WEC	1.28

17.7 Index 7

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
2248078	239176	02WOOD+	ATSI	238890	02LEMOYN	ATSI	1	ATSI-P2-3-TE-345-010T	breaker	223.0	107.97	116.96	DC	20.04

Bus #	Bus	MW Impact
238601	02FRMENG 1	2.21
238602	02FRMENG 2	2.21
238603	02FRMENG 3	3.98
247548	V4-010 C	2.63
247551	U4-028 C	0.16
247552	U4-029 C	0.16
247940	U4-028 E	8.8
247941	U4-029 E	8.8
247947	V4-010 E	17.61
900041	V4-011	0.33
925751	AC1-051 C	0.56
925752	AC1-051 E	3.74
932051	AC2-015 C	4.0
932052	AC2-015 E	4.74
934251	AD1-052 C1	1.22
934261	AD1-052 C2	1.22
934461	AD1-070 C O1	4.73
934462	AD1-070 E O1	22.18
937021	AD2-136 C O1	4.73
937022	AD2-136 E O1	31.67
937381	AD2-191 C	2.23
937382	AD2-191 E	14.95
939161	AE1-146 C O1	9.03
939162	AE1-146 E O1	4.3
941741	AE2-174 C	3.53
941742	AE2-174 E	16.51
CANNELTON	CANNELTON	0.02
CBM-N	CBM-N	0.04
CBM-S2	CBM-S2	0.14
COFFEEN	COFFEEN	0.15
COTTONWOOD	COTTONWOOD	0.2
CPLE	CPLE	0.06
DUCKCREEK	DUCKCREEK	0.49
EDWARDS	EDWARDS	0.24
ELMERSMITH	ELMERSMITH	0.03
FARMERCITY	FARMERCITY	0.11
G-007A	G-007A	0.19
GIBSON	GIBSON	0.03
LGEE	LGEE	0.02
NEWTON	NEWTON	0.32

Bus #	Bus	MW Impact
NYISO	NYISO	0.16
PRAIRIE	PRAIRIE	0.58
SMITHLAND	SMITHLAND	0.02
TATANKA	TATANKA	0.24
TILTON	TILTON	0.2
TVA	TVA	0.05
UNIONPOWER	UNIONPOWER	0.05
VFT	VFT	0.51

17.8 Index 8

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
2248662	239728	02BLKRVR	ATSI	239734	02USSTEEL	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	659.0	101.95	103.03	DC	15.79

Bus #	Bus	MW Impact
238571	02BEAVGA	1.2
238572	02BEAVGB	1.22
238670	02DVBSG1	89.84
238979	02NAPMUN	2.71
239174	02WLORG-5	1.43
239175	02WLORG-6	1.85
240968	02BG2 GEN	0.57
240969	02BG4 G1	0.14
240973	02BG6 AMPO	2.25
240975	02PGE GEN	2.96
241908	02LLF_W4-004	0.4
247548	V4-010 C	2.07
247940	U4-028 E	6.02
247941	U4-029 E	6.02
247947	V4-010 E	13.88
900041	V4-011	0.19
925751	AC1-051 C	0.47
925752	AC1-051 E	3.12
931951	AB1-107 1	22.49
931961	AB1-107 2	49.34
932051	AC2-015 C	3.24
932052	AC2-015 E	3.84
932791	AC2-103 C	4.81
932792	AC2-103 E	32.21
934251	AD1-052 C1	1.16
934261	AD1-052 C2	1.16
934461	AD1-070 C O1	2.33
934462	AD1-070 E O1	10.94
934761	AD1-103 C O1	8.09
934762	AD1-103 E O1	54.14
934891	AD1-118	5.63
937021	AD2-136 C O1	3.24
937022	AD2-136 E O1	21.67
937381	AD2-191 C	1.53
937382	AD2-191 E	10.23
938911	AE1-119	44.28
939161	AE1-146 C O1	4.9
939162	AE1-146 E O1	2.33
940841	AE2-072 C	4.71
940842	AE2-072 E	3.14

Bus #	Bus	MW Impact
941741	AE2-174 C	2.78
941742	AE2-174 E	13.01
941761	AE2-176 C	8.91
941762	AE2-176 E	5.94
941781	AE2-181 C	2.14
941782	AE2-181 E	1.43
942661	AE2-282 C O1	3.19
942662	AE2-282 E O1	1.68
942813	AE2-299 BAT	4.33
CARR	CARR	0.77
CBM-S1	CBM-S1	5.02
CBM-S2	CBM-S2	1.13
CBM-W1	CBM-W1	20.54
CBM-W2	CBM-W2	44.21
CIN	CIN	5.39
CPLE	CPLE	0.3
G-007	G-007	1.57
IPL	IPL	3.46
LGEE	LGEE	1.34
MEC	MEC	10.64
MECS	MECS	20.91
O-066	O-066	10.16
RENSSELAER	RENSSELAER	0.6
WEC	WEC	1.72

17.9 Index 9

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
2248638	239734	02USSTEEL	ATSI	238915	02LRN Q2	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	593.0	108.88	110.08	DC	15.79

Bus #	Bus	MW Impact
238571	02BEAVGA	1.2
238572	02BEAVGB	1.22
238670	02DVBSG1	89.84
238979	02NAPMUN	2.71
239174	02WLORG-5	1.43
239175	02WLORG-6	1.85
240968	02BG2 GEN	0.57
240969	02BG4 G1	0.14
240973	02BG6 AMPO	2.25
240975	02PGE GEN	2.96
241908	02LLF_W4-004	0.4
247548	V4-010 C	2.07
247940	U4-028 E	6.02
247941	U4-029 E	6.02
247947	V4-010 E	13.88
900041	V4-011	0.19
925751	AC1-051 C	0.47
925752	AC1-051 E	3.12
931951	AB1-107 1	22.49
931961	AB1-107 2	49.34
932051	AC2-015 C	3.24
932052	AC2-015 E	3.84
932791	AC2-103 C	4.81
932792	AC2-103 E	32.21
934251	AD1-052 C1	1.16
934261	AD1-052 C2	1.16
934461	AD1-070 C O1	2.33
934462	AD1-070 E O1	10.94
934761	AD1-103 C O1	8.09
934762	AD1-103 E O1	54.14
934891	AD1-118	5.63
937021	AD2-136 C O1	3.24
937022	AD2-136 E O1	21.67
937381	AD2-191 C	1.53
937382	AD2-191 E	10.23
938911	AE1-119	44.28
939161	AE1-146 C O1	4.9
939162	AE1-146 E O1	2.33
940841	AE2-072 C	4.71
940842	AE2-072 E	3.14

Bus #	Bus	MW Impact
941741	AE2-174 C	2.78
941742	AE2-174 E	13.01
941761	AE2-176 C	8.91
941762	AE2-176 E	5.94
941781	AE2-181 C	2.14
941782	AE2-181 E	1.43
942661	AE2-282 C O1	3.19
942662	AE2-282 E O1	1.68
942813	AE2-299 BAT	4.33
CARR	CARR	0.77
CBM-S1	CBM-S1	5.02
CBM-S2	CBM-S2	1.13
CBM-W1	CBM-W1	20.54
CBM-W2	CBM-W2	44.21
CIN	CIN	5.39
CPLE	CPLE	0.3
G-007	G-007	1.57
IPL	IPL	3.46
LGEE	LGEE	1.34
MEC	MEC	10.64
MECS	MECS	20.91
O-066	O-066	10.16
RENSSELAER	RENSSELAER	0.6
WEC	WEC	1.72

17.10 Index 10

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1580902	242953	05AIRCO 8	AEP	243137	05W.END	AEP	1	AEP_P4_#7110_05MELMOR 138_B	breaker	167.0	117.5	135.62	DC	30.27

Bus #	Bus	MW Impact
247548	V4-010 C	3.97
247551	U4-028 C	0.36
247552	U4-029 C	0.36
247940	U4-028 E	19.81
247941	U4-029 E	19.81
247947	V4-010 E	26.6
925751	AC1-051 C	0.99
925752	AC1-051 E	6.59
932051	AC2-015 C	7.51
932052	AC2-015 E	8.9
937021	AD2-136 C O1	10.66
937022	AD2-136 E O1	71.31
937381	AD2-191 C	5.03
937382	AD2-191 E	33.67
941741	AE2-174 C	5.33
941742	AE2-174 E	24.94
BLUEG	BLUEG	1.29
CALDERWOOD	CALDERWOOD	0.08
CANNELTON	CANNELTON	0.08
CATAWBA	CATAWBA	0.03
CBM-N	CBM-N	0.11
CHEOAH	CHEOAH	0.07
CHILHOWEE	CHILHOWEE	0.03
COFFEEN	COFFEEN	0.16
COTTONWOOD	COTTONWOOD	0.44
DUCKCREEK	DUCKCREEK	0.39
EDWARDS	EDWARDS	0.18
ELMERSMITH	ELMERSMITH	0.13
FARMERCITY	FARMERCITY	0.1
G-007A	G-007A	0.29
GIBSON	GIBSON	0.06
HAMLET	HAMLET	0.04
NEWTON	NEWTON	0.41
NYISO	NYISO	0.48
PRAIRIE	PRAIRIE	0.72
SANTEETLA	SANTEETLA	0.02
SMITHLAND	SMITHLAND	0.05
TATANKA	TATANKA	0.2
TILTON	TILTON	0.21
TRIMBLE	TRIMBLE	0.14
TVA	TVA	0.33
UNIONPOWER	UNIONPOWER	0.15

Bus #	Bus	MW Impact
VFT	VFT	0.79

17.11 Index 11

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1580829	242984	05CHATFL	AEP	932050	AC2-015 TAP	AEP	1	AEP_P4_#7110_05MELMOR 138_B	breaker	167.0	123.65	141.03	DC	29.03

Bus #	Bus	MW Impact
247548	V4-010 C	3.81
247551	U4-028 C	0.33
247552	U4-029 C	0.33
247940	U4-028 E	18.37
247941	U4-029 E	18.37
247947	V4-010 E	25.51
925751	AC1-051 C	0.52
925752	AC1-051 E	3.46
934251	AD1-052 C1	0.73
934261	AD1-052 C2	0.73
937021	AD2-136 C O1	9.88
937022	AD2-136 E O1	66.14
937381	AD2-191 C	4.67
937382	AD2-191 E	31.23
941741	AE2-174 C	5.11
941742	AE2-174 E	23.92
CALDERWOOD	CALDERWOOD	0.01
CARR	CARR	0.04
CATAWBA	CATAWBA	0.03
CBM-S1	CBM-S1	0.12
CBM-W1	CBM-W1	3.57
CBM-W2	CBM-W2	2.83
CHEOAH	CHEOAH	0.01
CHILHOWEE	CHILHOWEE	0.0
CIN	CIN	0.41
G-007	G-007	0.14
HAMLET	HAMLET	0.05
IPL	IPL	0.25
LGEE	LGEE	0.04
MEC	MEC	1.07
MECS	MECS	4.86
O-066	O-066	0.93
RENSSELAER	RENSSELAER	0.03
SANTEETLA	SANTEETLA	0.0
WEC	WEC	0.2

17.12 Index 12

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1580742	243008	05FREMCT	AEP	243009	05FRMNT	AEP	1	AEP_SUBT_P4_#1176_05FREMNT C 69.0_L	breaker	251.0	121.11	158.47	DC	93.78

Bus #	Bus	MW Impact
247548	V4-010 C	12.31
247551	U4-028 C	0.43
247552	U4-029 C	0.43
247940	U4-028 E	23.53
247941	U4-029 E	23.53
247947	V4-010 E	82.41
900041	V4-011	0.19
925751	AC1-051 C	1.46
925752	AC1-051 E	9.75
932051	AC2-015 C	10.43
932052	AC2-015 E	12.36
934461	AD1-070 C O1	2.68
934462	AD1-070 E O1	12.6
937021	AD2-136 C O1	12.66
937022	AD2-136 E O1	84.71
937381	AD2-191 C	5.98
937382	AD2-191 E	40.0
939161	AE1-146 C O1	5.17
939162	AE1-146 E O1	2.46
941741	AE2-174 C	16.51
941742	AE2-174 E	77.27
CARR	CARR	0.04
CBM-S1	CBM-S1	0.99
CBM-S2	CBM-S2	0.42
CBM-W2	CBM-W2	6.39
CIN	CIN	0.73
CPLE	CPLE	0.15
G-007	G-007	0.04
IPL	IPL	0.5
LGEE	LGEE	0.26
MEC	MEC	0.97
O-066	O-066	0.26
RENSSELAER	RENSSELAER	0.03
WEC	WEC	0.12

17.13 Index 13

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1580643	243039	05MELMOR	AEP	243006	05FOSTOR	AEP	1	AEP_P4_#7725_05FREMCT 138_M	breaker	167.0	185.97	223.94	DC	63.41

Bus #	Bus	MW Impact
247548	V4-010 C	8.33
247551	U4-028 C	0.54
247552	U4-029 C	0.54
247940	U4-028 E	29.43
247941	U4-029 E	29.43
247947	V4-010 E	55.73
925751	AC1-051 C	1.66
925752	AC1-051 E	11.1
932051	AC2-015 C	12.62
932052	AC2-015 E	14.95
937021	AD2-136 C O1	15.83
937022	AD2-136 E O1	105.97
937381	AD2-191 C	7.48
937382	AD2-191 E	50.04
941741	AE2-174 C	11.16
941742	AE2-174 E	52.25
BLUEG	BLUEG	0.97
CALDERWOOD	CALDERWOOD	0.04
CANNELTON	CANNELTON	0.06
CATAWBA	CATAWBA	0.01
CBM-N	CBM-N	0.11
CHEOAH	CHEOAH	0.04
CHILHOWEE	CHILHOWEE	0.01
COFFEEN	COFFEEN	0.15
COTTONWOOD	COTTONWOOD	0.35
CPLE	CPLE	0.01
DUCKCREEK	DUCKCREEK	0.4
EDWARDS	EDWARDS	0.19
ELMERSMITH	ELMERSMITH	0.11
FARMERCITY	FARMERCITY	0.1
G-007A	G-007A	0.34
GIBSON	GIBSON	0.05
NEWTON	NEWTON	0.38
NYISO	NYISO	0.47
PRAIRIE	PRAIRIE	0.66
SANTEETLA	SANTEETLA	0.01
SMITHLAND	SMITHLAND	0.04
TATANKA	TATANKA	0.2
TILTON	TILTON	0.2
TRIMBLE	TRIMBLE	0.11
TVA	TVA	0.23
UNIONPOWER	UNIONPOWER	0.11

Bus #	Bus	MW Impact
VFT	VFT	0.91

17.14 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
1580752	243039	05MELMOR	AEP	243110	05STIFFI	AEP	1	AEP_P4_#7110_05MELMOR 138_B	breaker	167.0	139.89	158.94	DC	31.82

Bus #	Bus	MW Impact
247548	V4-010 C	4.18
247551	U4-028 C	0.41
247552	U4-029 C	0.41
247940	U4-028 E	22.71
247941	U4-029 E	22.71
247947	V4-010 E	27.96
925751	AC1-051 C	1.0
925752	AC1-051 E	6.67
932051	AC2-015 C	8.19
932052	AC2-015 E	9.71
937021	AD2-136 C O1	12.22
937022	AD2-136 E O1	81.77
937381	AD2-191 C	5.77
937382	AD2-191 E	38.61
941741	AE2-174 C	5.6
941742	AE2-174 E	26.22
BLUEG	BLUEG	1.26
CALDERWOOD	CALDERWOOD	0.08
CANNELTON	CANNELTON	0.08
CATAWBA	CATAWBA	0.03
CBM-N	CBM-N	0.1
CHEOAH	CHEOAH	0.07
CHILHOWEE	CHILHOWEE	0.03
COFFEEN	COFFEEN	0.15
COTTONWOOD	COTTONWOOD	0.43
DUCKCREEK	DUCKCREEK	0.36
EDWARDS	EDWARDS	0.17
ELMERSMITH	ELMERSMITH	0.13
FARMERCITY	FARMERCITY	0.1
G-007A	G-007A	0.27
GIBSON	GIBSON	0.06
HAMLET	HAMLET	0.04
NEWTON	NEWTON	0.39
NYISO	NYISO	0.46
PRAIRIE	PRAIRIE	0.68
SANTEETLA	SANTEETLA	0.02
SMITHLAND	SMITHLAND	0.05
TATANKA	TATANKA	0.19
TILTON	TILTON	0.19
TRIMBLE	TRIMBLE	0.14
TVA	TVA	0.32
UNIONPOWER	UNIONPOWER	0.15

Bus #	Bus	MW Impact
VFT	VFT	0.74

17.15 Index 15

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
1580793	243039	05MELMOR	AEP	243024	05HOWARD	AEP	1	AEP_P4_#7112_05MELMOR 138_C	breaker	167.0	135.31	150.83	DC	25.92

Bus #	Bus	MW Impact
247548	V4-010 C	3.4
247551	U4-028 C	0.32
247552	U4-029 C	0.32
247940	U4-028 E	17.4
247941	U4-029 E	17.4
247947	V4-010 E	22.78
934251	AD1-052 C1	0.66
934261	AD1-052 C2	0.66
934461	AD1-070 C O1	1.93
934462	AD1-070 E O1	9.08
937021	AD2-136 C O1	9.36
937022	AD2-136 E O1	62.64
937381	AD2-191 C	4.42
937382	AD2-191 E	29.58
941741	AE2-174 C	4.56
941742	AE2-174 E	21.36
CALDERWOOD	CALDERWOOD	0.0
CARR	CARR	0.05
CATAWBA	CATAWBA	0.02
CBM-S1	CBM-S1	0.18
CBM-W1	CBM-W1	3.7
CBM-W2	CBM-W2	3.32
CHEOAH	CHEOAH	0.0
CHILHOWEE	CHILHOWEE	0.0
CIN	CIN	0.47
G-007	G-007	0.15
HAMLET	HAMLET	0.04
IPL	IPL	0.29
LGEE	LGEE	0.06
MEC	MEC	1.18
MECS	MECS	4.92
O-066	O-066	0.99
RENSSELAER	RENSSELAER	0.04
SANTEETLA	SANTEETLA	0.0
WEC	WEC	0.22

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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
1580695	243039	05MELMOR	AEP	242984	05CHATFL	AEP	1	AEP_P4_#7110_05MELMOR 138_B	breaker	167.0	157.06	175.75	DC	31.2

Bus #	Bus	MW Impact
247548	V4-010 C	4.1
247551	U4-028 C	0.39
247552	U4-029 C	0.39
247940	U4-028 E	21.37
247941	U4-029 E	21.37
247947	V4-010 E	27.42
934251	AD1-052 C1	0.78
934261	AD1-052 C2	0.78
937021	AD2-136 C O1	11.5
937022	AD2-136 E O1	76.95
937381	AD2-191 C	5.43
937382	AD2-191 E	36.34
941741	AE2-174 C	5.49
941742	AE2-174 E	25.71
CALDERWOOD	CALDERWOOD	0.02
CARR	CARR	0.04
CATAWBA	CATAWBA	0.03
CBM-S1	CBM-S1	0.1
CBM-W1	CBM-W1	3.65
CBM-W2	CBM-W2	2.69
CHEOAH	CHEOAH	0.01
CHILHOWEE	CHILHOWEE	0.0
CIN	CIN	0.39
G-007	G-007	0.15
HAMLET	HAMLET	0.05
IPL	IPL	0.24
LGEE	LGEE	0.04
MEC	MEC	1.06
MECS	MECS	5.04
O-066	O-066	0.94
RENSSELAER	RENSSELAER	0.03
SANTEETLA	SANTEETLA	0.0
WEC	WEC	0.2

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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
1580897	243110	05STIFFI	AEP	242953	05AIRCO8	AEP	1	AEP_P4_#7110_05MELMOR 138_B	breaker	167.0	117.56	135.68	DC	30.27

Bus #	Bus	MW Impact
247548	V4-010 C	3.97
247551	U4-028 C	0.36
247552	U4-029 C	0.36
247940	U4-028 E	19.81
247941	U4-029 E	19.81
247947	V4-010 E	26.6
925751	AC1-051 C	0.99
925752	AC1-051 E	6.59
932051	AC2-015 C	7.51
932052	AC2-015 E	8.9
937021	AD2-136 C O1	10.66
937022	AD2-136 E O1	71.31
937381	AD2-191 C	5.03
937382	AD2-191 E	33.67
941741	AE2-174 C	5.33
941742	AE2-174 E	24.94
BLUEG	BLUEG	1.29
CALDERWOOD	CALDERWOOD	0.08
CANNELTON	CANNELTON	0.08
CATAWBA	CATAWBA	0.03
CBM-N	CBM-N	0.11
CHEOAH	CHEOAH	0.07
CHILHOWEE	CHILHOWEE	0.03
COFFEEN	COFFEEN	0.16
COTTONWOOD	COTTONWOOD	0.44
DUCKCREEK	DUCKCREEK	0.39
EDWARDS	EDWARDS	0.18
ELMERSMITH	ELMERSMITH	0.13
FARMERCITY	FARMERCITY	0.1
G-007A	G-007A	0.29
GIBSON	GIBSON	0.06
HAMLET	HAMLET	0.04
NEWTON	NEWTON	0.41
NYISO	NYISO	0.48
PRAIRIE	PRAIRIE	0.72
SANTEETLA	SANTEETLA	0.02
SMITHLAND	SMITHLAND	0.05
TATANKA	TATANKA	0.2
TILTON	TILTON	0.21
TRIMBLE	TRIMBLE	0.14
TVA	TVA	0.33
UNIONPOWER	UNIONPOWER	0.15

Bus #	Bus	MW Impact
VFT	VFT	0.79

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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
2248143	907060	X1-027A_AT12	ATSI	238569	02BEAVER	ATSI	1	ATSI-P2-3-OEC-345-032	breaker	1742.0	105.64	106.13	DC	18.5

Bus #	Bus	MW Impact
238564	02BAYSG1	3.42
238670	02DVBSG1	262.54
238885	02LEMOG1	3.92
238886	02LEMOG2	3.92
238887	02LEMOG3	3.92
238888	02LEMOG4	3.92
238979	02NAPMUN	6.2
239293	02BS-PKR	0.31
240968	02BG2 GEN	1.24
240969	02BG4 G1	0.31
240973	02BG6 AMPO	4.81
240975	02PGE GEN	6.36
241902	Y1-069 GE	21.85
247548	V4-010 C	2.43
247567	V2-006 C	2.04
247940	U4-028 E	8.12
247941	U4-029 E	8.12
247947	V4-010 E	16.26
247961	V2-006 E	13.63
900041	V4-011	0.37
931951	AB1-107 1	48.83
931961	AB1-107 2	125.76
932791	AC2-103 C	20.33
932792	AC2-103 E	136.08
934251	AD1-052 C1	1.1
934261	AD1-052 C2	1.1
934461	AD1-070 C O1	4.58
934462	AD1-070 E O1	21.49
934761	AD1-103 C O1	34.18
934762	AD1-103 E O1	228.76
934891	AD1-118	14.06
937021	AD2-136 C O1	4.37
937022	AD2-136 E O1	29.22
937381	AD2-191 C	2.06
937382	AD2-191 E	13.8
938911	AE1-119	110.5
939161	AE1-146 C O1	9.72
939162	AE1-146 E O1	4.63
940841	AE2-072 C	10.39
940842	AE2-072 E	6.93

Bus #	Bus	MW Impact
941741	AE2-174 C	3.26
941742	AE2-174 E	15.24
941781	AE2-181 C	4.93
941782	AE2-181 E	3.29
942661	AE2-282 C O1	7.37
942662	AE2-282 E O1	3.88
950241	J419	10.05
953321	J799	18.94
953781	J833	10.05
CARR	CARR	1.29
CBM-S1	CBM-S1	10.1
CBM-S2	CBM-S2	2.06
CBM-W1	CBM-W1	47.07
CBM-W2	CBM-W2	91.66
CIN	CIN	11.25
CPLE	CPLE	0.51
G-007	G-007	2.93
IPL	IPL	7.2
LGEE	LGEE	2.7
MEC	MEC	22.7
MECS	MECS	50.66
O-066	O-066	18.97
RENSSELAER	RENSSELAER	1.02
WEC	WEC	3.71
Z1-043	Z1-043	14.28

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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
1580690	932050	AC2-015 TAP	AEP	243024	05HOWARD	AEP	1	AEP_P4_#7110_05MELMOR 138_B	breaker	167.0	159.02	176.41	DC	29.03

Bus #	Bus	MW Impact
247548	V4-010 C	3.81
247551	U4-028 C	0.33
247552	U4-029 C	0.33
247940	U4-028 E	18.37
247941	U4-029 E	18.37
247947	V4-010 E	25.51
925751	AC1-051 C	0.52
925752	AC1-051 E	3.46
932051	AC2-015 C	27.04
932052	AC2-015 E	32.04
934251	AD1-052 C1	0.73
934261	AD1-052 C2	0.73
937021	AD2-136 C O1	9.88
937022	AD2-136 E O1	66.14
937381	AD2-191 C	4.67
937382	AD2-191 E	31.23
941741	AE2-174 C	5.11
941742	AE2-174 E	23.92
CALDERWOOD	CALDERWOOD	0.01
CARR	CARR	0.04
CATAWBA	CATAWBA	0.03
CBM-S1	CBM-S1	0.12
CBM-W1	CBM-W1	3.57
CBM-W2	CBM-W2	2.83
CHEOAH	CHEOAH	0.01
CHILHOWEE	CHILHOWEE	0.0
CIN	CIN	0.41
G-007	G-007	0.14
HAMLET	HAMLET	0.05
IPL	IPL	0.25
LGEE	LGEE	0.04
MEC	MEC	1.07
MECS	MECS	4.86
O-066	O-066	0.93
RENSSELAER	RENSSELAER	0.03
SANTEETLA	SANTEETLA	0.0
WEC	WEC	0.2

Affected Systems

18 Affected Systems

18.1 LG&E

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

18.2 MISO

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

18.3 TVA

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

18.4 Duke Energy Progress

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

18.5 NYISO

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

19 Contingency Descriptions

Contingency Name	Contingency Definition
AEP_P1-2_#7161-B	CONTINGENCY 'AEP_P1-2_#7161-B' OPEN BRANCH FROM BUS 940150 TO BUS 243130 CKT 1 / 940150 V4-010 TAP 138 243130 05TIFFIN 138 1 END
AEP_P1-2_#7105	CONTINGENCY 'AEP_P1-2_#7105' OPEN BRANCH FROM BUS 243024 TO BUS 243039 CKT 1 / 243024 05HOWARD 138 243039 05MELMOR 138 1 END
AEP_P1-2_#7104	CONTINGENCY 'AEP_P1-2_#7104' OPEN BRANCH FROM BUS 243006 TO BUS 243039 CKT 1 / 243006 05FOSTOR 138 243039 05MELMOR 138 1 END
AEP_P7-1_#10931	CONTINGENCY 'AEP_P7-1_#10931' OPEN BRANCH FROM BUS 245616 TO BUS 243009 CKT 1 / 245616 05FREMNTEQ 999 243009 05FRMNT 138 1 OPEN BRANCH FROM BUS 245616 TO BUS 245617 CKT 1 / 245616 05FREMNTEQ 999 245617 05FREMONT 69.0 1 OPEN BRANCH FROM BUS 245616 TO BUS 245618 CKT 1 / 245616 05FREMNTEQ 999 245618 05FREMONT- 12.0 1 OPEN BRANCH FROM BUS 238884 TO BUS 238890 CKT ZB / 238884 02LEMO K 138 238890 02LEMOYN 138 ZB OPEN BRANCH FROM BUS 238884 TO BUS 239154 CKT 1 / 238884 02LEMO K 138 239154 02W.FREM 138 1 OPEN BRANCH FROM BUS 239154 TO BUS 243009 CKT 1 / 239154 02W.FREM 138 243009 05FRMNT 138 1 OPEN BRANCH FROM BUS 243008 TO BUS 243009 CKT 1 / 243008 05FREMCT 138 243009 05FRMNT 138 1 OPEN BRANCH FROM BUS 245645 TO BUS 245617 CKT 1 / 245645 05CLYDE 69.0 245617 05FREMONT 69.0 1 OPEN BRANCH FROM BUS 245617 TO BUS 245627 CKT 1 / 245617 05FREMONT 69.0 245627 05N FREMON 69.0 1 OPEN BRANCH FROM BUS 245617 TO BUS 245631 CKT 1 / 245617 05FREMONT 69.0 245631 05SBC CONT 69.0 1 OPEN BRANCH FROM BUS 245631 TO BUS 245634 CKT 1 / 245631 05SBC CONT 69.0 245634 05STONE ST 69.0 1 REMOVE SWSHUNT FROM BUS 245617 / 245617 05FREMONT 69.0 END

Contingency Name	Contingency Definition
AEP_P7-1_#10932	CONTINGENCY 'AEP_P7-1_#10932' OPEN BRANCH FROM BUS 245616 TO BUS 243009 CKT 1 / 245616 05FREMNTEQ 999 243009 05FRMNT 138 1 OPEN BRANCH FROM BUS 245616 TO BUS 245617 CKT 1 / 245616 05FREMNTEQ 999 245617 05FREMONT 69.0 1 OPEN BRANCH FROM BUS 245616 TO BUS 245618 CKT 1 / 245616 05FREMNTEQ 999 245618 05FREMONT- 12.0 1 OPEN BRANCH FROM BUS 239154 TO BUS 243009 CKT 1 / 239154 02W.FREM 138 243009 05FRMNT 138 1 OPEN BRANCH FROM BUS 243008 TO BUS 243009 CKT 1 / 243008 05FREMCT 138 243009 05FRMNT 138 1 OPEN BRANCH FROM BUS 245645 TO BUS 245617 CKT 1 / 245645 05CLYDE 69.0 245617 05FREMONT 69.0 1 OPEN BRANCH FROM BUS 245617 TO BUS 245627 CKT 1 / 245617 05FREMONT 69.0 245627 05N FREMON 69.0 1 OPEN BRANCH FROM BUS 245617 TO BUS 245631 CKT 1 / 245617 05FREMONT 69.0 245631 05SBC CONT 69.0 1 OPEN BRANCH FROM BUS 245631 TO BUS 245634 CKT 1 / 245631 05SBC CONT 69.0 245634 05STONE ST 69.0 1 REMOVE SWSHUNT FROM BUS 245617 / 245617 05FREMONT 69.0 END
AEP_P7-1_#10933	CONTINGENCY 'AEP_P7-1_#10933' OPEN BRANCH FROM BUS 238586 TO BUS 243024 CKT 1 / 238586 02BRKSID 138 243024 05HOWARD 138 1 OPEN BRANCH FROM BUS 243024 TO BUS 243100 CKT 1 / 243024 05HOWARD 138 243100 05SHELGH 138 1 OPEN BRANCH FROM BUS 243024 TO BUS 243101 CKT 1 / 243024 05HOWARD 138 243101 05SHELNS 138 1 END
ATSI-P7-1-TE-138-026	CONTINGENCY 'ATSI-P7-1-TE-138-026' /* WEST FREMONT-OTTAWA & W.FREMONT-KH-OTTAWA DISCONNECT BRANCH FROM BUS 239030 TO BUS 239154 CKT 1 /* 02OTTAWA 138 02W.FREM 138 DISCONNECT BUS 238871 /* 02KY-HS 138 END
ATSI-P7-1-OEC-345-001	CONTINGENCY 'ATSI-P7-1-OEC-345-001' /* BEAVER-LAKAVE 345 CK 1 & 2 DISCONNECT BRANCH FROM BUS 238569 TO BUS 239725 CKT 1 /* 02BEAVER 345 02LAKEAVE 345 DISCONNECT BRANCH FROM BUS 238569 TO BUS 239725 CKT 2 /* 02BEAVER 345 02LAKEAVE 345 END

Contingency Name	Contingency Definition
AEP_SUBT_P4_#1208_05HOWARD 69.0_U	CONTINGENCY 'AEP_SUBT_P4_#1208_05HOWARD 69.0_U' OPEN BRANCH FROM BUS 245666 TO BUS 243024 CKT 1 / 245666 05HOWRD1EQ 999 243024 05HOWARD 138 1 OPEN BRANCH FROM BUS 245666 TO BUS 245663 CKT 1 / 245666 05HOWRD1EQ 999 245663 05HOWARD 69.0 1 OPEN BRANCH FROM BUS 243024 TO BUS 243039 CKT 1 / 243024 05HOWARD 138 243039 05MELMOR 138 1 OPEN BRANCH FROM BUS 243024 TO BUS 243061 CKT 1 / 243024 05HOWARD 138 243061 05NLEXTN 138 1 OPEN BRANCH FROM BUS 243024 TO BUS 243101 CKT 1 / 243024 05HOWARD 138 243101 05SHELNS 138 1 OPEN BRANCH FROM BUS 245659 TO BUS 245663 CKT 1 / 245659 05E BUCYRU 69.0 245663 05HOWARD 69.0 1 OPEN BRANCH FROM BUS 245663 TO BUS 245678 CKT 1 / 245663 05HOWARD 69.0 245678 05NGALIOSS 69.0 1 OPEN BRANCH FROM BUS 245663 TO BUS 245679 CKT 1 / 245663 05HOWARD 69.0 245679 05WILLARD 69.0 1 OPEN BRANCH FROM BUS 245663 TO BUS 245657 CKT 1 / 245663 05HOWARD 69.0 245657 05WSHELBY 69.0 1 REMOVE SWSHUNT FROM BUS 245663 / 245663 05HOWARD 69.0 END
ATSI-P7-1-CEI-345-001-A	CONTINGENCY 'ATSI-P7-1-CEI-345-001-A' /* AVON-BEAVER #1 AND #2 345KV LINE OUTAGES DISCONNECT BRANCH FROM BUS 238551 TO BUS 239725 CKT 1 /* 02AVON 345 02LAKEAVE 345 DISCONNECT BRANCH FROM BUS 238551 TO BUS 239725 CKT 2 /* 02AVON 345 02LAKEAVE 345 END
AEP_P4_#10133_05HOWARD 138_H	CONTINGENCY 'AEP_P4_#10133_05HOWARD 138_H' OPEN BRANCH FROM BUS 238586 TO BUS 243024 CKT 1 / 238586 02BRKSID 138 243024 05HOWARD 138 1 OPEN BRANCH FROM BUS 932050 TO BUS 243024 CKT 1 / 932050 AC2-015 TAP 138 243024 05HOWARD 138 1 /* CONTINGENCY LINE ADDED FOR AE2 BUILD OPEN BRANCH FROM BUS 243024 TO BUS 243050 CKT 1 / 243024 05HOWARD 138 243050 05NBELVL 138 1 OPEN BRANCH FROM BUS 243024 TO BUS 243100 CKT 1 / 243024 05HOWARD 138 243100 05SHELGH 138 1 OPEN BRANCH FROM BUS 243050 TO BUS 245567 CKT 1 / 243050 05NBELVL 138 245567 05NBELLVIL 69.0 1 REMOVE SWSHUNT FROM BUS 243024 / 243024 05HOWARD 138 END
AEP_P4_#10729_05CHATFL 138_E	CONTINGENCY 'AEP_P4_#10729_05CHATFL 138_E' OPEN BRANCH FROM BUS 242984 TO BUS 932050 CKT 1 / 242984 05CHATFL 138 932050 AC2-015 TAP 138 1 /* CONTINGENCY LINE ADDED FOR AE1 BUILD OPEN BRANCH FROM BUS 242984 TO BUS 243039 CKT 1 / 242984 05CHATFL 138 243039 05MELMOR 138 1 OPEN BRANCH FROM BUS 242984 TO BUS 245656 CKT 1 / 242984 05CHATFL 138 245656 05CHATFIEL 69.0 1 END
ATSI-P2-3-OEC-345-032	CONTINGENCY 'ATSI-P2-3-OEC-345-032' /* HAYES 345KV BRK B-3 DISCONNECT BRANCH FROM BUS 239289 TO BUS 238569 CKT 1 /* 02HAYES 345 02BEAVER 345 DISCONNECT BRANCH FROM BUS 239289 TO BUS 239290 CKT 1 /* 02HAYES 345 02HAYES 138 END

Contingency Name	Contingency Definition
AEP_P4_#3141_05FOSTOR 345_B2	CONTINGENCY 'AEP_P4_#3141_05FOSTOR 345_B2' OPEN BRANCH FROM BUS 242935 TO BUS 242936 CKT 1 / 242935 05E LIMA 345 242936 05FOSTOR 345 1 OPEN BRANCH FROM BUS 242936 TO BUS 243006 CKT 1 / 242936 05FOSTOR 345 243006 05FOSTOR 138 1 END
ATSI-P2-3-TE-345-010T	CONTINGENCY 'ATSI-P2-3-TE-345-010T' /* LEMOYNE BK-B1 345 DISCONNECT BRANCH FROM BUS 238889 TO BUS 242936 CKT 1 /* 02LEMOYN 345 05FOSTOR 345 REMOVE MACHINE 1 FROM BUS 238885 /* 02LEMOG1 18 DISCONNECT BUS 238885 /* 02LEMOG1 18 REMOVE MACHINE 2 FROM BUS 238886 /* 02LEMOG2 18 DISCONNECT BUS 238886 /* 02LEMOG2 18 REMOVE MACHINE 3 FROM BUS 238887 /* 02LEMOG3 18 DISCONNECT BUS 238887 /* 02LEMOG3 18 REMOVE MACHINE 4 FROM BUS 238888 /* 02LEMOG4 18 DISCONNECT BUS 238888 /* 02LEMOG4 18 END
AEP_P4_#7112_05MELMOR 138_C	CONTINGENCY 'AEP_P4_#7112_05MELMOR 138_C' OPEN BRANCH FROM BUS 242953 TO BUS 243110 CKT 1 / 242953 05AIRCO8 138 243110 05STIFFI 138 1 OPEN BRANCH FROM BUS 242953 TO BUS 243137 CKT 1 / 242953 05AIRCO8 138 243137 05W.END
AEP_P1-2_#7161-A	CONTINGENCY 'AEP_P1-2_#7161-A' OPEN BRANCH FROM BUS 243008 TO BUS 940150 CKT 1 / 243008 05FREMCT 138 940150 V4-010 TAP 138 1 END
AEP_P4_#9521_05CHATFL 138_F	CONTINGENCY 'AEP_P4_#9521_05CHATFL 138_F' OPEN BRANCH FROM BUS 242984 TO BUS 243039 CKT 1 / 242984 05CHATFL 138 243039 05MELMOR 138 1 OPEN BRANCH FROM BUS 242984 TO BUS 245656 CKT 1 / 242984 05CHATFL 138 245656 05CHATFIEL 69.0 1 END
AEP_P1-2_#5249	CONTINGENCY 'AEP_P1-2_#5249' OPEN BRANCH FROM BUS 245616 TO BUS 243009 CKT 1 / 245616 05FREMNTEQ 999 243009 05FRMNT 138 1 OPEN BRANCH FROM BUS 245616 TO BUS 245617 CKT 1 / 245616 05FREMNTEQ 999 245617 05FREMONT 69.0 1 OPEN BRANCH FROM BUS 245616 TO BUS 245618 CKT 1 / 245616 05FREMNTEQ 999 245618 05FREMONT- 12.0 1 OPEN BRANCH FROM BUS 239154 TO BUS 243009 CKT 1 / 239154 02W.FREM 138 243009 05FRMNT 138 1 OPEN BRANCH FROM BUS 243008 TO BUS 243009 CKT 1 / 243008 05FREMCT 138 243009 05FRMNT 138 1 END
AEP_P7-1_#10929	CONTINGENCY 'AEP_P7-1_#10929' OPEN BRANCH FROM BUS 243006 TO BUS 243039 CKT 1 / 243006 05FOSTOR 138 243039 05MELMOR 138 1 OPEN BRANCH FROM BUS 243006 TO BUS 243137 CKT 1 / 243006 05FOSTOR 138 243137 05W.END

Contingency Name	Contingency Definition
AEP_SUBT_P4_#2200_05FREMNT C 69.0_E	CONTINGENCY 'AEP_SUBT_P4_#2200_05FREMNT C 69.0_E' OPEN BRANCH FROM BUS 243008 TO BUS 245614 CKT 1 / 243008 05FREMCT 138 245614 05FREMNT C 69.0 1 OPEN BRANCH FROM BUS 243008 TO BUS 245614 CKT 3 / 243008 05FREMCT 138 245614 05FREMNT C 69.0 3 OPEN BRANCH FROM BUS 245645 TO BUS 245614 CKT 1 / 245645 05CLYDE 69.0 245614 05FREMNT C 69.0 1 OPEN BRANCH FROM BUS 245611 TO BUS 245614 CKT 2 / 245611 05E FREMON 69.0 245614 05FREMNT C 69.0 2 OPEN BRANCH FROM BUS 245614 TO BUS 245623 CKT 1 / 245614 05FREMNT C 69.0 245623 05HOLRAN 69.0 1 END
AEP_P4_#7728_05FREMCT 138_C	CONTINGENCY 'AEP_P4_#7728_05FREMCT 138_C' OPEN BRANCH FROM BUS 245616 TO BUS 243009 CKT 1 / 245616 05FREMNTEQ 999 243009 05FRMNT 138 1 OPEN BRANCH FROM BUS 245616 TO BUS 245617 CKT 1 / 245616 05FREMNTEQ 999 245617 05FREMONT 69.0 1 OPEN BRANCH FROM BUS 245616 TO BUS 245618 CKT 1 / 245616 05FREMNTEQ 999 245618 05FREMONT- 12.0 1 OPEN BRANCH FROM BUS 239154 TO BUS 243009 CKT 1 / 239154 02W.FREM 138 243009 05FRMNT 138 1 OPEN BRANCH FROM BUS 243008 TO BUS 243009 CKT 1 / 243008 05FREMCT 138 243009 05FRMNT 138 1 OPEN BRANCH FROM BUS 243008 TO BUS 940150 CKT 1 / 243008 05FREMCT 138 940150 V4-010 TAP 138 1 OPEN BRANCH FROM BUS 243008 TO BUS 243130 CKT 2 / 243008 05FREMCT 138 243130 05TIFFIN 138 2 OPEN BRANCH FROM BUS 243008 TO BUS 245614 CKT 1 / 243008 05FREMCT 138 245614 05FREMNT C 69.0 1 OPEN BRANCH FROM BUS 243008 TO BUS 245614 CKT 3 / 243008 05FREMCT 138 245614 05FREMNT C 69.0 3 REMOVE SWSHUNT FROM BUS 243008 / 243008 05FREMCT 138 END
AEP_SUBT_P2-2_#1175_05FREMNT C 69.0_1	CONTINGENCY 'AEP_SUBT_P2-2_#1175_05FREMNT C 69.0_1' OPEN BRANCH FROM BUS 243008 TO BUS 245614 CKT 1 / 243008 05FREMCT 138 245614 05FREMNT C 69.0 1 OPEN BRANCH FROM BUS 243008 TO BUS 245614 CKT 3 / 243008 05FREMCT 138 245614 05FREMNT C 69.0 3 OPEN BRANCH FROM BUS 245645 TO BUS 245614 CKT 1 / 245645 05CLYDE 69.0 245614 05FREMNT C 69.0 1 OPEN BRANCH FROM BUS 245611 TO BUS 245614 CKT 2 / 245611 05E FREMON 69.0 245614 05FREMNT C 69.0 2 OPEN BRANCH FROM BUS 245614 TO BUS 245623 CKT 1 / 245614 05FREMNT C 69.0 245623 05HOLRAN 69.0 1 END
AEP_P2-2_#7118_05HOWARD 138_1	CONTINGENCY 'AEP_P2-2_#7118_05HOWARD 138_1' OPEN BRANCH FROM BUS 238586 TO BUS 243024 CKT 1 / 238586 02BRKSID 138 243024 05HOWARD 138 1 OPEN BRANCH FROM BUS 932050 TO BUS 243024 CKT 1 / 932050 AC2-015 TAP 138 243024 05HOWARD 138 1 /* CONTINGENCY LINE ADDED FOR AE1 BUILD OPEN BRANCH FROM BUS 243024 TO BUS 243050 CKT 1 / 243024 05HOWARD 138 243050 05NBELVL 138 1 OPEN BRANCH FROM BUS 243024 TO BUS 243100 CKT 1 / 243024 05HOWARD 138 243100 05SHELGH 138 1 REMOVE SWSHUNT FROM BUS 243024 / 243024 05HOWARD 138 END

Contingency Name	Contingency Definition
AEP_P2-2_#7725_05FREMCT 138_1	CONTINGENCY 'AEP_P2-2_#7725_05FREMCT 138_1' OPEN BRANCH FROM BUS 243008 TO BUS 243009 CKT 1 / 243008 05FREMCT 138 243009 05FRMNT 138 1 OPEN BRANCH FROM BUS 243008 TO BUS 940150 CKT 1 / 243008 05FREMCT 138 940150 V4-010 TAP 138 1 OPEN BRANCH FROM BUS 243008 TO BUS 243130 CKT 2 / 243008 05FREMCT 138 243130 05TIFFIN 138 2 OPEN BRANCH FROM BUS 243008 TO BUS 245614 CKT 1 / 243008 05FREMCT 138 245614 05FREMNT C 69.0 1 OPEN BRANCH FROM BUS 243008 TO BUS 245614 CKT 3 / 243008 05FREMCT 138 245614 05FREMNT C 69.0 3 REMOVE SWSHUNT FROM BUS 243008 / 243008 05FREMCT 138 END
Base Case	
AEP_SUBT_P4_#1176_05FREMNT C 69.0_L	CONTINGENCY 'AEP_SUBT_P4_#1176_05FREMNT C 69.0_L' OPEN BRANCH FROM BUS 243008 TO BUS 245614 CKT 1 / 243008 05FREMCT 138 245614 05FREMNT C 69.0 1 OPEN BRANCH FROM BUS 243008 TO BUS 245614 CKT 3 / 243008 05FREMCT 138 245614 05FREMNT C 69.0 3 OPEN BRANCH FROM BUS 245641 TO BUS 245614 CKT 1 / 245641 05BIRCHARDSS69.0 245614 05FREMNT C 69.0 1 OPEN BRANCH FROM BUS 245645 TO BUS 245614 CKT 1 / 245645 05CLYDE 69.0 245614 05FREMNT C 69.0 1 OPEN BRANCH FROM BUS 245611 TO BUS 245614 CKT 2 / 245611 05E FREMON 69.0 245614 05FREMNT C 69.0 2 OPEN BRANCH FROM BUS 245614 TO BUS 245623 CKT 1 / 245614 05FREMNT C 69.0 245623 05HOLRAN 69.0 1 OPEN BRANCH FROM BUS 245623 TO BUS 245625 CKT 1 / 245623 05HOLRAN 69.0 245625 05MAPLE GR 69.0 1 OPEN BRANCH FROM BUS 245625 TO BUS 245628 CKT 1 / 245625 05MAPLE GR 69.0 245628 05RIVERVIE 69.0 1 REMOVE SWSHUNT FROM BUS 245614 / 245614 05FREMNT C 69.0 END
AEP_P2-2_#9521_05CHATFL 138_2	CONTINGENCY 'AEP_P2-2_#9521_05CHATFL 138_2' OPEN BRANCH FROM BUS 242984 TO BUS 243039 CKT 1 / 242984 05CHATFL 138 243039 05MELMOR 138 1 OPEN BRANCH FROM BUS 242984 TO BUS 245656 CKT 1 / 242984 05CHATFL 138 245656 05CHATFIEL 69.0 1 END
AEP_P4_#7110_05MELMOR 138_B	CONTINGENCY 'AEP_P4_#7110_05MELMOR 138_B' OPEN BRANCH FROM BUS 243006 TO BUS 243039 CKT 1 / 243006 05FOSTOR 138 243039 05MELMOR 138 1 OPEN BRANCH FROM BUS 243024 TO BUS 243039 CKT 1 / 243024 05HOWARD 138 243039 05MELMOR 138 1 END
ATSI-P2-3-OEC-345-034	CONTINGENCY 'ATSI-P2-3-OEC-345-034' /* HAYES 345KV BRK B_12 DISCONNECT BRANCH FROM BUS 239289 TO BUS 238654 CKT 1 /* 02HAYES 345 02DAV-BE 345 DISCONNECT BRANCH FROM BUS 239289 TO BUS 239290 CKT 1 /* 02HAYES 345 02HAYES 138 END

Contingency Name	Contingency Definition
AEP_P1-2_#7709	CONTINGENCY 'AEP_P1-2_#7709' OPEN BRANCH FROM BUS 242984 TO BUS 243039 CKT 1 / 242984 05CHATFL 138 243039 05MELMOR 138 1 END
AEP_P4_#7725_05FREMCT 138_M	CONTINGENCY 'AEP_P4_#7725_05FREMCT 138_M' OPEN BRANCH FROM BUS 243008 TO BUS 243009 CKT 1 / 243008 05FREMCT 138 243009 05FRMNT 138 1 OPEN BRANCH FROM BUS 243008 TO BUS 940150 CKT 1 / 243008 05FREMCT 138 940150 V4-010 TAP 138 1 OPEN BRANCH FROM BUS 243008 TO BUS 243130 CKT 2 / 243008 05FREMCT 138 243130 05TIFFIN 138 2 OPEN BRANCH FROM BUS 243008 TO BUS 245614 CKT 1 / 243008 05FREMCT 138 245614 05FREMNT C 69.0 1 OPEN BRANCH FROM BUS 243008 TO BUS 245614 CKT 3 / 243008 05FREMCT 138 245614 05FREMNT C 69.0 3 REMOVE SWSHUNT FROM BUS 243008 / 243008 05FREMCT 138 END
AEP_P1-3_#744_05FOSTOR 345_1	CONTINGENCY 'AEP_P1-3_#744_05FOSTOR 345_1' OPEN BRANCH FROM BUS 242936 TO BUS 243006 CKT 1 / 242936 05FOSTOR 345 243006 05FOSTOR 138 1 END
ATSI-P2-3-OEC-345-023	CONTINGENCY 'ATSI-P2-3-OEC-345-023' /* BEAVER 345KV BRK B-121 DISCONNECT BRANCH FROM BUS 238569 TO BUS 239725 CKT 1 /* 02BEAVER 345 02LAKEAVE 345 DISCONNECT BRANCH FROM BUS 238569 TO BUS 238607 CKT 1 /* 02BEAVER 345 02CARLIL 345 END

Short Circuit

20 Short Circuit

The following Breakers are overduty

None.