



# **Generation Interconnection**

## **Feasibility Study Report**

**for**

**Queue Project AF1-206**

**FAYETTE-LYONS 138 KV**

**119.4 MW Capacity / 199 MW Energy**

January, 2020

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## 1 Introduction

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 36.2, as well as the Feasibility Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is American Transmission Systems Inc. (ATSI).

## 2 Preface

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

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

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

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

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

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

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

### 3 General

The Interconnection Customer (IC), has proposed a Solar generating facility located in Fulton County, Ohio. The installed facilities will have a total capability of 199 MW with 119.4 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is 11/01/2022. This study does not imply a TO commitment to this in-service date.

<b>Queue Number</b>	<b>AF1-206</b>
<b>Project Name</b>	FAYETTE-LYONS 138 KV
<b>State</b>	Ohio
<b>County</b>	Fulton
<b>Transmission Owner</b>	ATSI
<b>MFO</b>	199
<b>MWE</b>	199
<b>MWC</b>	119.4
<b>Fuel</b>	Solar
<b>Basecase Study Year</b>	2023

#### 3.1 Primary Point of Interconnection

The interconnection of the project at the primary Point of Interconnection (POI) will be accomplished by installing a new 138 kV breaker at the FirstEnergy East Fayette 138 kV substation and connecting the East Fayette 138 kV ring bus substation and the new line exit to the primary POI. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection line tap and the associated attachment facilities.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AF1-206 generation project to connect to the FirstEnergy (“FE”) transmission system. IC will be responsible for

constructing all of the facilities on its side of the POI, including the attachment facilities which connect the generator to the FE transmission system’s direct connection facilities.

### 3.2 Secondary Point of Interconnection

The interconnection of the project at a secondary POI can be accomplished by constructing a new 138 kV three (3) breaker ring bus substation and looping the Allen Junction-East Fayette 138 kV line into the new ring bus substation. A 138 kV line exit would then be extended from the new ring bus substation to the secondary POI. The new substation would be located approximately 1.0 miles from Fayette 138 kV substation and 12.2 miles from Lyons 138 kV substation. A full scope of work or estimated cost is not provided for the proposed secondary POI.

### 3.3 Cost Summary

The AF1-206 project will be responsible for the following costs:

Description	Total Cost
<b>Attachment Facilities</b>	\$ 291,000
<b>Direct Connection Network Upgrade</b>	\$ 1,679,800
<b>Non Direct Connection Network Upgrades</b>	\$ 80,500
<b>Total Costs</b>	<b>\$ 2,051,300</b>

In addition, the AF1-206 project may be responsible for a contribution to the following costs

Description	Total Cost
<b>System Upgrades</b>	<b>\$ 154,111,550</b>

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

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

- (a) to be charged to each affected New Service Customer for the Facilities and System Upgrades that are necessary to accommodate this queue project;
- (b) the time required to complete detailed design and construction of the facilities and upgrades; and

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

#### 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
Install SCADA and MOAB for the New Line Exit at East Fayette	\$ 291,000
<b>Total Attachment Facility Costs</b>	<b>\$ 291,000</b>

#### 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
Install (1) 138kV breaker for new ring position to accommodate the AF1-206 generator interconnection at East Fayette	\$ 1,679,800
<b>Total Direct Connection Facility Costs</b>	<b>\$ 1,679,800</b>

#### 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
Customer drawing review for the AF1-206 collector substation and Customer Attachment Facilities	\$ 80,500
<b>Total Non-Direct Connection Facility Costs</b>	<b>\$ 80,500</b>

#### 7 Schedule

Given 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.

## 8 Transmission Owner Analysis

FE performed an analysis of its underlying transmission < 100 kV system. The AF1-206 project did not contribute to any overloads on the FE transmission system.

## 9 Interconnection Customer Requirements

### 9.1 System Protection

The IC must design its Customer Facilities in accordance with all applicable standards, including the standards in FE’s “Requirements for Transmission Connected Facilities” document located at:

<http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx>. Preliminary Protection requirements will be provided as part of the Facilities Study. Detailed Protection Requirements will be provided once the project enters the construction phase.

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

### 9.2 Compliance Issues and Interconnection Customer Requirements

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

1. The purchase and installation of a fully rated 138 kV circuit breaker to protect the AF1-206 generator lead line. A single circuit breaker must be used to protect this line; if the project has several GSU transformers, the individual GSU transformer breakers cannot be used to protect this line.
2. The purchase and installation of the minimum required FE generation interconnection relaying and control facilities. This includes over/under voltage protection, over/under frequency protection, and zero sequence voltage protection relays.
3. The purchase and installation of supervisory control and data acquisition (“SCADA”) equipment to provide information in a compatible format to the FE Transmission System Control Center.
4. Compliance with the FE and PJM generator power factor and voltage control requirements.

5. The execution of a back-up service agreement to serve the customer load supplied from the AF1-206 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.

### **9.3 Power Factor Requirements**

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

## **10 Revenue Metering and SCADA Requirements**

### **10.1 PJM Requirements**

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

#### **10.1.1 Meteorological Data Reporting Requirement**

The solar generation facility shall provide the Transmission Provider with site-specific meteorological data including:

- Temperature (degrees Fahrenheit)
- Atmospheric pressure (hectopascals)
- Irradiance
- Forced outage data

### **10.2 ATSI 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>

## **11 Network Impacts – Primary Point of Interconnection**

The Queue Project AF1-206 was evaluated as a 199.0 MW (Capacity 119.4 MW) injection at the E. Fayette Substation 138 kV substation in the ATSI area. Project AF1-206 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-206 was studied with a commercial probability of 53%. Potential network impacts were as follows:

# Summer Peak Load Flow

### 11.1 Generation Deliverability

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

None

### 11.2 Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPACT
42224495	238569	02BEAVER	345.0	ATSI	239725	02LAKEAVE	345.0	ATSI	2	ATSI-P2-3-OEC-345-023	breaker	1878.0	99.69	100.57	DC	36.22
41618578	238979	02NAPMUN	138.0	ATSI	238962	02MIDWAY	138.0	ATSI	1	ATSI-P2-3-TE-138-042	breaker	179.0	72.49	120.35	DC	85.68
41618803	239127	02STRYKE	138.0	ATSI	238979	02NAPMUN	138.0	ATSI	1	ATSI-P2-3-TE-138-042	breaker	181.0	56.21	103.55	DC	85.68

### 11.3 Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPACT
41027066	238874	02LAKVEW	138.0	ATSI	238768	02GRNFLD	138.0	ATSI	1	ATSI-P7-1-TE-345-027A	tower	316.0	115.13	116.93	DC	12.56
41027092	239030	02OTTAWA	138.0	ATSI	238874	02LAKVEW	138.0	ATSI	1	ATSI-P7-1-TE-345-027A	tower	380.0	112.53	114.03	DC	12.56
41027161	239070	02RICHLD	138.0	ATSI	239165	02WAUSEO	138.0	ATSI	1	AEP_P7-1_#10983-B	tower	190.0	104.33	116.31	DC	22.76
41618605	239154	02W.FRE M	138.0	ATSI	243009	05FRMNT	138.0	AEP	1	AEP_P4_#517_05FOS TOR 345_A1	breaker	361.0	113.34	114.67	DC	10.47
41848010	239154	02W.FRE M	138.0	ATSI	243009	05FRMNT	138.0	AEP	1	AEP_P2-2_#517_05FOS TOR 345_1	bus	361.0	113.34	114.67	DC	10.47
43526575	242936	05FOSTOR	345.0	AEP	242935	05E LIMA	345.0	AEP	1	AEP_P4_#6155_05FO STOR 345_A2	breaker	1318.0	127.57	128.69	DC	32.69
43526680	242936	05FOSTOR	345.0	AEP	242942	05SBERWI	345.0	AEP	1	AEP_P4_#3141_05FO STOR 345_B2	breaker	1409.0	101.94	102.9	DC	29.6
43527115	242936	05FOSTOR	345.0	AEP	242935	05E LIMA	345.0	AEP	1	ATSI-P7-1-TE-345-029A	tower	1318.0	131.29	132.34	DC	30.62
43527117	242936	05FOSTOR	345.0	AEP	242935	05E LIMA	345.0	AEP	1	AEP_P7-1_#10999	tower	1318.0	123.3	124.19	DC	25.79
43527209	242936	05FOSTOR	345.0	AEP	242942	05SBERWI	345.0	AEP	1	ATSI-P7-1-TE-345-029A	tower	1409.0	103.05	103.95	DC	27.86
43526450	256000	18ARGN TA	345.0	MET C	243234	05TWIN B	345.0	AEP	1	AEP_P4_#7027_05CO OK 345_N	breaker	956.0	177.48	178.17	DC	14.41
43527080	256000	18ARGN TA	345.0	MET C	243234	05TWIN B	345.0	AEP	1	AEP_P7-1_#10999	tower	956.0	235.82	236.63	DC	17.04
43527081	256000	18ARGN TA	345.0	MET C	243234	05TWIN B	345.0	AEP	1	AEP_P7-1_#10998	tower	956.0	177.48	178.17	DC	14.41

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
42006163	907060	X1-027A_AT12	345.0	ATSI	238569	02BEAVER	345.0	ATSI	1	AEP_P2-2_#517_05FOSTOR345_1	bus	1646.0	109.0	109.81	DC	29.2
42224229	907060	X1-027A_AT12	345.0	ATSI	238569	02BEAVER	345.0	ATSI	1	ATSI-P2-3-OEC-345-031	breaker	1646.0	114.38	115.31	DC	33.29
42224230	907060	X1-027A_AT12	345.0	ATSI	238569	02BEAVER	345.0	ATSI	1	AEP_P4_#517_05FOSTOR345_A1	breaker	1646.0	109.0	109.81	DC	29.2
41027241	945640	AF1-229TAP	345.0	AEP	238745	02GALION	345.0	ATSI	1	ATSI-P7-1-TE-345-029A	tower	1409.0	103.24	104.12	DC	27.34

#### 11.4 Potential Congestion due to Local Energy Deliverability

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
41297432	238889	02LEMOYN	345.0	ATSI	242936	05FOSTOR	345.0	AEP	1	ATSI-P1-2-TE-345-602T	operation	1409.0	137.89	139.22	DC	41.61
41297643	238979	02NAPMUN	138.0	ATSI	238962	02MIDWAY	138.0	ATSI	1	ATSI-P1-2-TE-138-039	operation	179.0	72.48	120.35	DC	85.68
41297874	239127	02STRYKE	138.0	ATSI	238979	02NAPMUN	138.0	ATSI	1	ATSI-P1-2-TE-138-039	operation	181.0	56.21	103.54	DC	85.68
41297900	239351	02EASTFAYT	138.0	ATSI	239127	02STRYKE	138.0	ATSI	1	ATSI-P1-2-TE-138-039	operation	262.0	35.39	101.75	DC	173.86
41297543	241901	02LALLENDORF	345.0	ATSI	242936	05FOSTOR	345.0	AEP	1	ATSI-P1-2-TE-345-603T	operation	1409.0	130.19	131.11	DC	28.92
43526932	242936	05FOSTOR	345.0	AEP	242935	05E LIMA	345.0	AEP	1	Base Case	operation	1025.0	125.74	126.79	DC	23.88
43526933	242936	05FOSTOR	345.0	AEP	242935	05E LIMA	345.0	AEP	1	ATSI-P1-2-OES-345-934T-B	operation	1318.0	121.83	122.88	DC	30.77
43526784	247803	05SEGREGTO	345.0	AEP	243212	05BENTON	345.0	AEP	1	AEP_P1-2_#7023	operation	1887.0	161.28	161.74	DC	19.37

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G%	POST PROJECT LOADIN G%	AC DC	MW IMPACT
43526902	25600	18ARGNTA	345.0	METC	243234	05TWIN B	345.0	AEP	1	AEP_P1 - 2_#7021	operation	956.0	129.18	129.71	DC	11.09
42526199	90706	X1-027A_AT12	345.0	ATSI	238569	02BEAVER	345.0	ATSI	1	ATSI-P1-2-SYS-345-810	operation	1646.0	107.92	108.81	DC	31.72

## 11.5 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
43527209,43526680	9	05FOSTOR 345.0 kV - 05SBERWI 345.0 kV Ckt 1	<p><u>AEP</u>            AEPO0031a (397): Sag Study will be required on 11.7 mile single circuit line between Fostoria Central and South Berwick .The cost is expected to be 46,800. New Ratings after sag study: S/N: 1409MVA S/E: 1887MVA.            Rebuild/Reconductor cost : \$ 23.4 million            Project Type : FAC            Cost : \$46,800            Time Estimate : 6 - 12 months</p>	\$46,800

ID	Index	Facility	Upgrade Description	Cost
43527080,43526450, 43527081	10	18ARGNTA 345.0 kV - 05TWIN B 345.0 kV Ckt 1	<p><u>AEP</u>  <b>AEPI0013a (445): A Sag Study will be required on the 51.4mile section of line to mitigate the overload . Depending on the sag study results, cost for this upgrade is expected to be between \$205,600 (no remediations required just sag study) and \$102.8 million (complete line reconductor/rebuild required).</b>  <b>Project Type : FAC</b>  <b>Cost : \$205,600</b>  <b>Time Estimate : 6-12 months</b></p> <p><b>AEPI0013b (446) : Replace Twin Branch wave trap (2500A)</b>  <b>Project Type : FAC</b>  <b>Cost : \$200,000</b>  <b>Time Estimate : 12-18 months</b></p> <p><b>AEPI0013c (447) : Replace three Twin Branch 3000A CT's</b>  <b>Project Type : FAC</b>  <b>Cost : \$1,800,000</b>  <b>Time Estimate : 12-18 months</b></p> <p><b>AEPI0013d (448) : Replace two Twin Branch breakers (3000A)</b>  <b>Project Type : FAC</b>  <b>Cost : \$2,000,000</b>  <b>Time Estimate : 12-18 months</b></p> <p><b>AEPI0013e (449): An engineering study will need to be conducted to determine if the Twin Branch relay compliance trip limits settings can be adjusted to mitigate the overload, Estimated Cost: \$25,000. New relay packages will be required if the settings cannot be adjusted, Estimated Cost:\$600,000</b>  <b>Project Type : FAC</b>  <b>Cost : \$25,000</b>  <b>Time Estimate : 12-18 months</b></p> <p><b>AEPI0013f (450) : Replace 13 Twin Branch sub cond 2-1700 kcm AAC 61 Str.</b>  <b>Project Type : FAC</b>  <b>Cost : \$1,300,000</b>  <b>Time Estimate : 12-18 months</b></p> <p><b>AEPI0013g (451) : Replace Twin Branch wave trap (3000A)</b>  <b>Project Type : FAC</b>  <b>Cost : \$200,000</b>  <b>Time Estimate : 12-18 months</b></p>	\$5,730,600
41027161	6	02RICHLD 138.0 kV - 02WAUSEO 138.0 kV Ckt 1	<p><u>ATSI</u>  <b>TE-011A (2335): Reconductor the Richland-Wauseon 138 kV line with 336 ACSS (approx. 26.3 miles). This project is dependent on the s1698 project Richland-Wauseon-Midway 138 kV Three-Terminal Elimination project (ISD 12/31/2020)</b>  <b>Project Type : FAC</b>  <b>Cost : \$53,257,500</b>  <b>Time Estimate : 36.0 months</b></p>	\$53,257,500

ID	Index	Facility	Upgrade Description	Cost
42006163,42224229, 42224230	11	X1-027A_AT12 345.0 kV - 02BEAVER 345.0 kV Ckt 1	<u>ATSI</u> N6187 (18): Reconductor the line with 954 kcmil ACSS conductor Project Type : FAC Cost : \$18,992,000 Time Estimate : 14.0 Months	\$18,992,000
41027241	12	AF1-229 TAP 345.0 kV - 02GALION 345.0 kV Ckt 1	<u>AEP</u> AEPO0035a (402): Sag Study will be required on ACSR ~ 954 ~ 45/7, 18.3 miles line between South Berwick and Galion. The cost is expected to be 73,200. New Ratings after sag study: S/N: 1409 MVA S/E: 1887 MVA.Rebuild/Reconductor, cost: \$ 36.6 million Project Type : FAC Cost : \$73,200 Time Estimate : 6 – 12 months  <u>ATSI</u> OES-002A (2329): Replace 2000 A wave trap at Galion, on S Berwick / AF1-229 exit, with a 3000 A wave trap. Resulting limits on ATSI facilities will be 1415/1742/1842 MVA SN/SE/SLD. * Limits cited here are for ATSI end/facilities; resulting circuit rating will depend on required AEP upgrades to meet queue loading requirements Project Type : FAC Cost : \$250,000 Time Estimate : 9.0 months	\$323,200

ID	Index	Facility	Upgrade Description	Cost
41618605,41848010	7	02W.FREM 138.0 kV - 05FRMNT 138.0 kV Ckt 1	<p><u>AEP</u>            AEPO0026a (349): 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.            Project Type : CON            Cost : \$4,000,000            Time Estimate : 24-36 months</p> <p>AEPO0026b (350): Replace 1200 A switch at Fremont            Project Type : FAC            Cost : \$200,000            Time Estimate : 12-18 months</p> <p>AEPO0026d (352): Replace three Sub Cond 1590 AAC 61 Str at Fremont            Project Type : FAC            Cost : \$300,000            Time Estimate : 12-18 months</p> <p>AEPO0026f (354): 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.            Project Type : FAC            Cost : \$10,500,000            Time Estimate : 24-36 months</p> <p><u>ATSI</u>            TE-012A (2336): For the Fremont-West Fremont 138 kV Line, reconductor the line drop at West Fremont with 954 ACSS. Reconductor the existing section of the 954 ACSR 48/7 with 954 ACSS. AEP would need to replace their section of limiting conductor and provide estimates for their replacement.            Project Type : FAC            Cost : \$1,761,750            Time Estimate : 18.0 months</p>	\$16,617,750
42224495	1	02BEAVER 345.0 kV - 02LAKEAVE 345.0 kV Ckt 2	<p><u>ATSI</u>            N6186 (16): Reconductor Beaver-Lake Ave 345kV #2 line with dual 954Kcmil ACSS            Project Type : FAC            Cost : \$5,921,900            Time Estimate : 12.0 months</p>	\$5,921,900
41618578	2	02NAPMUN 138.0 kV - 02MIDWAY 138.0 kV Ckt 1	<p><u>ATSI</u>            TE-016A (47): For the Napoleon Muni-Midway 138 kV Line, reconductor the section of 336 ACSR 30/7 of the transmission line with 556.5 ACSR. Change the relay settings of the SEL relay for the ZR component to meet or exceed 262 MVA for Summer Emergency.            Project Type : Facility            Cost : \$23,100,600            Time Estimate : 11.0 months</p>	\$23,100,600

ID	Index	Facility	Upgrade Description	Cost
41027092	5	02OTTAWA 138.0 kV - 02LAKVEW 138.0 kV Ckt 1	<p><u>ATSI</u>  TE-010A (2334): For the Lakeview-Ottawa 138 kV line, reconductor the substation conductor and line drop at Lakeview 138 kV and Ottawa 138 kV with bundled (2 conductor per phase) 1033.5 54/7 ACSR. The Lakeview-Ottawa 138 kV Transmission line has mixed 954 ACSR, 336.4 ACSR bundled (2 conductor per phase), 795 ACSS, and 739.8 ACAR bundled (2 conductor per phase). Reconductor the Lakeview-Ottawa 138 kV line with 795 45/7 ACSR bundled (2 conductor per phase). The sections of transmission line that has 739.8 ACSR 24/13 does not need to be reconducted (approx 2.7 miles). Replace the wave trap at Lakeview 138 kV with a 2000A unit.  Project Type : FAC  Cost : \$5,737,500  Time Estimate : 24.0 months</p>	\$5,737,500
43527115,43527117, 43526575	8	05FOSTOR 345.0 kV - 05E LIMA 345.0 kV Ckt 1	<p><u>AEP</u>  AEPO0030a (392) : Replace five sub Cond 2156 ACSR 84/19 Std at E Lima  Project Type : FAC  Cost : \$500,000  Time Estimate : 12- 18 Months</p> <p>AEPO0030b (393): Sag study is required on 4 mile single circuit line between Fremont Center and Fremont with 1033 ACSR. The cost is expected to be approximately \$20,000. The rating after the sag study S/N: 1409MVA ,S/E: 1887MVA. Rebuild/Reconductor, cost : \$8,000,000  Project Type : FAC  Cost : \$20,000  Time Estimate : 6 - 12 months</p> <p>AEPO0030c (394) : Replace sub Cond 2870 MCM ACSR at E Lima  Project Type : FAC  Cost : \$100,000  Time Estimate : 12- 18 months</p>	\$620,000
41618803	3	02STRYKE 138.0 kV - 02NAPMUN 138.0 kV Ckt 1	<p><u>ATSI</u>  TE-015A (46): For the Napoleon Muni-Stryker 138 kV Line, reconductor the existing 336 ACSR 30/7 substation conductor at Stryker 138 kV with 556.5 ACSR. Target Summer Normal Rating 161 MVA, Summer Emergency Rating 194 MVA.  Project Type : Facility  Cost : \$183,700  Time Estimate : 6.0 months</p>	\$183,700

ID	Index	Facility	Upgrade Description	Cost
41027066	4	02LAKVEW 138.0 kV - 02GRNFLD 138.0 kV Ckt 1	<u>ATSI</u> OEC-011-B (2345): Reconductor roughly 13.1 miles of the Greenfield-Lakeview 138 kV Line (currently bundled 336 ACSR) with 795 ACSS conductor. Replace two 1200A line switches with 2000A line switches. Upgrade 500 CU substation conductor at Greenfield to exceed line ratings of 795 ACSS. Upgrade RT for B-242 to exceed line ratings of 795 ACSS. Project Type : Facility Cost : \$23,580,000 Time Estimate : 24.0 Months	\$23,580,000
			TOTAL COST	<b>\$154,111,550</b>

## 11.6 Flow Gate Details

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

### 11.6.1 Contingency Descriptions

Contingency Name	Contingency Definition
<b>ATSI-P1-2-SYS-345-810</b>	CONTINGENCY 'ATSI-P1-2-SYS-345-810' /* LINE 02HAYES TO 02DAV-BE 345 CK 1 DISCONNECT BRANCH FROM BUS 239289 TO BUS 238654 CKT 1 /* 02HAYES 345 02DAV-BE 345 END
<b>AEP_P1-2_#7021</b>	CONTINGENCY 'AEP_P1-2_#7021' OPEN BRANCH FROM BUS 243212 TO BUS 247803 CKT 1 / 243212 05BENTON 345 247803 05SEGRETO 345 1 END
<b>AEP_P7-1_#10998</b>	CONTINGENCY 'AEP_P7-1_#10998' OPEN BRANCH FROM BUS 243212 TO BUS 243215 CKT 1 / 243212 05BENTON 345 243215 05COOK 345 1 OPEN BRANCH FROM BUS 243215 TO BUS 247803 CKT 1 / 243215 05COOK 345 247803 05SEGRETO 345 1 END
<b>AEP_P7-1_#10999</b>	CONTINGENCY 'AEP_P7-1_#10999' OPEN BRANCH FROM BUS 243212 TO BUS 247803 CKT 1 / 243212 05BENTON 345 247803 05SEGRETO 345 1 OPEN BRANCH FROM BUS 243215 TO BUS 247803 CKT 1 / 243215 05COOK 345 247803 05SEGRETO 345 1 END
<b>ATSI-P1-2-TE-138-039</b>	CONTINGENCY 'ATSI-P1-2-TE-138-039' /* LINE ALLEN JCT TO E FAYETTE 138 DISCONNECT BRANCH FROM BUS 238531 TO BUS 239345 CKT 1 /* 02ALLNJ 138 02SIL_AE+ 138 DISCONNECT BRANCH FROM BUS 239345 TO BUS 238517 CKT 1 /* 02SIL_AE+ 138 02LYONS 138 DISCONNECT BRANCH FROM BUS 238712 TO BUS 238517 CKT 1 /* 02FAYET 138 02LYONS 138 DISCONNECT BRANCH FROM BUS 238712 TO BUS 239351 CKT 1 /* 02FAYET 138 02EASTFAYT 138 REMOVE LOAD O FROM BUS 238517 /* 02LYONS 138 REMOVE LOAD O FROM BUS 238712 /* 02FAYET 138 END

Contingency Name	Contingency Definition
AEP_P4_#6155_05FOSTOR 345_A2	CONTINGENCY 'AEP_P4_#6155_05FOSTOR 345_A2' OPEN BRANCH FROM BUS 242936 TO BUS 242942 CKT 1 / 242936 05FOSTOR 345 242942 05SBERWI 345 1 OPEN BRANCH FROM BUS 242936 TO BUS 243006 CKT 1 / 242936 05FOSTOR 345 243006 05FOSTOR 138 1 END
AEP_P4_#7027_05COOK 345_N	CONTINGENCY 'AEP_P4_#7027_05COOK 345_N' OPEN BRANCH FROM BUS 243212 TO BUS 243215 CKT 1 / 243212 05BENTON 345 243215 05COOK 345 1 OPEN BRANCH FROM BUS 243215 TO BUS 247803 CKT 1 / 243215 05COOK 345 247803 05SEGRETO 345 1 END
AEP_P1-2_#7023	CONTINGENCY 'AEP_P1-2_#7023' OPEN BRANCH FROM BUS 243215 TO BUS 247803 CKT 1 / 243215 05COOK 345 247803 05SEGRETO 345 1 END
AEP_P4_#517_05FOSTOR 345_A1	CONTINGENCY 'AEP_P4_#517_05FOSTOR 345_A1' OPEN BRANCH FROM BUS 241901 TO BUS 242936 CKT 1 / 241901 02LALLEND
AEP_P2-2_#517_05FOSTOR 345_1	CONTINGENCY 'AEP_P2-2_#517_05FOSTOR 345_1' OPEN BRANCH FROM BUS 241901 TO BUS 242936 CKT 1 / 241901 02LALLEND
Base Case	
ATSI-P1-2-TE-345-602T	CONTINGENCY 'ATSI-P1-2-TE-345-602T' /*LINE OUTAGE: LALLEND
ATSI-P2-3-TE-138-042	CONTINGENCY 'ATSI-P2-3-TE-138-042' /* ALLEN 13373 BREAKER DISCONNECT BUS 238531 /* 02ALLNJ 138 DISCONNECT BUS 239345 /* 02SIL_AE+ 138 DISCONNECT BUS 238517 /* 02LYONS 138 DISCONNECT BUS 238712 /* 02FAYET 138 REMOVE LOAD O FROM BUS 238712 /* 02FAYET 138 END
ATSI-P2-3-OEC-345-031	CONTINGENCY 'ATSI-P2-3-OEC-345-031' /* HAYES 345KV BRK B-3_6_12 DISCONNECT BRANCH FROM BUS 239289 TO BUS 238654 CKT 1 /* 02HAYES 345 02DAV-BE 345 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
ATSI-P1-2-TE-345-603T	CONTINGENCY 'ATSI-P1-2-TE-345-603T' /*LINE OUTAGE: LEMOYNE TO AEP FOSTORIA DISCONNECT BRANCH FROM BUS 238889 TO BUS 242936 CKT 1 END

Contingency Name	Contingency Definition
ATSI-P7-1-TE-345-027A	CONTINGENCY 'ATSI-P7-1-TE-345-027A' /* DB - X1-027A & DB - HAYES 345 DISCONNECT BRANCH FROM BUS 238654 TO BUS 907060 CKT 1 /* 02DAV-BE 345 X1-027A_AT12 345 DISCONNECT BRANCH FROM BUS 238654 TO BUS 239289 CKT 1 /* 02DAV-BE 345 02HAYES 345 END
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-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
AEP_P7-1_#10983-B	CONTINGENCY 'AEP_P7-1_#10983-B' OPEN BRANCH FROM BUS 239070 TO BUS 243029 CKT 1 / 239070 02RICHLD 138 243029 05LCKWRD 138 1 OPEN BRANCH FROM BUS 940840 TO BUS 242993 CKT 1 / 239269 AE2-072 TAP 138 242993 05E.LPSC 138 1 OPEN BRANCH FROM BUS 242993 TO BUS 893021 CKT 1 / 242993 05E.LPSC 138 893021 V2-006 C 138 1 OPEN BRANCH FROM BUS 242971 TO BUS 243029 CKT 1 / 242971 05BRYAN 138 243029 05LCKWRD 138 1 REMOVE SWSHUNT FROM BUS 243029 / 243029 05LCKWRD 138 END
ATSI-P7-1-TE-345-029A	CONTINGENCY 'ATSI-P7-1-TE-345-029A' /* X1-027A - BEAVER & BEAVER - HAYES 345 DISCONNECT BRANCH FROM BUS 907060 TO BUS 238569 CKT 1 /* X1-027A_AT12 345 02BEAVER 345 DISCONNECT BRANCH FROM BUS 239289 TO BUS 238569 CKT 1 /* 02HAYES 345 02BEAVER 345 END
ATSI-P1-2-OES-345-934T-B	CONTINGENCY 'ATSI-P1-2-OES-345-934T-B' /* LINE 02GALION - 05SBERWI(AEP) 345 CK 1 DISCONNECT BRANCH FROM BUS 945640 TO BUS 238745 CKT 1 /* AF1-229 TAP 345 02GALION 345 END

## 11.6.2 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
42224495	238569	02BEAVER	ATSI	239725	02LAKEAVE	ATSI	2	ATSI-P2-3-OEC-345-023	breaker	1878.0	99.69	100.57	DC	36.22

Bus #	Bus	MW Impact
238564	02BAYSG1	4.4909
238670	02DVBSG1 (Deactivation : 05/31/20)	25.5246
238888	02LEMOG4	4.6732
238979	02NAPMUN	5.9032
239171	02WLORG-2	5.0784
239172	02WLORG-3	5.1650
239173	02WLORG-4	5.1650
239174	02WLORG-5	5.1917
239276	02COLLW 11	-3.2504
239293	02BS-PKR	0.3920
239297	02CPPW41	-3.6783
241902	Y1-069 GE	25.7091
244357	05GRANGER EL	0.3727
247548	V4-010 C	3.4861
247551	U4-028 C	1.6271
247552	U4-029 C	1.6271
247940	U4-028 E	10.8891
247941	U4-029 E	10.8891
247947	V4-010 E	23.3297
893021	V2-006 C	1.9245
893022	V2-006 E	12.8795
915952	Y3-092 NFTWR	110.5200
923821	AB2-019 FTWR	3.0946
925751	AC1-051 C	0.7955
925752	AC1-051 E	5.3240
931951	AB1-107 1	47.4714
931961	AB1-107 2	129.1472
932051	AC2-015 C	5.5249
932052	AC2-015 E	6.5463
932791	AC2-103 C	14.4426
932792	AC2-103 E	96.6709
934252	AD1-052 E1	0.9798
934262	AD1-052 E2	0.9798
934461	AD1-070 C O1	4.6745
934462	AD1-070 E O1	21.9440
934761	AD1-103 C O1	24.2833
934762	AD1-103 E O1	162.5111
934891	AD1-118	12.4504
937021	AD2-136 C O1	5.8576
937022	AD2-136 E O1	39.2009

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
937381	AD2-191 C	2.7661
937382	AD2-191 E	18.5115
938911	AE1-119	97.8244
939161	AE1-146 C O1	9.9136
939162	AE1-146 E O1	4.6296
940841	AE2-072 C	5.1326
940842	AE2-072 E	3.4217
941741	AE2-174 C	2.4765
941742	AE2-174 E	11.5937
941761	AE2-176 C	15.8827
941762	AE2-176 E	10.5885
941781	AE2-181 C	4.4547
941782	AE2-181 E	2.9698
942661	AE2-282 C O1	6.7921
942662	AE2-282 E O1	3.5740
943951	AF1-063 C O1	1.0623
943952	AF1-063 E O1	0.5890
943961	AF1-064 C O1	2.9433
943962	AF1-064 E O1	1.4628
944392	AF1-104 BAT	2.1502
944551	AF1-120 C	2.1812
944552	AF1-120 E	1.0988
945401	AF1-205 C O1	2.0294
945402	AF1-205 E O1	1.3529
945411	AF1-206 C O1	9.7908
945412	AF1-206 E O1	6.5272
945641	AF1-229 C	5.1827
945642	AF1-229 E	3.4551
945651	AF1-230 C	1.7062
945652	AF1-230 E	1.1375
955621	J1046	5.7380
955721	J1056 C	3.3468
955722	J1056 E	18.1072
955781	J1062	22.9520
LGEE	LGEE	2.4589
CPL	CPL	0.5484
WEC	WEC	1.9177
CBM-W2	CBM-W2	35.1679
NY	NY	2.3873
CBM-W1	CBM-W1	110.4633
TVA	TVA	4.6158
O-066	O-066	24.2256
CBM-S2	CBM-S2	8.0747
CBM-S1	CBM-S1	29.6922
G-007	G-007	3.7149
MADISON	MADISON	1.9596
MEC	MEC	8.5679

### 11.6.3 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
41618578	238979	02NAPMUN	ATSI	238962	02MIDWAY	ATSI	1	ATSI-P2-3-TE-138-042	breaker	179.0	72.49	120.35	DC	85.68

Bus #	Bus	MW Impact
238979	02NAPMUN	28.1133
239064	02RICHG1	0.2405
239065	02RICHG2&3	0.4741
239067	02RICHG4	2.5800
239068	02RICHG5	2.5800
239069	02RICHG6	2.5800
239202	02STRYCT	0.7049
893021	V2-006 C	1.0268
893022	V2-006 E	6.8718
926941	AC1-181	0.1093
940841	AE2-072 C	3.8380
940842	AE2-072 E	2.5587
941781	AE2-181 C	11.7285
941782	AE2-181 E	7.8190
942661	AE2-282 C O1	18.9003
942662	AE2-282 E O1	9.9452
943951	AF1-063 C O1	2.0549
943952	AF1-063 E O1	1.1392
944551	AF1-120 C	11.4521
944552	AF1-120 E	5.7691
945401	AF1-205 C O1	18.2357
945402	AF1-205 E O1	12.1571
945411	AF1-206 C O1	51.4053
945412	AF1-206 E O1	34.2702
LGEE	LGEE	0.1090
CPLE	CPLE	0.0205
WEC	WEC	0.0810
CBM-W2	CBM-W2	1.5561
NY	NY	0.0796
TVA	TVA	0.1946
O-066	O-066	0.8534
CBM-S2	CBM-S2	0.3121
CBM-S1	CBM-S1	1.2695
G-007	G-007	0.1300
MADISON	MADISON	0.0887
MEC	MEC	0.3655

### 11.6.4 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
41618803	239127	02STRYKE	ATSI	238979	02NAPMUN	ATSI	1	ATSI-P2-3-TE-138-042	breaker	181.0	56.21	103.55	DC	85.68

Bus #	Bus	MW Impact
239064	02RICHG1	0.2405
239065	02RICHG2&3	0.4741
239067	02RICHG4	2.5800
239068	02RICHG5	2.5800
239069	02RICHG6	2.5800
239202	02STRYCT	0.7049
893021	V2-006 C	1.0268
893022	V2-006 E	6.8718
926941	AC1-181	0.1093
940841	AE2-072 C	3.8380
940842	AE2-072 E	2.5587
941781	AE2-181 C	11.7285
941782	AE2-181 E	7.8190
942661	AE2-282 C O1	18.9003
942662	AE2-282 E O1	9.9452
943951	AF1-063 C O1	2.0549
943952	AF1-063 E O1	1.1392
944551	AF1-120 C	11.4521
944552	AF1-120 E	5.7691
945411	AF1-206 C O1	51.4053
945412	AF1-206 E O1	34.2702
LGEE	LGEE	0.1090
CPLE	CPLE	0.0205
WEC	WEC	0.0810
CBM-W2	CBM-W2	1.5561
NY	NY	0.0796
TVA	TVA	0.1946
O-066	O-066	0.8534
CBM-S2	CBM-S2	0.3121
CBM-S1	CBM-S1	1.2695
G-007	G-007	0.1300
MADISON	MADISON	0.0887
MEC	MEC	0.3655

## 11.6.5 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
41027066	238874	02LAKVEV	ATSI	238768	02GRNFLD	ATSI	1	ATSI-P7-1-TE-345-027A	tower	316.0	115.13	116.93	DC	12.56

Bus #	Bus	MW Impact
238601	02FRMENG 1	2.4779
238602	02FRMENG 2	2.4779
238603	02FRMENG 3	4.4733
238979	02NAPMUN	2.0225
247548	V4-010 C	1.4243
247551	U4-028 C	0.6092
247552	U4-029 C	0.6092
247940	U4-028 E	4.0769
247941	U4-029 E	4.0769
247947	V4-010 E	9.5322
931951	AB1-107 1	20.5456
931961	AB1-107 2	33.5314
934251	AD1-052 C1	0.1839
934252	AD1-052 E1	0.5861
934261	AD1-052 C2	0.1839
934262	AD1-052 E2	0.5861
934461	AD1-070 C O1	1.5612
934462	AD1-070 E O1	7.3290
934891	AD1-118	3.6670
937021	AD2-136 C O1	2.1931
937022	AD2-136 E O1	14.6767
937381	AD2-191 C	1.0356
937382	AD2-191 E	6.9307
938911	AE1-119	28.8120
941741	AE2-174 C	1.0119
941742	AE2-174 E	4.7370
941781	AE2-181 C	1.5331
941782	AE2-181 E	1.0221
942661	AE2-282 C O1	2.3557
942662	AE2-282 E O1	1.2396
943961	AF1-064 C O1	1.0626
943962	AF1-064 E O1	0.5281
944551	AF1-120 C	0.7565
944552	AF1-120 E	0.3811
945401	AF1-205 C O1	0.6953
945402	AF1-205 E O1	0.4635
945411	AF1-206 C O1	3.3957
945412	AF1-206 E O1	2.2638
LGEE	LGEE	0.7188
CPL	CPL	0.1528
WEC	WEC	0.5758

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
<b>CBM-W2</b>	CBM-W2	10.4095
<b>NY</b>	NY	0.6564
<b>CBM-W1</b>	CBM-W1	33.7395
<b>TVA</b>	TVA	1.3510
<b>O-066</b>	O-066	6.8410
<b>CBM-S2</b>	CBM-S2	2.2947
<b>CBM-S1</b>	CBM-S1	8.6904
<b>G-007</b>	G-007	1.0494
<b>MADISON</b>	MADISON	0.6713
<b>MEC</b>	MEC	2.5615

## 11.6.6 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
41027092	239030	02OTTAWA	ATSI	238874	02LAKVEW	ATSI	1	ATSI-P7-1-TE-345-027A	tower	380.0	112.53	114.03	DC	12.56

Bus #	Bus	MW Impact
238601	02FRMENG 1	2.4779
238602	02FRMENG 2	2.4779
238603	02FRMENG 3	4.4733
238979	02NAPMUN	2.0225
247548	V4-010 C	1.4243
247551	U4-028 C	0.6092
247552	U4-029 C	0.6092
247940	U4-028 E	4.0769
247941	U4-029 E	4.0769
247947	V4-010 E	9.5322
931951	AB1-107 1	20.5456
931961	AB1-107 2	33.5314
934251	AD1-052 C1	0.1839
934252	AD1-052 E1	0.5861
934261	AD1-052 C2	0.1839
934262	AD1-052 E2	0.5861
934461	AD1-070 C O1	1.5612
934462	AD1-070 E O1	7.3290
934891	AD1-118	3.6670
937021	AD2-136 C O1	2.1931
937022	AD2-136 E O1	14.6767
937381	AD2-191 C	1.0356
937382	AD2-191 E	6.9307
938911	AE1-119	28.8120
941741	AE2-174 C	1.0119
941742	AE2-174 E	4.7370
941781	AE2-181 C	1.5331
941782	AE2-181 E	1.0221
942661	AE2-282 C O1	2.3557
942662	AE2-282 E O1	1.2396
943961	AF1-064 C O1	1.0626
943962	AF1-064 E O1	0.5281
944551	AF1-120 C	0.7565
944552	AF1-120 E	0.3811
945401	AF1-205 C O1	0.6953
945402	AF1-205 E O1	0.4635
945411	AF1-206 C O1	3.3957
945412	AF1-206 E O1	2.2638
LGEE	LGEE	0.7188
CPL	CPL	0.1528
WEC	WEC	0.5758

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
<b>CBM-W2</b>	CBM-W2	10.4095
<b>NY</b>	NY	0.6564
<b>CBM-W1</b>	CBM-W1	33.7395
<b>TVA</b>	TVA	1.3510
<b>O-066</b>	O-066	6.8410
<b>CBM-S2</b>	CBM-S2	2.2947
<b>CBM-S1</b>	CBM-S1	8.6904
<b>G-007</b>	G-007	1.0494
<b>MADISON</b>	MADISON	0.6713
<b>MEC</b>	MEC	2.5615

11.6.7 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
41027161	239070	02RICHLD	ATSI	239165	02WAUSEO	ATSI	1	AEP_P7-1_#10983-B	tower	190.0	104.33	116.31	DC	22.76

Bus #	Bus	MW Impact
238979	02NAPMUN	2.1002
239064	02RICHG1	0.6855
239065	02RICHG2&3	1.3657
239067	02RICHG4	7.3530
239068	02RICHG5	7.3530
239069	02RICHG6	7.3530
239202	02STRYCT	0.2457
926941	AC1-181	0.3116
940841	AE2-072 C	40.0275
940842	AE2-072 E	26.6850
941781	AE2-181 C	3.6253
941782	AE2-181 E	2.4169
942661	AE2-282 C O1	5.0204
942662	AE2-282 E O1	2.6417
944551	AF1-120 C	3.0420
944552	AF1-120 E	1.5324
945401	AF1-205 C O1	0.7220
945402	AF1-205 E O1	0.4814
945411	AF1-206 C O1	13.6546
945412	AF1-206 E O1	9.1031
DUCKCREEK	DUCKCREEK	0.1128
NEWTON	NEWTON	0.1053
FARMERCITY	FARMERCITY	0.0055
NY	NY	0.0531
PRAIRIE	PRAIRIE	0.2531
O-066	O-066	0.6384
COFFEEN	COFFEEN	0.0518
EDWARDS	EDWARDS	0.0343
CHEOAH	CHEOAH	0.0485
TILTON	TILTON	0.0617
G-007	G-007	0.0988
GIBSON	GIBSON	0.0535
CALDERWOOD	CALDERWOOD	0.0482
BLUEG	BLUEG	0.1684
TRIMBLE	TRIMBLE	0.0540
CATAWBA	CATAWBA	0.0336

11.6.8 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
41848010	239154	02W.FREM	ATSI	243009	05FRMNT	AEP	1	AEP_P2-2_#517_05FOSTOR345_1	bus	361.0	113.34	114.67	DC	10.47

Bus #	Bus	MW Impact
238601	02FRMENG 1	5.1449
238602	02FRMENG 2	5.1449
238603	02FRMENG 3	9.2882
238979	02NAPMUN	1.8002
244357	05GRANGER EL	-0.2415
931951	AB1-107 1	17.8239
931961	AB1-107 2	31.8644
932791	AC2-103 C	1.6746
932792	AC2-103 E	11.2087
934251	AD1-052 C1	0.3818
934252	AD1-052 E1	1.2169
934261	AD1-052 C2	0.3818
934262	AD1-052 E2	1.2169
934761	AD1-103 C O1	2.8156
934762	AD1-103 E O1	18.8427
934891	AD1-118	3.7390
938911	AE1-119	29.3777
941761	AE2-176 C	9.9660
941762	AE2-176 E	6.6440
942661	AE2-282 C O1	1.9628
942662	AE2-282 E O1	1.0328
943961	AF1-064 C O1	1.0155
943962	AF1-064 E O1	0.5047
944551	AF1-120 C	0.6303
944552	AF1-120 E	0.3175
945401	AF1-205 C O1	0.6189
945402	AF1-205 E O1	0.4126
945411	AF1-206 C O1	2.8293
945412	AF1-206 E O1	1.8862
DUCKCREEK	DUCKCREEK	0.3524
NEWTON	NEWTON	0.5254
FARMERCITY	FARMERCITY	0.0217
G-007A	G-007A	0.0983
VFT	VFT	0.2838
CBM-W1	CBM-W1	12.3474
PRAIRIE	PRAIRIE	1.2218
COFFEEN	COFFEEN	0.2310
EDWARDS	EDWARDS	0.0994
CHEOAH	CHEOAH	0.3023
TILTON	TILTON	0.2747
MADISON	MADISON	1.4193

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
<b>GIBSON</b>	GIBSON	0.3380
<b>CALDERWOOD</b>	CALDERWOOD	0.3017
<b>BLUEG</b>	BLUEG	1.3037
<b>TRIMBLE</b>	TRIMBLE	0.4213
<b>CATAWBA</b>	CATAWBA	0.1915

11.6.9 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
43527115	242936	05FOSTOR	AEP	242935	05E LIMA	AEP	1	ATSI-P7-1-TE-345-029A	tower	1318.0	131.29	132.34	DC	30.62

Bus #	Bus	MW Impact
238564	02BAYSG1	4.2891
238670	02DVBSG1 (Deactivation : 05/31/20)	19.2828
238885	02LEMOG1	4.9048
238886	02LEMOG2	4.9048
238887	02LEMOG3	4.9048
238888	02LEMOG4	4.9048
238979	02NAPMUN	5.2588
239293	02BS-PKR	0.3744
241902	Y1-069 GE	25.4390
244357	05GRANGER EL	0.2405
247548	V4-010 C	3.4518
247551	U4-028 C	1.6685
247552	U4-029 C	1.6685
247940	U4-028 E	11.1664
247941	U4-029 E	11.1664
247947	V4-010 E	23.1005
924791	AB2-131 C OP	3.1774
924792	AB2-131 E OP	5.1841
925751	AC1-051 C	0.7634
925752	AC1-051 E	5.1088
927181	AC1-212 C	-0.1293
927182	AC1-212 E	-1.2254
927183	AC1-212 BAT	1.5938
931951	AB1-107 1	53.3315
931961	AB1-107 2	127.7904
932051	AC2-015 C	5.3765
932052	AC2-015 E	6.3705
932791	AC2-103 C	7.9995
932792	AC2-103 E	53.5446
933721	AC2-195 C O1	2.9312
933722	AC2-195 E O1	1.7870
934252	AD1-052 E1	0.8479
934262	AD1-052 E2	0.8479
934461	AD1-070 C O1	6.4807
934462	AD1-070 E O1	30.4234
934761	AD1-103 C O1	13.4502
934762	AD1-103 E O1	90.0126
934891	AD1-118	15.3734
936722	AD2-091 BAT	8.2145
936752	AD2-096 BAT	2.8990
937021	AD2-136 C O1	6.0068

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
937022	AD2-136 E O1	40.1992
937381	AD2-191 C	2.8365
937382	AD2-191 E	18.9830
938911	AE1-119	120.7910
939161	AE1-146 C O1	8.3874
939162	AE1-146 E O1	3.9169
941741	AE2-174 C	2.4522
941742	AE2-174 E	11.4798
941761	AE2-176 C	9.7665
941762	AE2-176 E	6.5110
941781	AE2-181 C	3.6303
941782	AE2-181 E	2.4202
942042	AE2-216 BAT	9.0359
942661	AE2-282 C O1	5.7413
942662	AE2-282 E O1	3.0210
943011	AE2-324	0.9582
943961	AF1-064 C O1	6.1383
943962	AF1-064 E O1	3.0507
944551	AF1-120 C	1.8438
944552	AF1-120 E	0.9288
944571	AF1-122 C O1	1.2160
944572	AF1-122 E O1	1.6793
945401	AF1-205 C O1	1.8079
945402	AF1-205 E O1	1.2052
945411	AF1-206 C O1	8.2761
945412	AF1-206 E O1	5.5174
945623	AF1-227 BAT	7.2500
945641	AF1-229 C	19.6658
945642	AF1-229 E	13.1106
945651	AF1-230 C	1.6887
945652	AF1-230 E	1.1258
946203	AF1-285 BAT	2.9626
950311	G934 C	2.0802
950312	G934 E	8.3208
950351	J466	3.3642
950791	J201 C	0.4019
950792	J201 E	1.6075
950871	J246 C	0.1061
950872	J246 E	0.4245
950942	J325 E	0.4630
951531	J533 C	3.0320
951532	J533 E	12.1280
951571	J538 C	3.0651
951572	J538 E	12.2604
951941	J602 C	2.9824
951942	J602 E	16.1356
952201	J589 C	2.5144
952202	J589 E	13.6036
952312	J646 E	0.2016
952401	J752 C	1.7113
952402	J752 E	9.2587
952611	J717 C	2.8072

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
952612	J717 E	15.1878
952761	J728 C	2.6107
952762	J728 E	14.1433
952881	J758	12.4400
952971	J793	166.1490
953071	J794 C	0.1655
953072	J794 E	0.8954
953271	J701 C	0.8330
953272	J701 E	4.5066
953291	J796	22.3776
953321	J799	27.3426
953361	J806	11.5415
953421	J841	66.0161
953771	J832	7.6750
953781	J833	14.5640
953811	J839	12.2010
953941	J857	8.7328
954111	J875	18.6240
955021	J978 C	0.9842
955022	J978 E	5.3248
955071	J984 C	2.1634
955072	J984 E	11.7046
955121	J989	8.5104
955181	J996	11.2808
955261	J1005	18.7400
955351	J1014 C	5.1420
955352	J1014 E	3.0852
955591	J1043 C	1.1556
955592	J1043 E	20.4772
955621	J1046	8.4605
955721	J1056 C	4.7555
955722	J1056 E	25.7285
955781	J1062	33.8420
955811	J1065 C	2.2492
955812	J1065 E	12.1688
955831	J1068 C	4.4139
955832	J1068 E	23.8801
955961	J1083	6.2769
956011	J1088	14.0550
956021	J1089	16.1007
956031	J1090	8.9154
956161	J1103	2.1794
956291	J1117	7.3864
956301	J1119	60.8400
956741	J1172	5.1165
956751	J1173	10.2776
956801	J1178	5.8286
DUCKCREEK	DUCKCREEK	1.2897
NEWTON	NEWTON	1.6203
FARMERCITY	FARMERCITY	0.0686
G-007A	G-007A	0.5083
VFT	VFT	1.3996

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
<b>CBM-W1</b>	CBM-W1	39.8569
<b>PRAIRIE</b>	PRAIRIE	3.6291
<b>COFFEEN</b>	COFFEEN	0.7341
<b>EDWARDS</b>	EDWARDS	0.3783
<b>CHEOAH</b>	CHEOAH	0.6812
<b>TILTON</b>	TILTON	0.9236
<b>MADISON</b>	MADISON	3.5986
<b>GIBSON</b>	GIBSON	1.0194
<b>CALDERWOOD</b>	CALDERWOOD	0.6809
<b>BLUEG</b>	BLUEG	3.5692
<b>TRIMBLE</b>	TRIMBLE	1.1514
<b>CATAWBA</b>	CATAWBA	0.3882

11.6.10 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
43527209	242936	05FOSTOR	AEP	242942	05SBERWI	AEP	1	ATSI-P7-1-TE-345-029A	tower	1409.0	103.05	103.95	DC	27.86

Bus #	Bus	MW Impact
238564	02BAYSG1	3.2996
238670	02DVBSG1 (Deactivation : 05/31/20)	14.8526
238885	02LEMOG1	3.8494
238886	02LEMOG2	3.8494
238887	02LEMOG3	3.8494
238888	02LEMOG4	3.8494
238979	02NAPMUN	4.5725
239293	02BS-PKR	0.2880
241902	Y1-069 GE	19.9178
244357	05GRANGER EL	0.3157
247506	U2-041 C (Withdrawn : 12/05/2019)	1.8511
247549	V3-028 C	0.3607
247607	V1-011 C	0.6381
247908	05BLCK-1 E	5.2826
247909	05BLCK-2 E	5.2826
247910	05BLCK-3 E	5.3737
247919	U2-041 E (Withdrawn : 12/05/2019)	12.3881
247948	V3-028 E	0.5886
247959	V1-011 E	4.2706
893021	V2-006 C	1.4611
893022	V2-006 E	9.7780
925131	AB2-170 C O1	2.3447
925132	AB2-170 E O1	3.8256
926811	AC1-167 C O1	1.7090
926812	AC1-167 E O1	0.8291
931951	AB1-107 1	41.1576
931961	AB1-107 2	100.0555
932301	AC2-044 C	0.4326
932302	AC2-044 E	0.7059
932791	AC2-103 C	6.1370
932792	AC2-103 E	41.0778
934252	AD1-052 E1	0.5182
934262	AD1-052 E2	0.5182
934461	AD1-070 C O1	4.0438
934462	AD1-070 E O1	18.9833
934741	AD1-101 C O1	1.0483
934742	AD1-101 E O1	1.7107
934761	AD1-103 C O1	10.3185
934762	AD1-103 E O1	69.0549
934891	AD1-118	12.0652
934901	AD1-119 C O1	0.9454

Bus #	Bus	MW Impact
934902	AD1-119 E O1	1.5427
934981	AD1-130 C	5.4584
934982	AD1-130 E	2.6105
936601	AD2-075	7.2570
936671	AD2-086 C	6.5500
936672	AD2-086 E	4.3667
936721	AD2-091	2.3732
938681	AE1-090 C	1.0233
938682	AE1-090 E	1.3499
938761	AE1-102 C	0.8880
938762	AE1-102 E	0.5920
938911	AE1-119	94.7980
939161	AE1-146 C O1	8.4708
939162	AE1-146 E O1	3.9558
940031	AE1-245 C O1	0.5073
940032	AE1-245 E O1	3.3951
940841	AE2-072 C	3.8781
940842	AE2-072 E	2.5854
941761	AE2-176 C	5.8962
941762	AE2-176 E	3.9308
941781	AE2-181 C	3.4236
941782	AE2-181 E	2.2824
942041	AE2-216	2.6105
942661	AE2-282 C O1	5.2248
942662	AE2-282 E O1	2.7493
942801	AE2-298 C O1	0.7883
942802	AE2-298 E O1	0.5256
943012	AE2-324 BAT	3.7295
943181	AE2-322 C	1.0864
943182	AE2-322 E	0.5311
943581	AF1-029 C O1	0.3942
943582	AF1-029 E O1	0.2628
943791	AF1-047 C	0.5629
943792	AF1-047 E	0.3753
943951	AF1-063 C O1	0.7617
943952	AF1-063 E O1	0.4223
943961	AF1-064 C O1	4.9956
943962	AF1-064 E O1	2.4829
944091	AF1-077 C O1	3.2085
944092	AF1-077 E O1	2.0001
944171	AF1-085 C O1	0.7987
944172	AF1-085 E O1	1.1029
944551	AF1-120 C	1.6779
944552	AF1-120 E	0.8453
945401	AF1-205 C O1	1.5720
945402	AF1-205 E O1	1.0480
945411	AF1-206 C O1	7.5316
945412	AF1-206 E O1	5.0211
946052	AF1-270 BAT	4.6615
950351	J466	2.2722
950791	J201 C	0.2756
950792	J201 E	1.1026

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
950871	J246 C	0.0762
950872	J246 E	0.3048
950942	J325 E	0.3114
951531	J533 C	2.1772
951532	J533 E	8.7088
951571	J538 C	2.1210
951572	J538 E	8.4840
951941	J602 C	2.0608
951942	J602 E	11.1492
952201	J589 C	1.7865
952202	J589 E	9.6655
952312	J646 E	0.1342
952401	J752 C	1.1592
952402	J752 E	6.2718
952611	J717 C	1.9582
952612	J717 E	10.5941
952761	J728 C	1.8211
952762	J728 E	9.8655
952971	J793	110.6117
953071	J794 C	0.1166
953072	J794 E	0.6306
953271	J701 C	0.5647
953272	J701 E	3.0554
953291	J796	15.5111
953321	J799	17.9210
953361	J806	8.3321
953421	J841	45.7283
953771	J832	5.5020
953781	J833	9.5400
953811	J839	8.1520
954111	J875	12.4500
955121	J989	5.7912
955181	J996	7.4272
955261	J1005	12.9860
955351	J1014 C	3.5280
955352	J1014 E	2.1168
955621	J1046	5.4770
955721	J1056 C	3.0997
955722	J1056 E	16.7703
955781	J1062	21.9080
955831	J1068 C	2.9004
955832	J1068 E	15.6916
955961	J1083	4.4016
956011	J1088	9.7470
956021	J1089	11.1469
956031	J1090	6.1506
956161	J1103	1.4776
956291	J1117	5.1512
956301	J1119	41.8140
956741	J1172	3.5000
956751	J1173	6.8400
956801	J1178	4.0872

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
LGEE	LGEE	0.5551
WEC	WEC	0.8987
CBM-W2	CBM-W2	11.4414
NY	NY	0.7101
CBM-W1	CBM-W1	67.4164
TVA	TVA	0.9674
O-066	O-066	8.5814
CBM-S1	CBM-S1	6.3304
G-007	G-007	1.3260
MADISON	MADISON	3.3627
MEC	MEC	3.6356
CATAWBA	CATAWBA	0.0879

11.6.11 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
43527080	256000	18ARGNTA	METC	243234	05TWIN B	AEP	1	AEP_P7-1_#10999	tower	956.0	235.82	236.63	DC	17.04

Bus #	Bus	MW Impact
238979	02NAPMUN	2.6670
247528	05COVRT1	8.0093
247529	05COVRT2	8.0093
247530	05COVRT3	8.0093
247531	05COVRT4	4.8070
247532	05COVRT5	4.8070
247533	05COVRT6	4.8070
247548	V4-010 C	1.2814
247551	U4-028 C	0.6020
247552	U4-029 C	0.6020
247940	U4-028 E	4.0288
247941	U4-029 E	4.0288
247947	V4-010 E	8.5752
925961	AC1-072	0.7430
926581	AC1-141	-5.0803
931951	AB1-107 1	20.5615
931961	AB1-107 2	46.4644
932791	AC2-103 C	2.1347
932792	AC2-103 E	14.2883
934252	AD1-052 E1	0.3531
934262	AD1-052 E2	0.3531
934461	AD1-070 C O1	1.7350
934462	AD1-070 E O1	8.1450
934761	AD1-103 C O1	3.5891
934762	AD1-103 E O1	24.0197
934891	AD1-118	5.2818
936601	AD2-075	38.5903
937021	AD2-136 C O1	2.1672
937022	AD2-136 E O1	14.5037
937381	AD2-191 C	1.0234
937382	AD2-191 E	6.8490
938911	AE1-119	41.5000
940262	AE2-008 BAT	5.1368
941741	AE2-174 C	0.9103
941742	AE2-174 E	4.2615
941761	AE2-176 C	4.1374
941762	AE2-176 E	2.7583
941781	AE2-181 C	2.0229
941782	AE2-181 E	1.3486
942661	AE2-282 C O1	3.1945
942662	AE2-282 E O1	1.6810
942682	AE2-284 BAT	4.9785

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
943023	AE2-325 BAT	3.1529
943961	AF1-064 C O1	1.3064
943962	AF1-064 E O1	0.6493
944551	AF1-120 C	1.0259
944552	AF1-120 E	0.5168
944963	AF1-161 BAT	3.0200
945113	AF1-176 BAT	6.2346
945401	AF1-205 C O1	0.9169
945402	AF1-205 E O1	0.6112
945411	AF1-206 C O1	4.6049
945412	AF1-206 E O1	3.0700
945641	AF1-229 C	1.9904
945642	AF1-229 E	1.3269
950311	G934 C	6.2940
950312	G934 E	25.1760
950351	J466	4.9536
950791	J201 C	0.7096
950792	J201 E	2.8386
950871	J246 C	0.2843
950872	J246 E	1.1372
950942	J325 E	0.6452
951531	J533 C	8.1228
951532	J533 E	32.4912
951571	J538 C	4.6164
951572	J538 E	18.4656
951941	J602 C	5.6940
951942	J602 E	30.8060
952161	J571	1.4700
952201	J589 C	6.1870
952202	J589 E	33.4730
952312	J646 E	0.2408
952401	J752 C	2.6160
952402	J752 E	14.1530
952611	J717 C	5.8873
952612	J717 E	31.8516
952761	J728 C	5.4751
952762	J728 E	29.6611
952881	J758	42.8000
952971	J793	199.4501
953071	J794 C	0.3779
953072	J794 E	2.0447
953271	J701 C	1.2876
953272	J701 E	6.9664
953291	J796	44.0955
953321	J799	24.4793
953361	J806	29.6510
953421	J841	129.2663
953771	J832	20.2930
953781	J833	12.8100
953811	J839	15.4740
953941	J857	25.7547
954111	J875	22.3290

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
954381	J906 C	3.6412
954382	J906 E	19.6998
954591	J937	141.2079
955021	J978 C	3.3776
955022	J978 E	18.2734
955071	J984 C	6.5458
955072	J984 E	35.4142
955121	J989	13.7016
955181	J996	10.2152
955261	J1005	36.8960
955341	J1013	13.7952
955351	J1014 C	8.7705
955352	J1014 E	5.2623
955591	J1043 C	4.4194
955592	J1043 E	78.3118
955621	J1046	5.3620
955721	J1056 C	3.7325
955722	J1056 E	20.1935
955781	J1062	21.4480
955801	J1064 C	7.0649
955802	J1064 E	38.2231
955811	J1065 C	6.4653
955812	J1065 E	34.9787
955831	J1068 C	4.1527
955832	J1068 E	22.4673
955861	J1071	23.0470
955961	J1083	13.3413
956011	J1088	27.6915
956021	J1089	31.2001
956031	J1090	16.2342
956161	J1103	3.3690
956291	J1117	14.9624
956301	J1119	107.7540
956741	J1172	8.7730
956751	J1173	11.5128
956801	J1178	12.3883
<b>DUCKCREEK</b>	<b>DUCKCREEK</b>	4.5427
<b>NEWTON</b>	<b>NEWTON</b>	2.9785
<b>FARMERCITY</b>	<b>FARMERCITY</b>	0.1838
<b>G-007A</b>	<b>G-007A</b>	2.1554
<b>VFT</b>	<b>VFT</b>	5.8308
<b>CBM-W1</b>	<b>CBM-W1</b>	47.5505
<b>PRAIRIE</b>	<b>PRAIRIE</b>	7.0852
<b>COFFEEN</b>	<b>COFFEEN</b>	1.6262
<b>EDWARDS</b>	<b>EDWARDS</b>	1.4340
<b>CHEOAH</b>	<b>CHEOAH</b>	0.5666
<b>TILTON</b>	<b>TILTON</b>	1.9486
<b>GIBSON</b>	<b>GIBSON</b>	1.2198
<b>CALDERWOOD</b>	<b>CALDERWOOD</b>	0.5706
<b>BLUEG</b>	<b>BLUEG</b>	2.9807
<b>TRIMBLE</b>	<b>TRIMBLE</b>	0.9472
<b>CATAWBA</b>	<b>CATAWBA</b>	0.2233



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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
42224229	907060	X1-027A_AT12	ATSI	238569	02BEAVER	ATSI	1	ATSI-P2-3-OEC-345-031	breaker	1646.0	114.38	115.31	DC	33.29

Bus #	Bus	MW Impact
238564	02BAYSG1	3.9432
238670	02DVBSG1 (Deactivation : 05/31/20)	27.1070
238885	02LEMOG1	4.5115
238886	02LEMOG2	4.5115
238887	02LEMOG3	4.5115
238888	02LEMOG4	4.5115
238979	02NAPMUN	5.4078
239276	02COLLW 11	-2.3669
239293	02BS-PKR	0.3442
239297	02CPPW41	-2.6666
241902	Y1-069 GE	25.1299
244357	05GRANGER EL	0.3074
247548	V4-010 C	2.0328
247551	U4-028 C	1.0072
247552	U4-029 C	1.0072
247940	U4-028 E	6.7405
247941	U4-029 E	6.7405
247947	V4-010 E	13.6038
893021	V2-006 C	1.7067
893022	V2-006 E	11.4219
931951	AB1-107 1	49.1692
931961	AB1-107 2	126.2381
932791	AC2-103 C	20.4163
932792	AC2-103 E	136.6559
934252	AD1-052 E1	0.4577
934262	AD1-052 E2	0.4577
934461	AD1-070 C O1	3.7987
934462	AD1-070 E O1	17.8327
934761	AD1-103 C O1	34.3273
934762	AD1-103 E O1	229.7288
934891	AD1-118	14.1407
936601	AD2-075	10.7104
937021	AD2-136 C O1	3.6259
937022	AD2-136 E O1	24.2660
937381	AD2-191 C	1.7123
937382	AD2-191 E	11.4589
938911	AE1-119	111.1055
939161	AE1-146 C O1	8.1301
939162	AE1-146 E O1	3.7967
940841	AE2-072 C	4.5998

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
940842	AE2-072 E	3.0666
941741	AE2-174 C	1.4441
941742	AE2-174 E	6.7604
941781	AE2-181 C	4.0881
941782	AE2-181 E	2.7254
942661	AE2-282 C O1	6.2417
942662	AE2-282 E O1	3.2843
943951	AF1-063 C O1	0.9641
943952	AF1-063 E O1	0.5345
943961	AF1-064 C O1	5.8367
943962	AF1-064 E O1	2.9009
944551	AF1-120 C	2.0044
944552	AF1-120 E	1.0098
945401	AF1-205 C O1	1.8591
945402	AF1-205 E O1	1.2394
945411	AF1-206 C O1	8.9974
945412	AF1-206 E O1	5.9983
945641	AF1-229 C	4.5176
945642	AF1-229 E	3.0117
952312	J646 E	0.1437
952971	J793	118.4115
953321	J799	19.0191
953781	J833	10.0920
953811	J839	8.7240
954111	J875	13.0680
955181	J996	7.7392
955621	J1046	5.6675
955721	J1056 C	3.2616
955722	J1056 E	17.6464
955781	J1062	22.6700
955831	J1068 C	3.0813
955832	J1068 E	16.6707
956751	J1173	7.1744
LGEE	LGEE	2.1422
CPL	CPL	0.4631
WEC	WEC	1.7256
CBM-W2	CBM-W2	31.1138
NY	NY	1.9427
CBM-W1	CBM-W1	102.4944
TVA	TVA	4.0390
O-066	O-066	20.2070
CBM-S2	CBM-S2	6.9013
CBM-S1	CBM-S1	25.9519
G-007	G-007	3.0992
MADISON	MADISON	2.0805
MEC	MEC	7.6701

### 11.6.13 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
41027241	945640	AF1-229 TAP	AEP	238745	02GALION	ATSI	1	ATSI-P7-1-TE-345-029A	tower	1409.0	103.24	104.12	DC	27.34

Bus #	Bus	MW Impact
238564	02BAYSG1	3.2612
238670	02DVBSG1 (Deactivation : 05/31/20)	14.3755
238885	02LEMOG1	3.7004
238886	02LEMOG2	3.7004
238887	02LEMOG3	3.7004
238888	02LEMOG4	3.7004
238979	02NAPMUN	4.4923
239293	02BS-PKR	0.2847
241902	Y1-069 GE	19.1335
244357	05GRANGER EL	0.3785
247506	U2-041 C (Withdrawn : 12/05/2019)	1.8110
247548	V4-010 C	2.6071
247549	V3-028 C	0.3529
247551	U4-028 C	1.2492
247552	U4-029 C	1.2492
247607	V1-011 C	0.6602
247908	05BLCK-1 E	5.1911
247909	05BLCK-2 E	5.1911
247910	05BLCK-3 E	5.2806
247911	05TIMB G E	5.5119
247919	U2-041 E (Withdrawn : 12/05/2019)	12.1197
247926	U1-059 E	3.3795
247940	U4-028 E	8.3600
247941	U4-029 E	8.3600
247942	W1-056 E	1.2430
247947	V4-010 E	17.4478
247948	V3-028 E	0.5758
247959	V1-011 E	4.4185
893021	V2-006 C	1.5503
893022	V2-006 E	10.3748
925131	AB2-170 C O1	2.2939
925132	AB2-170 E O1	3.7427
925751	AC1-051 C	0.4341
925752	AC1-051 E	2.9049
926811	AC1-167 C O1	1.7584
926812	AC1-167 E O1	0.8531
926901	AC1-176 C	0.3468
926902	AC1-176 E	2.3316
931951	AB1-107 1	40.6520
931961	AB1-107 2	96.1154
932051	AC2-015 C	2.9368

Bus #	Bus	MW Impact
932052	AC2-015 E	3.4797
932301	AC2-044 C	0.4251
932302	AC2-044 E	0.6936
932791	AC2-103 C	5.9408
932792	AC2-103 E	39.7648
934252	AD1-052 E1	0.6219
934262	AD1-052 E2	0.6219
934461	AD1-070 C O1	5.8291
934462	AD1-070 E O1	27.3645
934741	AD1-101 C O1	1.1481
934742	AD1-101 E O1	1.8735
934761	AD1-103 C O1	9.9887
934762	AD1-103 E O1	66.8477
934891	AD1-118	11.5983
934901	AD1-119 C O1	0.9670
934902	AD1-119 E O1	1.5779
934981	AD1-130 C	5.3401
934982	AD1-130 E	2.5540
936601	AD2-075	7.0055
936671	AD2-086 C	6.4081
936672	AD2-086 E	4.2721
936721	AD2-091	2.3218
937021	AD2-136 C O1	4.4971
937022	AD2-136 E O1	30.0962
937381	AD2-191 C	2.1236
937382	AD2-191 E	14.2121
938681	AE1-090 C	1.0011
938682	AE1-090 E	1.3206
938691	AE1-091 C	2.8793
938692	AE1-091 E	3.8695
938761	AE1-102 C	0.8726
938762	AE1-102 E	0.5818
938911	AE1-119	91.1295
939161	AE1-146 C O1	12.0475
939162	AE1-146 E O1	5.6261
940031	AE1-245 C O1	0.5249
940032	AE1-245 E O1	3.5127
940841	AE2-072 C	4.0148
940842	AE2-072 E	2.6765
941741	AE2-174 C	1.8521
941742	AE2-174 E	8.6707
941761	AE2-176 C	6.6051
941762	AE2-176 E	4.4034
941781	AE2-181 C	3.3659
941782	AE2-181 E	2.2439
942041	AE2-216	2.5540
942661	AE2-282 C O1	5.1271
942662	AE2-282 E O1	2.6978
942801	AE2-298 C O1	0.8162
942802	AE2-298 E O1	0.5441
943012	AE2-324 BAT	3.9244
943181	AE2-322 C	1.1178

Bus #	Bus	MW Impact
943182	AE2-322 E	0.5464
943581	AF1-029 C O1	0.4081
943582	AF1-029 E O1	0.2721
943791	AF1-047 C	0.5792
943792	AF1-047 E	0.3861
943951	AF1-063 C O1	0.7582
943952	AF1-063 E O1	0.4203
943961	AF1-064 C O1	4.9472
943962	AF1-064 E O1	2.4588
944091	AF1-077 C O1	3.3085
944092	AF1-077 E O1	2.0624
944171	AF1-085 C O1	0.8234
944172	AF1-085 E O1	1.1371
944551	AF1-120 C	1.6465
944552	AF1-120 E	0.8294
945401	AF1-205 C O1	1.5444
945402	AF1-205 E O1	1.0296
945411	AF1-206 C O1	7.3907
945412	AF1-206 E O1	4.9271
945641	AF1-229 C	29.9711
945642	AF1-229 E	19.9807
945651	AF1-230 C	1.0430
945652	AF1-230 E	0.6953
946052	AF1-270 BAT	4.9200
950351	J466	2.1945
950791	J201 C	0.2663
950792	J201 E	1.0653
950942	J325 E	0.3008
951571	J538 C	2.0559
951572	J538 E	8.2236
951941	J602 C	1.9915
951942	J602 E	10.7745
952201	J589 C	1.7272
952202	J589 E	9.3448
952312	J646 E	0.1295
952401	J752 C	1.1196
952402	J752 E	6.0574
952611	J717 C	1.8923
952612	J717 E	10.2378
952761	J728 C	1.7598
952762	J728 E	9.5337
952971	J793	106.7912
953071	J794 C	0.1127
953072	J794 E	0.6095
953271	J701 C	0.5455
953272	J701 E	2.9512
953291	J796	14.9877
953321	J799	17.3219
953361	J806	8.0654
953421	J841	44.1839
953781	J833	9.2240
953811	J839	7.8720

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
954111	J875	12.0525
955121	J989	5.5952
955181	J996	7.1984
955261	J1005	12.5500
955351	J1014 C	3.4125
955352	J1014 E	2.0475
955621	J1046	5.2745
955721	J1056 C	2.9999
955722	J1056 E	16.2301
955781	J1062	21.0980
955831	J1068 C	2.8027
955832	J1068 E	15.1633
955961	J1083	4.2567
956011	J1088	9.4200
956021	J1089	10.7729
956031	J1090	5.9481
956161	J1103	1.4272
956291	J1117	4.9816
956301	J1119	40.4220
956741	J1172	3.3815
956751	J1173	6.6232
956801	J1178	3.9526
LGEE	LGEE	0.5152
WEC	WEC	0.8647
CBM-W2	CBM-W2	10.8354
NY	NY	0.6802
CBM-W1	CBM-W1	64.9144
TVA	TVA	0.8862
O-066	O-066	8.2723
CBM-S1	CBM-S1	5.8192
G-007	G-007	1.2782
MADISON	MADISON	3.3022
MEC	MEC	3.4831
CATAWBA	CATAWBA	0.0980

# Short Circuit

## 11.7 Short Circuit

The following Breakers are overdutied:

None

## **12 Network Impacts – Secondary Point of Interconnection**

The Queue Project AF1-206 was evaluated as a 199.0 MW (Capacity 119.4 MW) injection tapping the Fayette to Lyons 138 kV line in the ATSI area. Project AF1-206 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-206 was studied with a commercial probability of 53%. Potential network impacts were as follows:

# Summer Peak Load Flow

## 12.1 Generation Deliverability

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

None

## 12.2 Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
42224495	238569	02BEAVER	345.0	ATSI	239725	02LAKEAVER	345.0	ATSI	2	ATSI-P2-3-OEC-345-023	breaker	1878.0	99.67	100.56	DC	36.33

## 12.3 Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
42760082	238569	02BEAVER	345.0	ATSI	238607	02CARLIL	345.0	ATSI	1	ATSI-P7-1-OEC-345-001	tower	1243.0	106.85	107.91	DC	28.88
41027066	238874	02LAKVEW	138.0	ATSI	238768	02GRNFLD	138.0	ATSI	1	ATSI-P7-1-TE-345-027A	tower	316.0	115.09	116.9	DC	12.61
41297433	238889	02LEMOYN	345.0	ATSI	242936	05FOSTOR	345.0	AEP	1	ATSI-P1-2-TE-345-602T	single	1409.0	113.41	115.2	DC	25.13
41027092	239030	02OTTAWA	138.0	ATSI	238874	02LAKVEW	138.0	ATSI	1	ATSI-P7-1-TE-345-027A	tower	380.0	112.5	114.0	DC	12.61
41027161	239070	02RICHLD	138.0	ATSI	239165	02WAUSEO	138.0	ATSI	1	AEP_P7-1_#10983-B	tower	190.0	104.42	115.97	DC	21.94
41618605	239154	02W.FREM	138.0	ATSI	243009	05FRMNT	138.0	AEP	1	AEP_P4_#517_05FOS TOR 345_A1	breaker	361.0	113.31	114.65	DC	10.55
41848010	239154	02W.FREM	138.0	ATSI	243009	05FRMNT	138.0	AEP	1	AEP_P2-2_#517_05FOSTOR 345_1	bus	361.0	113.31	114.65	DC	10.55
41297544	241901	02LALLENDORF	345.0	ATSI	242936	05FOSTOR	345.0	AEP	1	ATSI-P1-2-TE-345-603T	single	1409.0	105.37	106.61	DC	17.52
43526575	242936	05FOSTOR	345.0	AEP	242935	05ELIMA	345.0	AEP	1	AEP_P4_#6155_05FO STOR 345_A2	breaker	1318.0	127.54	128.67	DC	32.97
43526680	242936	05FOSTOR	345.0	AEP	242942	05SBERWI	345.0	AEP	1	AEP_P4_#3141_05FO STOR 345_B2	breaker	1409.0	101.92	102.88	DC	29.77
43527115	242936	05FOSTOR	345.0	AEP	242935	05ELIMA	345.0	AEP	1	ATSI-P7-1-TE-345-029A	tower	1318.0	131.22	132.28	DC	30.87
43527117	242936	05FOSTOR	345.0	AEP	242935	05ELIMA	345.0	AEP	1	AEP_P7-1_#10999	tower	1318.0	123.24	124.13	DC	26.04
43527209	242936	05FOSTOR	345.0	AEP	242942	05SBERWI	345.0	AEP	1	ATSI-P7-1-TE-345-029A	tower	1409.0	103.92	104.82	DC	27.95
43526450	256000	18ARGNTA	345.0	METC	243234	05TWINB	345.0	AEP	1	AEP_P4_#7027_05CO OK 345_N	breaker	956.0	177.46	178.16	DC	14.52
43526451	256000	18ARGNTA	345.0	METC	243234	05TWINB	345.0	AEP	1	AEP_P4_#7026_05BE NTON 345_A	breaker	956.0	130.05	130.58	DC	11.18
43527080	256000	18ARGNTA	345.0	METC	243234	05TWINB	345.0	AEP	1	AEP_P7-1_#10999	tower	956.0	235.14	235.96	DC	17.17
43527081	256000	18ARGNTA	345.0	METC	243234	05TWINB	345.0	AEP	1	AEP_P7-1_#10998	tower	956.0	177.46	178.16	DC	14.52

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
42006163	907060	X1-027A_AT12	345.0	ATSI	238569	02BEAVER	345.0	ATSI	1	AEP_P2-2_#517_05FOSTOR345_1	bus	1646.0	108.99	109.8	DC	29.33
42224229	907060	X1-027A_AT12	345.0	ATSI	238569	02BEAVER	345.0	ATSI	1	ATSI-P2-3-OEC-345-031	breaker	1646.0	114.36	115.29	DC	33.4
42224230	907060	X1-027A_AT12	345.0	ATSI	238569	02BEAVER	345.0	ATSI	1	AEP_P4_#517_05FOSTOR345_A1	breaker	1646.0	108.99	109.8	DC	29.33
41027241	945640	AF1-229TAP	345.0	AEP	238745	02GALION	345.0	ATSI	1	ATSI-P7-1-TE-345-029A	tower	1409.0	103.09	103.97	DC	27.42

## 12.4 Potential Congestion due to Local Energy Deliverability

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
41297432	238889	02LEMOYN	345.0	ATSI	242936	05FOSTOR	345.0	AEP	1	ATSI-P1-2-TE-345-602T	operation	1409.0	137.85	139.19	DC	41.88
54828943	238979	02NAPMUN	138.0	ATSI	238962	02MIDWAY	138.0	ATSI	1	ATSI-P1-2-TE-138-039-A	operation	179.0	70.34	118.2	DC	85.67
54829004	239127	02STRYKE	138.0	ATSI	945400	AF1-205TAP	138.0	ATSI	1	ATSI-P1-2-TE-138-039-A	operation	181.0	54.71	102.04	DC	85.67
41297543	241901	02LALLENDORF	345.0	ATSI	242936	05FOSTOR	345.0	AEP	1	ATSI-P1-2-TE-345-603T	operation	1409.0	130.17	131.11	DC	29.2
43526932	242936	05FOSTOR	345.0	AEP	242935	05E LIMA	345.0	AEP	1	Base Case	operation	1025.0	125.65	126.71	DC	24.11
43526933	242936	05FOSTOR	345.0	AEP	242935	05E LIMA	345.0	AEP	1	ATSI-P1-2-OES-345-934T-B	operation	1318.0	121.81	122.87	DC	31.02
43526784	247803	05SEGRETO	345.0	AEP	243212	05BENTON	345.0	AEP	1	AEP_P1-2_#7023	operation	1887.0	161.24	161.71	DC	19.52
43526902	256000	18ARGNTA	345.0	METC	243234	05TWIN B	345.0	AEP	1	AEP_P1-2_#7021	operation	956.0	129.16	129.69	DC	11.18

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G%	POST PROJECT LOADIN G%	AC DC	MW IMPACT
42526199	907060	X1-027A_AT12	345.0	ATSI	238569	02BEAVER	345.0	ATSI	1	ATSI-P1-2-SYS-345-810	operation	1646.0	107.9	108.79	DC	31.82
54828938	945400	AF1-205 TAP	138.0	ATSI	238979	02NAPMUN	138.0	ATSI	1	ATSI-P1-2-TE-138-039-A	operation	181.0	70.88	118.21	DC	85.67

## 12.5 Flow Gate Details

The following indices contain additional information about each flowgate presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gauge 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.

### 12.5.1 Contingency Descriptions

Contingency Name	Contingency Definition
ATSI-P1-2-TE-345-603T	CONTINGENCY 'ATSI-P1-2-TE-345-603T' /*LINE OUTAGE: LEMOYNE TO AEP FOSTORIA DISCONNECT BRANCH FROM BUS 238889 TO BUS 242936 CKT 1 END
AEP_P4_#517_05FOSTOR 345_A1	CONTINGENCY 'AEP_P4_#517_05FOSTOR 345_A1' OPEN BRANCH FROM BUS 241901 TO BUS 242936 CKT 1 / 241901 02LALLEND
ATSI-P1-2-SYS-345-810	CONTINGENCY 'ATSI-P1-2-SYS-345-810' /* LINE 02HAYES TO 02DAV-BE 345 CK 1 DISCONNECT BRANCH FROM BUS 239289 TO BUS 238654 CKT 1 /* 02HAYES 345 02DAV-BE 345 END
ATSI-P7-1-TE-345-029A	CONTINGENCY 'ATSI-P7-1-TE-345-029A' /* X1-027A - BEAVER & BEAVER - HAYES 345 DISCONNECT BRANCH FROM BUS 907060 TO BUS 238569 CKT 1 /* X1-027A_AT12 345 02BEAVER 345 DISCONNECT BRANCH FROM BUS 239289 TO BUS 238569 CKT 1 /* 02HAYES 345 02BEAVER 345 END
ATSI-P1-2-OES-345-934T-B	CONTINGENCY 'ATSI-P1-2-OES-345-934T-B' /* LINE 02GALION - 05SBERWI(AEP) 345 CK 1 DISCONNECT BRANCH FROM BUS 945640 TO BUS 238745 CKT 1 /* AF1-229 TAP 345 02GALION 345 END

Contingency Name	Contingency Definition
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
AEP_P2-2_#517_05FOSTOR 345_1	CONTINGENCY 'AEP_P2-2_#517_05FOSTOR 345_1' OPEN BRANCH FROM BUS 241901 TO BUS 242936 CKT 1 / 241901 02LALLEND
AEP_P1-2_#7023	CONTINGENCY 'AEP_P1-2_#7023' OPEN BRANCH FROM BUS 243215 TO BUS 247803 CKT 1 / 243215 05COOK 345 247803 05SEGRETO 345 1 END
AEP_P1-2_#7021	CONTINGENCY 'AEP_P1-2_#7021' OPEN BRANCH FROM BUS 243212 TO BUS 247803 CKT 1 / 243212 05BENTON 345 247803 05SEGRETO 345 1 END
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
AEP_P4_#6155_05FOSTOR 345_A2	CONTINGENCY 'AEP_P4_#6155_05FOSTOR 345_A2' OPEN BRANCH FROM BUS 242936 TO BUS 242942 CKT 1 / 242936 05FOSTOR 345 242942 05SBERWI 345 1 OPEN BRANCH FROM BUS 242936 TO BUS 243006 CKT 1 / 242936 05FOSTOR 345 243006 05FOSTOR 138 1 END
ATSI-P2-3-OEC-345-031	CONTINGENCY 'ATSI-P2-3-OEC-345-031' /* HAYES 345KV BRK B-3_6_12 DISCONNECT BRANCH FROM BUS 239289 TO BUS 238654 CKT 1 /* 02HAYES 345 02DAV-BE 345 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
ATSI-P1-2-TE-345-602T	CONTINGENCY 'ATSI-P1-2-TE-345-602T' /*LINE OUTAGE: LALLEND
Base Case	

Contingency Name	Contingency Definition
<b>AEP_P7-1_#10983-B</b>	CONTINGENCY 'AEP_P7-1_#10983-B' OPEN BRANCH FROM BUS 239070 TO BUS 243029 CKT 1 / 239070 02RICHLD 138 243029 05LCKWRD 138 1 OPEN BRANCH FROM BUS 940840 TO BUS 242993 CKT 1 / 239269 AE2-072 TAP 138 242993 05E.LPSC 138 1 OPEN BRANCH FROM BUS 242993 TO BUS 893021 CKT 1 / 242993 05E.LPSC 138 893021 V2-006 C 138 1 OPEN BRANCH FROM BUS 242971 TO BUS 243029 CKT 1 / 242971 05BRYAN 138 243029 05LCKWRD 138 1 REMOVE SWSHUNT FROM BUS 243029 / 243029 05LCKWRD 138 END
<b>AEP_P4_#7026_05BENTON 345_A</b>	CONTINGENCY 'AEP_P4_#7026_05BENTON 345_A' OPEN BRANCH FROM BUS 243212 TO BUS 243215 CKT 1 / 243212 05BENTON 345 243215 05COOK 345 1 OPEN BRANCH FROM BUS 243212 TO BUS 247803 CKT 1 / 243212 05BENTON 345 247803 05SEGRETO 345 1 OPEN BRANCH FROM BUS 243212 TO BUS 243250 CKT 1 / 243212 05BENTON 345 243250 05BENTON 138 1 END
<b>AEP_P7-1_#10998</b>	CONTINGENCY 'AEP_P7-1_#10998' OPEN BRANCH FROM BUS 243212 TO BUS 243215 CKT 1 / 243212 05BENTON 345 243215 05COOK 345 1 OPEN BRANCH FROM BUS 243215 TO BUS 247803 CKT 1 / 243215 05COOK 345 247803 05SEGRETO 345 1 END
<b>AEP_P7-1_#10999</b>	CONTINGENCY 'AEP_P7-1_#10999' OPEN BRANCH FROM BUS 243212 TO BUS 247803 CKT 1 / 243212 05BENTON 345 247803 05SEGRETO 345 1 OPEN BRANCH FROM BUS 243215 TO BUS 247803 CKT 1 / 243215 05COOK 345 247803 05SEGRETO 345 1 END
<b>ATSI-P2-3-OEC-345-023</b>	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
<b>AEP_P4_#7027_05COOK 345_N</b>	CONTINGENCY 'AEP_P4_#7027_05COOK 345_N' OPEN BRANCH FROM BUS 243212 TO BUS 243215 CKT 1 / 243212 05BENTON 345 243215 05COOK 345 1 OPEN BRANCH FROM BUS 243215 TO BUS 247803 CKT 1 / 243215 05COOK 345 247803 05SEGRETO 345 1 END
<b>ATSI-P7-1-TE-345-027A</b>	CONTINGENCY 'ATSI-P7-1-TE-345-027A' /* DB - X1-027A & DB - HAYES 345 DISCONNECT BRANCH FROM BUS 238654 TO BUS 907060 CKT 1 /* 02DAV-BE 345 X1-027A_AT12 345 DISCONNECT BRANCH FROM BUS 238654 TO BUS 239289 CKT 1 /* 02DAV-BE 345 02HAYES 345 END

Contingency Name	Contingency Definition
<b>ATSI-P1-2-TE-138-039-A</b>	CONTINGENCY 'ATSI-P1-2-TE-138-039-A' /* LINE ALLEN JCT TO E FAYETTE 138 DISCONNECT BRANCH FROM BUS 238531 TO BUS 239345 CKT 1 /* 02ALLNJ 138 02SIL_AE+ 138 DISCONNECT BRANCH FROM BUS 239345 TO BUS 238517 CKT 1 /* 02SIL_AE+ 138 02LYONS 138 DISCONNECT BRANCH FROM BUS 945410 TO BUS 238517 CKT 1 /* AF1-206 TAP 138 02LYONS 138 REMOVE LOAD O FROM BUS 238517 /* 02LYONS 138 END

## 12.5.2 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
42224495	238569	02BEAVER	ATSI	239725	02LAKEAVE	ATSI	2	ATSI-P2-3-OEC-345-023	breaker	1878.0	99.67	100.56	DC	36.33

Bus #	Bus	MW Impact
238564	02BAYSG1	4.4909
238670	02DVBSG1 (Deactivation : 05/31/20)	25.5246
238888	02LEMOG4	4.6732
238979	02NAPMUN	5.9032
239171	02WLORG-2	5.0784
239172	02WLORG-3	5.1650
239173	02WLORG-4	5.1650
239174	02WLORG-5	5.1917
239276	02COLLW 11	-3.2504
239293	02BS-PKR	0.3920
239297	02CPPW41	-3.6783
241902	Y1-069 GE	25.7091
244357	05GRANGER EL	0.3727
247548	V4-010 C	3.4861
247551	U4-028 C	1.6271
247552	U4-029 C	1.6271
247940	U4-028 E	10.8891
247941	U4-029 E	10.8891
247947	V4-010 E	23.3297
893021	V2-006 C	1.9245
893022	V2-006 E	12.8795
915952	Y3-092 NFTWR	110.5200
923821	AB2-019 FTWR	3.0946
925751	AC1-051 C	0.7955
925752	AC1-051 E	5.3240
931951	AB1-107 1	47.4714
931961	AB1-107 2	129.1472
932051	AC2-015 C	5.5249
932052	AC2-015 E	6.5463
932791	AC2-103 C	14.4426
932792	AC2-103 E	96.6709
934252	AD1-052 E1	0.9798
934262	AD1-052 E2	0.9798
934461	AD1-070 C O1	4.6745
934462	AD1-070 E O1	21.9440
934761	AD1-103 C O1	24.2833
934762	AD1-103 E O1	162.5111
934891	AD1-118	12.4504
937021	AD2-136 C O1	5.8576
937022	AD2-136 E O1	39.2009

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
937381	AD2-191 C	2.7661
937382	AD2-191 E	18.5115
938911	AE1-119	97.8244
939161	AE1-146 C O1	9.9136
939162	AE1-146 E O1	4.6296
940841	AE2-072 C	5.1326
940842	AE2-072 E	3.4217
941741	AE2-174 C	2.4765
941742	AE2-174 E	11.5937
941761	AE2-176 C	15.8827
941762	AE2-176 E	10.5885
941781	AE2-181 C	4.4547
941782	AE2-181 E	2.9698
942661	AE2-282 C O1	6.7921
942662	AE2-282 E O1	3.5740
943951	AF1-063 C O2	1.0602
943952	AF1-063 E O2	0.5878
943961	AF1-064 C O2	2.9433
943962	AF1-064 E O2	1.4628
944392	AF1-104 BAT	2.1502
944551	AF1-120 C	2.1812
944552	AF1-120 E	1.0988
945401	AF1-205 C O2	2.0165
945402	AF1-205 E O2	1.3444
945411	AF1-206 C O2	9.8209
945412	AF1-206 E O2	6.5473
945641	AF1-229 C	5.1827
945642	AF1-229 E	3.4551
945651	AF1-230 C	1.7062
945652	AF1-230 E	1.1375
955621	J1046	5.7380
955721	J1056 C	3.3468
955722	J1056 E	18.1072
955781	J1062	22.9520
LGEE	LGEE	2.4589
CPL	CPL	0.5484
WEC	WEC	1.9177
CBM-W2	CBM-W2	35.1679
NY	NY	2.3873
CBM-W1	CBM-W1	110.4633
TVA	TVA	4.6158
O-066	O-066	24.2256
CBM-S2	CBM-S2	8.0747
CBM-S1	CBM-S1	29.6922
G-007	G-007	3.7149
MADISON	MADISON	1.9596
MEC	MEC	8.5679

### 12.5.3 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
42760082	238569	02BEAVER	ATSI	238607	02CARLIL	ATSI	1	ATSI-P7-1-OEC-345-001	tower	1243.0	106.85	107.91	DC	28.88

Bus #	Bus	MW Impact
238572	02BEAVGB	1.4271
238670	02DVBSG1 (Deactivation : 05/31/20)	20.3235
238979	02NAPMUN	4.6958
239171	02WLOG-2	4.0328
239172	02WLOG-3	4.1016
239173	02WLOG-4	4.1016
239174	02WLOG-5	4.1228
239175	02WLOG-6	2.1669
244357	05GRANGER EL	0.2952
247548	V4-010 C	2.8109
247551	U4-028 C	1.3082
247552	U4-029 C	1.3082
247926	U1-059 E	2.9465
247940	U4-028 E	8.7549
247941	U4-029 E	8.7549
247942	W1-056 E	1.0838
247947	V4-010 E	18.8114
893021	V2-006 C	1.5080
893022	V2-006 E	10.0920
925751	AC1-051 C	0.6401
925752	AC1-051 E	4.2839
931951	AB1-107 1	37.9352
931961	AB1-107 2	87.3739
932051	AC2-015 C	4.4475
932052	AC2-015 E	5.2697
932791	AC2-103 C	11.4809
932792	AC2-103 E	76.8468
934252	AD1-052 E1	0.7972
934262	AD1-052 E2	0.7972
934461	AD1-070 C O1	3.7191
934462	AD1-070 E O1	17.4592
934761	AD1-103 C O1	19.3035
934762	AD1-103 E O1	129.1852
934891	AD1-118	9.9068
937021	AD2-136 C O1	4.7096
937022	AD2-136 E O1	31.5178
937381	AD2-191 C	2.2240
937382	AD2-191 E	14.8834
938911	AE1-119	77.8388
939161	AE1-146 C O1	7.8645
939162	AE1-146 E O1	3.6727

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
940841	AE2-072 C	4.0342
940842	AE2-072 E	2.6895
941741	AE2-174 C	1.9969
941742	AE2-174 E	9.3483
941761	AE2-176 C	11.1448
941762	AE2-176 E	7.4299
941781	AE2-181 C	3.5383
941782	AE2-181 E	2.3589
942661	AE2-282 C O1	5.3976
942662	AE2-282 E O1	2.8402
943951	AF1-063 C O2	0.8316
943952	AF1-063 E O2	0.4610
943961	AF1-064 C O2	2.3465
943962	AF1-064 E O2	1.1662
944551	AF1-120 C	1.7334
944552	AF1-120 E	0.8732
945401	AF1-205 C O2	1.6039
945402	AF1-205 E O2	1.0692
945411	AF1-206 C O2	7.8054
945412	AF1-206 E O2	5.2036
945641	AF1-229 C	4.1017
945642	AF1-229 E	2.7344
945651	AF1-230 C	1.3729
945652	AF1-230 E	0.9153
953321	J799	15.7815
953781	J833	8.3890
955181	J996	6.5000
955621	J1046	4.6650
955721	J1056 C	2.7225
955722	J1056 E	14.7295
955781	J1062	18.6600
955831	J1068 C	2.5547
955832	J1068 E	13.8213
LGEE	LGEE	1.7914
CPL	CPL	0.2719
WEC	WEC	1.4440
CBM-W2	CBM-W2	25.7412
NY	NY	1.7320
CBM-W1	CBM-W1	85.2682
TVA	TVA	3.2830
O-066	O-066	18.8698
CBM-S2	CBM-S2	4.9130
CBM-S1	CBM-S1	21.2404
G-007	G-007	2.8974
MADISON	MADISON	1.6209
MEC	MEC	6.3957

### 12.5.4 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
41027066	238874	02LAKVEV	ATSI	238768	02GRNFLD	ATSI	1	ATSI-P7-1-TE-345-027A	tower	316.0	115.09	116.9	DC	12.61

Bus #	Bus	MW Impact
238601	02FRMENG 1	2.4779
238602	02FRMENG 2	2.4779
238603	02FRMENG 3	4.4733
238979	02NAPMUN	2.0225
247548	V4-010 C	1.4243
247551	U4-028 C	0.6092
247552	U4-029 C	0.6092
247940	U4-028 E	4.0769
247941	U4-029 E	4.0769
247947	V4-010 E	9.5322
931951	AB1-107 1	20.5456
931961	AB1-107 2	33.5314
934251	AD1-052 C1	0.1839
934252	AD1-052 E1	0.5861
934261	AD1-052 C2	0.1839
934262	AD1-052 E2	0.5861
934461	AD1-070 C O1	1.5612
934462	AD1-070 E O1	7.3290
934891	AD1-118	3.6670
937021	AD2-136 C O1	2.1931
937022	AD2-136 E O1	14.6767
937381	AD2-191 C	1.0356
937382	AD2-191 E	6.9307
938911	AE1-119	28.8120
941741	AE2-174 C	1.0119
941742	AE2-174 E	4.7370
941781	AE2-181 C	1.5331
941782	AE2-181 E	1.0221
942661	AE2-282 C O1	2.3557
942662	AE2-282 E O1	1.2396
943961	AF1-064 C O2	1.0626
943962	AF1-064 E O2	0.5281
944551	AF1-120 C	0.7565
944552	AF1-120 E	0.3811
945401	AF1-205 C O2	0.6909
945402	AF1-205 E O2	0.4606
945411	AF1-206 C O2	3.4092
945412	AF1-206 E O2	2.2728
LGEE	LGEE	0.7188
CPL	CPL	0.1528
WEC	WEC	0.5758

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
<b>CBM-W2</b>	CBM-W2	10.4095
<b>NY</b>	NY	0.6564
<b>CBM-W1</b>	CBM-W1	33.7395
<b>TVA</b>	TVA	1.3510
<b>O-066</b>	O-066	6.8410
<b>CBM-S2</b>	CBM-S2	2.2947
<b>CBM-S1</b>	CBM-S1	8.6904
<b>G-007</b>	G-007	1.0494
<b>MADISON</b>	MADISON	0.6713
<b>MEC</b>	MEC	2.5615

## 12.5.5 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
41297433	238889	02LEMOYN	ATSI	242936	05FOSTOR	AEP	1	ATSI-P1-2-TE-345-602T	single	1409.0	113.41	115.2	DC	25.13

Bus #	Bus	MW Impact
238564	02BAYSG1	4.7137
238601	02FRMENG 1	3.1432
238602	02FRMENG 2	3.1432
238603	02FRMENG 3	5.6744
238670	02DVBSG1 (Deactivation : 05/31/20)	21.2234
238885	02LEMOG1	7.4325
238886	02LEMOG2	7.4325
238887	02LEMOG3	7.4325
238888	02LEMOG4	7.4325
238979	02NAPMUN	8.4412
239068	02RICHG5	1.8498
239069	02RICHG6	1.8498
239171	02WLORG-2	1.2056
239172	02WLORG-3	1.2262
239173	02WLORG-4	1.2262
239174	02WLORG-5	1.2325
239202	02STRYCT	0.3520
239293	02BS-PKR	0.4115
241902	Y1-069 GE	25.8223
241912	AA1-006	0.0400
927181	AC1-212 C	-0.1102
931951	AB1-107 1	59.2860
931961	AB1-107 2	129.7160
932791	AC2-103 C	6.7410
934251	AD1-052 C1	0.2333
934261	AD1-052 C2	0.2333
934761	AD1-103 C O1	11.3340
934891	AD1-118	23.2960
938911	AE1-119	183.0400
941761	AE2-176 C	9.9323
941781	AE2-181 C	5.8826
942661	AE2-282 C O1	9.1786
943951	AF1-063 C O2	0.5921
943961	AF1-064 C O2	7.9205
944551	AF1-120 C	5.5615
945341	AF1-199	0.1483
945401	AF1-205 C O2	5.3938
945411	AF1-206 C O2	25.1301
946141	AF1-279 C O2	3.7407
950311	G934 C	2.6256
950351	J466	4.1016

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
950791	J201 C	0.4940
950871	J246 C	0.1330
951531	J533 C	3.7996
951571	J538 C	4.0188
951941	J602 C	3.6832
952201	J589 C	3.1381
952401	J752 C	2.0892
952611	J717 C	3.4743
952761	J728 C	3.2310
952881	J758	16.4140
952971	J793	201.0101
953071	J794 C	0.2057
953271	J701 C	1.0173
953291	J796	27.6308
953321	J799	33.8858
953361	J806	15.0043
953421	J841	81.4390
953771	J832	9.6120
953781	J833	18.2200
953811	J839	14.7930
953941	J857	11.4429
954111	J875	23.9280
954381	J906 C	0.9828
955021	J978 C	1.2553
955071	J984 C	2.7306
955121	J989	10.4784
955181	J996	14.7104
955261	J1005	23.1200
955341	J1013	5.5912
955351	J1014 C	6.5830
955591	J1043 C	1.4832
955621	J1046	11.8605
955721	J1056 C	6.0235
955781	J1062	47.4420
955801	J1064 C	2.1331
955811	J1065 C	2.8336
955831	J1068 C	5.4559
955861	J1071	6.6520
955961	J1083	8.0346
956011	J1088	17.4540
956021	J1089	19.9563
956031	J1090	11.3949
956161	J1103	2.6618
956291	J1117	9.4048
956301	J1119	77.6940
956741	J1172	6.2895
956751	J1173	13.2104
956801	J1178	7.4607
DUCKCREEK	DUCKCREEK	0.3915
NEWTON	NEWTON	1.1572
FARMERCITY	FARMERCITY	0.0385
G-007A	G-007A	0.1582

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
VFT	VFT	0.4838
CBM-W1	CBM-W1	59.9980
PRAIRIE	PRAIRIE	2.6631
COFFEEN	COFFEEN	0.4598
EDWARDS	EDWARDS	0.0882
CHEOAH	CHEOAH	0.8323
TILTON	TILTON	0.5368
MADISON	MADISON	5.4392
GIBSON	GIBSON	0.8627
CALDERWOOD	CALDERWOOD	0.8290
BLUEG	BLUEG	3.6196
TRIMBLE	TRIMBLE	1.1737
CATAWBA	CATAWBA	0.5400

## 12.5.6 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
41027092	239030	02OTTAWA	ATSI	238874	02LAKVEW	ATSI	1	ATSI-P7-1-TE-345-027A	tower	380.0	112.5	114.0	DC	12.61

Bus #	Bus	MW Impact
238601	02FRMENG 1	2.4779
238602	02FRMENG 2	2.4779
238603	02FRMENG 3	4.4733
238979	02NAPMUN	2.0225
247548	V4-010 C	1.4243
247551	U4-028 C	0.6092
247552	U4-029 C	0.6092
247940	U4-028 E	4.0769
247941	U4-029 E	4.0769
247947	V4-010 E	9.5322
931951	AB1-107 1	20.5456
931961	AB1-107 2	33.5314
934251	AD1-052 C1	0.1839
934252	AD1-052 E1	0.5861
934261	AD1-052 C2	0.1839
934262	AD1-052 E2	0.5861
934461	AD1-070 C O1	1.5612
934462	AD1-070 E O1	7.3290
934891	AD1-118	3.6670
937021	AD2-136 C O1	2.1931
937022	AD2-136 E O1	14.6767
937381	AD2-191 C	1.0356
937382	AD2-191 E	6.9307
938911	AE1-119	28.8120
941741	AE2-174 C	1.0119
941742	AE2-174 E	4.7370
941781	AE2-181 C	1.5331
941782	AE2-181 E	1.0221
942661	AE2-282 C O1	2.3557
942662	AE2-282 E O1	1.2396
943961	AF1-064 C O2	1.0626
943962	AF1-064 E O2	0.5281
944551	AF1-120 C	0.7565
944552	AF1-120 E	0.3811
945401	AF1-205 C O2	0.6909
945402	AF1-205 E O2	0.4606
945411	AF1-206 C O2	3.4092
945412	AF1-206 E O2	2.2728
LGEE	LGEE	0.7188
CPL	CPL	0.1528
WEC	WEC	0.5758

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
<b>CBM-W2</b>	CBM-W2	10.4095
<b>NY</b>	NY	0.6564
<b>CBM-W1</b>	CBM-W1	33.7395
<b>TVA</b>	TVA	1.3510
<b>O-066</b>	O-066	6.8410
<b>CBM-S2</b>	CBM-S2	2.2947
<b>CBM-S1</b>	CBM-S1	8.6904
<b>G-007</b>	G-007	1.0494
<b>MADISON</b>	MADISON	0.6713
<b>MEC</b>	MEC	2.5615

12.5.7 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
41027161	239070	02RICHLD	ATSI	239165	02WAUSEO	ATSI	1	AEP_P7-1_#10983-B	tower	190.0	104.42	115.97	DC	21.94

Bus #	Bus	MW Impact
238979	02NAPMUN	2.1002
239064	02RICHG1	0.6855
239065	02RICHG2&3	1.3657
239067	02RICHG4	7.3530
239068	02RICHG5	7.3530
239069	02RICHG6	7.3530
239202	02STRYCT	0.2457
926941	AC1-181	0.3116
940841	AE2-072 C	40.0275
940842	AE2-072 E	26.6850
941781	AE2-181 C	3.6253
941782	AE2-181 E	2.4169
942661	AE2-282 C O1	5.0204
942662	AE2-282 E O1	2.6417
944551	AF1-120 C	3.0420
944552	AF1-120 E	1.5324
945401	AF1-205 C O2	0.8259
945402	AF1-205 E O2	0.5506
945411	AF1-206 C O2	13.1639
945412	AF1-206 E O2	8.7759
DUCKCREEK	DUCKCREEK	0.1128
NEWTON	NEWTON	0.1053
FARMERCITY	FARMERCITY	0.0055
NY	NY	0.0531
PRAIRIE	PRAIRIE	0.2531
O-066	O-066	0.6384
COFFEEN	COFFEEN	0.0518
EDWARDS	EDWARDS	0.0343
CHEOAH	CHEOAH	0.0485
TILTON	TILTON	0.0617
G-007	G-007	0.0988
GIBSON	GIBSON	0.0535
CALDERWOOD	CALDERWOOD	0.0482
BLUEG	BLUEG	0.1684
TRIMBLE	TRIMBLE	0.0540
CATAWBA	CATAWBA	0.0336

## 12.5.8 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
41848010	239154	02W.FREM	ATSI	243009	05FRMNT	AEP	1	AEP_P2-2_#517_05FOSTOR345_1	bus	361.0	113.31	114.65	DC	10.55

Bus #	Bus	MW Impact
238601	02FRMENG 1	5.1449
238602	02FRMENG 2	5.1449
238603	02FRMENG 3	9.2882
238979	02NAPMUN	1.8002
244357	05GRANGER EL	-0.2415
931951	AB1-107 1	17.8239
931961	AB1-107 2	31.8644
932791	AC2-103 C	1.6746
932792	AC2-103 E	11.2087
934251	AD1-052 C1	0.3818
934252	AD1-052 E1	1.2169
934261	AD1-052 C2	0.3818
934262	AD1-052 E2	1.2169
934761	AD1-103 C O1	2.8156
934762	AD1-103 E O1	18.8427
934891	AD1-118	3.7390
938911	AE1-119	29.3777
941761	AE2-176 C	9.9660
941762	AE2-176 E	6.6440
942661	AE2-282 C O1	1.9628
942662	AE2-282 E O1	1.0328
943961	AF1-064 C O2	1.0155
943962	AF1-064 E O2	0.5047
944551	AF1-120 C	0.6303
944552	AF1-120 E	0.3175
945401	AF1-205 C O2	0.6090
945402	AF1-205 E O2	0.4060
945411	AF1-206 C O2	2.8509
945412	AF1-206 E O2	1.9006
DUCKCREEK	DUCKCREEK	0.3524
NEWTON	NEWTON	0.5254
FARMERCITY	FARMERCITY	0.0217
G-007A	G-007A	0.0983
VFT	VFT	0.2838
CBM-W1	CBM-W1	12.3474
PRAIRIE	PRAIRIE	1.2218
COFFEEN	COFFEEN	0.2310
EDWARDS	EDWARDS	0.0994
CHEOAH	CHEOAH	0.3023
TILTON	TILTON	0.2747
MADISON	MADISON	1.4193

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
<b>GIBSON</b>	GIBSON	0.3380
<b>CALDERWOOD</b>	CALDERWOOD	0.3017
<b>BLUEG</b>	BLUEG	1.3037
<b>TRIMBLE</b>	TRIMBLE	0.4213
<b>CATAWBA</b>	CATAWBA	0.1915

## 12.5.9 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
41297544	241901	02LALLENDORF	ATSI	242936	05FOSTOR	AEP	1	ATSI-P1-2-TE-345-603T	single	1409.0	105.37	106.61	DC	17.52

Bus #	Bus	MW Impact
238564	02BAYSG1	4.7371
238572	02BEAVGB	0.6097
238601	02FRMENG 1	2.4739
238602	02FRMENG 2	2.4739
238603	02FRMENG 3	4.4661
238670	02DVBSG1 (Deactivation : 05/31/20)	18.3102
238885	02LEMOG1	3.9421
238886	02LEMOG2	3.9421
238887	02LEMOG3	3.9421
238888	02LEMOG4	3.9421
238979	02NAPMUN	5.5063
239171	02WLOG-2	1.0371
239172	02WLOG-3	1.0548
239173	02WLOG-4	1.0548
239174	02WLOG-5	1.0603
239175	02WLOG-6	0.9258
239202	02STRYCT	0.2347
239293	02BS-PKR	0.4135
241902	Y1-069 GE	35.4657
241912	AA1-006	0.0338
927181	AC1-212 C	-0.0943
931951	AB1-107 1	58.3872
931961	AB1-107 2	178.1588
932791	AC2-103 C	5.8105
934251	AD1-052 C1	0.1836
934261	AD1-052 C2	0.1836
934761	AD1-103 C O1	9.7695
934891	AD1-118	12.3557
938911	AE1-119	97.0805
941761	AE2-176 C	8.2478
941781	AE2-181 C	3.9875
942661	AE2-282 C O1	6.3809
943961	AF1-064 C O2	5.3330
944551	AF1-120 C	3.8663
945341	AF1-199	0.1276
945401	AF1-205 C O2	3.5234
945411	AF1-206 C O2	17.5196
946141	AF1-279 C O2	3.2120
950311	G934 C	2.2737
950351	J466	3.6573
950791	J201 C	0.4365

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
950871	J246 C	0.1158
951531	J533 C	3.3080
951571	J538 C	3.0012
951941	J602 C	3.2339
952201	J589 C	2.7390
952401	J752 C	1.8606
952611	J717 C	3.0548
952761	J728 C	2.8409
952881	J758	13.0600
952971	J793	180.8232
953071	J794 C	0.1802
953271	J701 C	0.9057
953291	J796	24.3254
953321	J799	28.3160
953361	J806	11.9424
953421	J841	71.8216
953771	J832	8.3730
953781	J833	14.8430
953811	J839	13.2720
953941	J857	9.0701
954111	J875	18.4065
954381	J906 C	0.8240
955021	J978 C	1.0755
955071	J984 C	2.3646
955121	J989	9.1712
955181	J996	10.6888
955261	J1005	20.3940
955341	J1013	4.2920
955351	J1014 C	5.2445
955591	J1043 C	1.2682
955621	J1046	7.2225
955721	J1056 C	4.7162
955781	J1062	28.8900
955801	J1064 C	1.7993
955811	J1065 C	2.4533
955831	J1068 C	4.6004
955861	J1071	5.6110
955961	J1083	6.5254
956011	J1088	15.1590
956021	J1089	17.3927
956031	J1090	9.1665
956161	J1103	2.3696
956291	J1117	7.7056
956301	J1119	62.5320
956741	J1172	5.5460
956751	J1173	10.1080
956801	J1178	6.0593
DUCKCREEK	DUCKCREEK	0.4238
NEWTON	NEWTON	1.0552
FARMERCITY	FARMERCITY	0.0366
G-007A	G-007A	0.1678
VFT	VFT	0.4966

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
<b>CBM-W1</b>	CBM-W1	53.8430
<b>PRAIRIE</b>	PRAIRIE	2.4254
<b>COFFEEN</b>	COFFEEN	0.4276
<b>EDWARDS</b>	EDWARDS	0.1033
<b>CHEOAH</b>	CHEOAH	0.7237
<b>TILTON</b>	TILTON	0.5034
<b>MADISON</b>	MADISON	4.5562
<b>GIBSON</b>	GIBSON	0.7671
<b>CALDERWOOD</b>	CALDERWOOD	0.7206
<b>BLUEG</b>	BLUEG	3.1647
<b>TRIMBLE</b>	TRIMBLE	1.0251
<b>CATAWBA</b>	CATAWBA	0.4666

12.5.10 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
43527115	242936	05FOSTOR	AEP	242935	05E LIMA	AEP	1	ATSI-P7-1-TE-345-029A	tower	1318.0	131.22	132.28	DC	30.87

Bus #	Bus	MW Impact
238564	02BAYSG1	4.2891
238670	02DVBSG1 (Deactivation : 05/31/20)	19.2828
238885	02LEMOG1	4.9048
238886	02LEMOG2	4.9048
238887	02LEMOG3	4.9048
238888	02LEMOG4	4.9048
238979	02NAPMUN	5.2588
239293	02BS-PKR	0.3744
241902	Y1-069 GE	25.4390
244357	05GRANGER EL	0.2405
247548	V4-010 C	3.4518
247551	U4-028 C	1.6685
247552	U4-029 C	1.6685
247940	U4-028 E	11.1664
247941	U4-029 E	11.1664
247947	V4-010 E	23.1005
924791	AB2-131 C OP	3.1774
924792	AB2-131 E OP	5.1841
925751	AC1-051 C	0.7634
925752	AC1-051 E	5.1088
927181	AC1-212 C	-0.1293
927182	AC1-212 E	-1.2254
927183	AC1-212 BAT	1.5938
931951	AB1-107 1	53.3315
931961	AB1-107 2	127.7904
932051	AC2-015 C	5.3765
932052	AC2-015 E	6.3705
932791	AC2-103 C	7.9995
932792	AC2-103 E	53.5446
933721	AC2-195 C O1	2.9312
933722	AC2-195 E O1	1.7870
934252	AD1-052 E1	0.8479
934262	AD1-052 E2	0.8479
934461	AD1-070 C O1	6.4807
934462	AD1-070 E O1	30.4234
934761	AD1-103 C O1	13.4502
934762	AD1-103 E O1	90.0126
934891	AD1-118	15.3734
936722	AD2-091 BAT	8.2145
936752	AD2-096 BAT	2.8990
937021	AD2-136 C O1	6.0068

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
937022	AD2-136 E O1	40.1992
937381	AD2-191 C	2.8365
937382	AD2-191 E	18.9830
938911	AE1-119	120.7910
939161	AE1-146 C O1	8.3874
939162	AE1-146 E O1	3.9169
941741	AE2-174 C	2.4522
941742	AE2-174 E	11.4798
941761	AE2-176 C	9.7665
941762	AE2-176 E	6.5110
941781	AE2-181 C	3.6303
941782	AE2-181 E	2.4202
942042	AE2-216 BAT	9.0359
942661	AE2-282 C O1	5.7413
942662	AE2-282 E O1	3.0210
943011	AE2-324	0.9582
943961	AF1-064 C O2	6.1383
943962	AF1-064 E O2	3.0507
944551	AF1-120 C	1.8438
944552	AF1-120 E	0.9288
944571	AF1-122 C O2	0.9369
944572	AF1-122 E O2	1.2938
945401	AF1-205 C O2	1.7780
945402	AF1-205 E O2	1.1854
945411	AF1-206 C O2	8.3455
945412	AF1-206 E O2	5.5636
945623	AF1-227 BAT	9.1920
945641	AF1-229 C	19.6658
945642	AF1-229 E	13.1106
945651	AF1-230 C	1.6887
945652	AF1-230 E	1.1258
946203	AF1-285 BAT	2.9626
950311	G934 C	2.0802
950312	G934 E	8.3208
950351	J466	3.3642
950791	J201 C	0.4019
950792	J201 E	1.6075
950871	J246 C	0.1061
950872	J246 E	0.4245
950942	J325 E	0.4630
951531	J533 C	3.0320
951532	J533 E	12.1280
951571	J538 C	3.0651
951572	J538 E	12.2604
951941	J602 C	2.9824
951942	J602 E	16.1356
952201	J589 C	2.5144
952202	J589 E	13.6036
952312	J646 E	0.2016
952401	J752 C	1.7113
952402	J752 E	9.2587
952611	J717 C	2.8072

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
952612	J717 E	15.1878
952761	J728 C	2.6107
952762	J728 E	14.1433
952881	J758	12.4400
952971	J793	166.1490
953071	J794 C	0.1655
953072	J794 E	0.8954
953271	J701 C	0.8330
953272	J701 E	4.5066
953291	J796	22.3776
953321	J799	27.3426
953361	J806	11.5415
953421	J841	66.0161
953771	J832	7.6750
953781	J833	14.5640
953811	J839	12.2010
953941	J857	8.7328
954111	J875	18.6240
955021	J978 C	0.9842
955022	J978 E	5.3248
955071	J984 C	2.1634
955072	J984 E	11.7046
955121	J989	8.5104
955181	J996	11.2808
955261	J1005	18.7400
955351	J1014 C	5.1420
955352	J1014 E	3.0852
955591	J1043 C	1.1556
955592	J1043 E	20.4772
955621	J1046	8.4605
955721	J1056 C	4.7555
955722	J1056 E	25.7285
955781	J1062	33.8420
955811	J1065 C	2.2492
955812	J1065 E	12.1688
955831	J1068 C	4.4139
955832	J1068 E	23.8801
955961	J1083	6.2769
956011	J1088	14.0550
956021	J1089	16.1007
956031	J1090	8.9154
956161	J1103	2.1794
956291	J1117	7.3864
956301	J1119	60.8400
956741	J1172	5.1165
956751	J1173	10.2776
956801	J1178	5.8286
DUCKCREEK	DUCKCREEK	1.2897
NEWTON	NEWTON	1.6203
FARMERCITY	FARMERCITY	0.0686
G-007A	G-007A	0.5083
VFT	VFT	1.3996

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
<b>CBM-W1</b>	CBM-W1	39.8569
<b>PRAIRIE</b>	PRAIRIE	3.6291
<b>COFFEEN</b>	COFFEEN	0.7341
<b>EDWARDS</b>	EDWARDS	0.3783
<b>CHEOAH</b>	CHEOAH	0.6812
<b>TILTON</b>	TILTON	0.9236
<b>MADISON</b>	MADISON	3.5986
<b>GIBSON</b>	GIBSON	1.0194
<b>CALDERWOOD</b>	CALDERWOOD	0.6809
<b>BLUEG</b>	BLUEG	3.5692
<b>TRIMBLE</b>	TRIMBLE	1.1514
<b>CATAWBA</b>	CATAWBA	0.3882

12.5.11 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
43527209	242936	05FOSTOR	AEP	242942	05SBERWI	AEP	1	ATSI-P7-1-TE-345-029A	tower	1409.0	103.92	104.82	DC	27.95

Bus #	Bus	MW Impact
238564	02BAYSG1	3.2996
238670	02DVBSG1 (Deactivation : 05/31/20)	14.8526
238885	02LEMOG1	3.8494
238886	02LEMOG2	3.8494
238887	02LEMOG3	3.8494
238888	02LEMOG4	3.8494
238979	02NAPMUN	4.5725
239293	02BS-PKR	0.2880
241902	Y1-069 GE	19.9178
244357	05GRANGER EL	0.3157
247506	U2-041 C	1.8511
247548	V4-010 C	1.1936
247549	V3-028 C	0.3607
247607	V1-011 C	0.6381
247908	05BLCK-1 E	5.2826
247909	05BLCK-2 E	5.2826
247910	05BLCK-3 E	5.3737
247919	U2-041 E	12.3881
247947	V4-010 E	7.9881
247948	V3-028 E	0.5886
247959	V1-011 E	4.2706
893021	V2-006 C	1.4611
893022	V2-006 E	9.7780
925131	AB2-170 C O1	2.3447
925132	AB2-170 E O1	3.8256
926811	AC1-167 C O1	1.7090
926812	AC1-167 E O1	0.8291
931951	AB1-107 1	41.1576
931961	AB1-107 2	100.0555
932301	AC2-044 C	0.4326
932302	AC2-044 E	0.7059
932791	AC2-103 C	6.1370
932792	AC2-103 E	41.0778
934252	AD1-052 E1	0.5182
934262	AD1-052 E2	0.5182
934461	AD1-070 C O1	4.0438
934462	AD1-070 E O1	18.9833
934741	AD1-101 C O1	1.0483
934742	AD1-101 E O1	1.7107
934761	AD1-103 C O1	10.3185
934762	AD1-103 E O1	69.0549

Bus #	Bus	MW Impact
934891	AD1-118	12.0652
934901	AD1-119 C O1	0.9454
934902	AD1-119 E O1	1.5427
934981	AD1-130 C	5.4584
934982	AD1-130 E	2.6105
936601	AD2-075	7.2570
936671	AD2-086 C	6.5500
936672	AD2-086 E	4.3667
936721	AD2-091	2.3732
938681	AE1-090 C	1.0233
938682	AE1-090 E	1.3499
938761	AE1-102 C	0.8880
938762	AE1-102 E	0.5920
938911	AE1-119	94.7980
939161	AE1-146 C O1	8.4708
939162	AE1-146 E O1	3.9558
940031	AE1-245 C O1	0.5073
940032	AE1-245 E O1	3.3951
940841	AE2-072 C	3.8781
940842	AE2-072 E	2.5854
941741	AE2-174 C	0.8480
941742	AE2-174 E	3.9697
941761	AE2-176 C	5.8962
941762	AE2-176 E	3.9308
941781	AE2-181 C	3.4236
941782	AE2-181 E	2.2824
942041	AE2-216	2.6105
942661	AE2-282 C O1	5.2248
942662	AE2-282 E O1	2.7493
942801	AE2-298 C O1	0.7883
942802	AE2-298 E O1	0.5256
943012	AE2-324 BAT	3.7295
943181	AE2-322 C	1.0864
943182	AE2-322 E	0.5311
943581	AF1-029 C O2	0.3937
943582	AF1-029 E O2	0.2625
943791	AF1-047 C	0.5629
943792	AF1-047 E	0.3753
943951	AF1-063 C O2	0.7598
943952	AF1-063 E O2	0.4213
943961	AF1-064 C O2	4.9956
943962	AF1-064 E O2	2.4829
944091	AF1-077 C O2	3.2124
944092	AF1-077 E O2	2.0026
944551	AF1-120 C	1.6779
944552	AF1-120 E	0.8453
945401	AF1-205 C O2	1.5607
945402	AF1-205 E O2	1.0405
945411	AF1-206 C O2	7.5558
945412	AF1-206 E O2	5.0372
946052	AF1-270 BAT	4.6615
950351	J466	2.2722

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
950791	J201 C	0.2756
950792	J201 E	1.1026
950871	J246 C	0.0762
950872	J246 E	0.3048
950942	J325 E	0.3114
951531	J533 C	2.1772
951532	J533 E	8.7088
951571	J538 C	2.1210
951572	J538 E	8.4840
951941	J602 C	2.0608
951942	J602 E	11.1492
952201	J589 C	1.7865
952202	J589 E	9.6655
952312	J646 E	0.1342
952401	J752 C	1.1592
952402	J752 E	6.2718
952611	J717 C	1.9582
952612	J717 E	10.5941
952761	J728 C	1.8211
952762	J728 E	9.8655
952971	J793	110.6117
953071	J794 C	0.1166
953072	J794 E	0.6306
953271	J701 C	0.5647
953272	J701 E	3.0554
953291	J796	15.5111
953321	J799	17.9210
953361	J806	8.3321
953421	J841	45.7283
953771	J832	5.5020
953781	J833	9.5400
953811	J839	8.1520
954111	J875	12.4500
955121	J989	5.7912
955181	J996	7.4272
955261	J1005	12.9860
955351	J1014 C	3.5280
955352	J1014 E	2.1168
955621	J1046	5.4770
955721	J1056 C	3.0997
955722	J1056 E	16.7703
955781	J1062	21.9080
955831	J1068 C	2.9004
955832	J1068 E	15.6916
955961	J1083	4.4016
956011	J1088	9.7470
956021	J1089	11.1469
956031	J1090	6.1506
956161	J1103	1.4776
956291	J1117	5.1512
956301	J1119	41.8140
956741	J1172	3.5000

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
956751	J1173	6.8400
956801	J1178	4.0872
LGEE	LGEE	0.5551
WEC	WEC	0.8987
CBM-W2	CBM-W2	11.4414
NY	NY	0.7101
CBM-W1	CBM-W1	67.4164
TVA	TVA	0.9674
O-066	O-066	8.5814
CBM-S1	CBM-S1	6.3304
G-007	G-007	1.3260
MADISON	MADISON	3.3627
MEC	MEC	3.6356
CATAWBA	CATAWBA	0.0879

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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
43527080	256000	18ARGNTA	METC	243234	05TWIN B	AEP	1	AEP_P7-1_#10999	tower	956.0	235.14	235.96	DC	17.17

Bus #	Bus	MW Impact
238979	02NAPMUN	2.6670
247528	05COVRT1	8.0093
247529	05COVRT2	8.0093
247530	05COVRT3	8.0093
247531	05COVRT4	4.8070
247532	05COVRT5	4.8070
247533	05COVRT6	4.8070
247548	V4-010 C	1.2814
247551	U4-028 C	0.6020
247552	U4-029 C	0.6020
247940	U4-028 E	4.0288
247941	U4-029 E	4.0288
247947	V4-010 E	8.5752
925961	AC1-072	0.7430
926581	AC1-141	-5.0803
931951	AB1-107 1	20.5615
931961	AB1-107 2	46.4644
932791	AC2-103 C	2.1347
932792	AC2-103 E	14.2883
934252	AD1-052 E1	0.3531
934262	AD1-052 E2	0.3531
934461	AD1-070 C O1	1.7350
934462	AD1-070 E O1	8.1450
934761	AD1-103 C O1	3.5891
934762	AD1-103 E O1	24.0197
934891	AD1-118	5.2818
936601	AD2-075	38.5903
937021	AD2-136 C O1	2.1672
937022	AD2-136 E O1	14.5037
937381	AD2-191 C	1.0234
937382	AD2-191 E	6.8490
938911	AE1-119	41.5000
940262	AE2-008 BAT	5.1368
941741	AE2-174 C	0.9103
941742	AE2-174 E	4.2615
941761	AE2-176 C	4.1374
941762	AE2-176 E	2.7583
941781	AE2-181 C	2.0229
941782	AE2-181 E	1.3486
942661	AE2-282 C O1	3.1945
942662	AE2-282 E O1	1.6810
942682	AE2-284 BAT	4.9785

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
943023	AE2-325 BAT	3.1529
943961	AF1-064 C O2	1.3064
943962	AF1-064 E O2	0.6493
944551	AF1-120 C	1.0259
944552	AF1-120 E	0.5168
944963	AF1-161 BAT	3.0200
945401	AF1-205 C O2	0.9090
945402	AF1-205 E O2	0.6060
945411	AF1-206 C O2	4.6399
945412	AF1-206 E O2	3.0933
945641	AF1-229 C	1.9904
945642	AF1-229 E	1.3269
950311	G934 C	6.2940
950312	G934 E	25.1760
950351	J466	4.9536
950791	J201 C	0.7096
950792	J201 E	2.8386
950871	J246 C	0.2843
950872	J246 E	1.1372
950942	J325 E	0.6452
951531	J533 C	8.1228
951532	J533 E	32.4912
951571	J538 C	4.6164
951572	J538 E	18.4656
951941	J602 C	5.6940
951942	J602 E	30.8060
952161	J571	1.4700
952201	J589 C	6.1870
952202	J589 E	33.4730
952312	J646 E	0.2408
952401	J752 C	2.6160
952402	J752 E	14.1530
952611	J717 C	5.8873
952612	J717 E	31.8516
952761	J728 C	5.4751
952762	J728 E	29.6611
952881	J758	42.8000
952971	J793	199.4501
953071	J794 C	0.3779
953072	J794 E	2.0447
953271	J701 C	1.2876
953272	J701 E	6.9664
953291	J796	44.0955
953321	J799	24.4793
953361	J806	29.6510
953421	J841	129.2663
953771	J832	20.2930
953781	J833	12.8100
953811	J839	15.4740
953941	J857	25.7547
954111	J875	22.3290
954381	J906 C	3.6412

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
954382	J906 E	19.6998
954591	J937	141.2079
955021	J978 C	3.3776
955022	J978 E	18.2734
955071	J984 C	6.5458
955072	J984 E	35.4142
955121	J989	13.7016
955181	J996	10.2152
955261	J1005	36.8960
955341	J1013	13.7952
955351	J1014 C	8.7705
955352	J1014 E	5.2623
955591	J1043 C	4.4194
955592	J1043 E	78.3118
955621	J1046	5.3620
955721	J1056 C	3.7325
955722	J1056 E	20.1935
955781	J1062	21.4480
955801	J1064 C	7.0649
955802	J1064 E	38.2231
955811	J1065 C	6.4653
955812	J1065 E	34.9787
955831	J1068 C	4.1527
955832	J1068 E	22.4673
955861	J1071	23.0470
955961	J1083	13.3413
956011	J1088	27.6915
956021	J1089	31.2001
956031	J1090	16.2342
956161	J1103	3.3690
956291	J1117	14.9624
956301	J1119	107.7540
956741	J1172	8.7730
956751	J1173	11.5128
956801	J1178	12.3883
DUCKCREEK	DUCKCREEK	4.5427
NEWTON	NEWTON	2.9785
FARMERCITY	FARMERCITY	0.1838
G-007A	G-007A	2.1554
VFT	VFT	5.8308
CBM-W1	CBM-W1	47.5505
PRAIRIE	PRAIRIE	7.0852
COFFEEN	COFFEEN	1.6262
EDWARDS	EDWARDS	1.4340
CHEOAH	CHEOAH	0.5666
TILTON	TILTON	1.9486
GIBSON	GIBSON	1.2198
CALDERWOOD	CALDERWOOD	0.5706
BLUEG	BLUEG	2.9807
TRIMBLE	TRIMBLE	0.9472
CATAWBA	CATAWBA	0.2233

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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
42224229	907060	X1-027A_AT12	ATSI	238569	02BEAVER	ATSI	1	ATSI-P2-3-OEC-345-031	breaker	1646.0	114.36	115.29	DC	33.4

Bus #	Bus	MW Impact
238564	02BAYSG1	3.9432
238670	02DVBSG1 (Deactivation : 05/31/20)	27.1070
238885	02LEMOG1	4.5115
238886	02LEMOG2	4.5115
238887	02LEMOG3	4.5115
238888	02LEMOG4	4.5115
238979	02NAPMUN	5.4078
239276	02COLLW 11	-2.3669
239293	02BS-PKR	0.3442
239297	02CPPW41	-2.6666
241902	Y1-069 GE	25.1299
244357	05GRANGER EL	0.3074
247548	V4-010 C	2.0328
247551	U4-028 C	1.0072
247552	U4-029 C	1.0072
247940	U4-028 E	6.7405
247941	U4-029 E	6.7405
247947	V4-010 E	13.6038
893021	V2-006 C	1.7067
893022	V2-006 E	11.4219
931951	AB1-107 1	49.1692
931961	AB1-107 2	126.2381
932791	AC2-103 C	20.4163
932792	AC2-103 E	136.6559
934252	AD1-052 E1	0.4577
934262	AD1-052 E2	0.4577
934461	AD1-070 C O1	3.7987
934462	AD1-070 E O1	17.8327
934761	AD1-103 C O1	34.3273
934762	AD1-103 E O1	229.7288
934891	AD1-118	14.1407
936601	AD2-075	10.7104
937021	AD2-136 C O1	3.6259
937022	AD2-136 E O1	24.2660
937381	AD2-191 C	1.7123
937382	AD2-191 E	11.4589
938911	AE1-119	111.1055
939161	AE1-146 C O1	8.1301
939162	AE1-146 E O1	3.7967
940841	AE2-072 C	4.5998

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
940842	AE2-072 E	3.0666
941741	AE2-174 C	1.4441
941742	AE2-174 E	6.7604
941781	AE2-181 C	4.0881
941782	AE2-181 E	2.7254
942661	AE2-282 C O1	6.2417
942662	AE2-282 E O1	3.2843
943951	AF1-063 C O2	0.9622
943952	AF1-063 E O2	0.5335
943961	AF1-064 C O2	5.8367
943962	AF1-064 E O2	2.9009
944551	AF1-120 C	2.0044
944552	AF1-120 E	1.0098
945401	AF1-205 C O2	1.8473
945402	AF1-205 E O2	1.2316
945411	AF1-206 C O2	9.0270
945412	AF1-206 E O2	6.0180
945641	AF1-229 C	4.5176
945642	AF1-229 E	3.0117
952312	J646 E	0.1437
952971	J793	118.4115
953321	J799	19.0191
953781	J833	10.0920
953811	J839	8.7240
954111	J875	13.0680
955181	J996	7.7392
955621	J1046	5.6675
955721	J1056 C	3.2616
955722	J1056 E	17.6464
955781	J1062	22.6700
955831	J1068 C	3.0813
955832	J1068 E	16.6707
956751	J1173	7.1744
LGEE	LGEE	2.1422
CPL	CPL	0.4631
WEC	WEC	1.7256
CBM-W2	CBM-W2	31.1138
NY	NY	1.9427
CBM-W1	CBM-W1	102.4944
TVA	TVA	4.0390
O-066	O-066	20.2070
CBM-S2	CBM-S2	6.9013
CBM-S1	CBM-S1	25.9519
G-007	G-007	3.0992
MADISON	MADISON	2.0805
MEC	MEC	7.6701

12.5.14 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
41027241	945640	AF1-229 TAP	AEP	238745	02GALION	ATSI	1	ATSI-P7-1-TE-345-029A	tower	1409.0	103.09	103.97	DC	27.42

Bus #	Bus	MW Impact
238564	02BAYSG1	3.2612
238670	02DVBSG1 (Deactivation : 05/31/20)	14.3755
238885	02LEMOG1	3.7004
238886	02LEMOG2	3.7004
238887	02LEMOG3	3.7004
238888	02LEMOG4	3.7004
238979	02NAPMUN	4.4923
239293	02BS-PKR	0.2847
241902	Y1-069 GE	19.1335
244357	05GRANGER EL	0.3785
247506	U2-041 C	1.8110
247548	V4-010 C	2.6071
247549	V3-028 C	0.3529
247551	U4-028 C	1.2492
247552	U4-029 C	1.2492
247607	V1-011 C	0.6602
247908	05BLCK-1 E	5.1911
247909	05BLCK-2 E	5.1911
247910	05BLCK-3 E	5.2806
247911	05TIMB G E	5.5119
247919	U2-041 E	12.1197
247926	U1-059 E	3.3795
247940	U4-028 E	8.3600
247941	U4-029 E	8.3600
247942	W1-056 E	1.2430
247947	V4-010 E	17.4478
247948	V3-028 E	0.5758
247959	V1-011 E	4.4185
893021	V2-006 C	1.5503
893022	V2-006 E	10.3748
925131	AB2-170 C O1	2.2939
925132	AB2-170 E O1	3.7427
925751	AC1-051 C	0.4341
925752	AC1-051 E	2.9049
926811	AC1-167 C O1	1.7584
926812	AC1-167 E O1	0.8531
926901	AC1-176 C	0.3468
926902	AC1-176 E	2.3316
931951	AB1-107 1	40.6520
931961	AB1-107 2	96.1154
932051	AC2-015 C	2.9368

Bus #	Bus	MW Impact
932052	AC2-015 E	3.4797
932301	AC2-044 C	0.4251
932302	AC2-044 E	0.6936
932791	AC2-103 C	5.9408
932792	AC2-103 E	39.7648
934252	AD1-052 E1	0.6219
934262	AD1-052 E2	0.6219
934461	AD1-070 C O1	5.8291
934462	AD1-070 E O1	27.3645
934741	AD1-101 C O1	1.1481
934742	AD1-101 E O1	1.8735
934761	AD1-103 C O1	9.9887
934762	AD1-103 E O1	66.8477
934891	AD1-118	11.5983
934901	AD1-119 C O1	0.9670
934902	AD1-119 E O1	1.5779
934981	AD1-130 C	5.3401
934982	AD1-130 E	2.5540
936601	AD2-075	7.0055
936671	AD2-086 C	6.4081
936672	AD2-086 E	4.2721
936721	AD2-091	2.3218
937021	AD2-136 C O1	4.4971
937022	AD2-136 E O1	30.0962
937381	AD2-191 C	2.1236
937382	AD2-191 E	14.2121
938681	AE1-090 C	1.0011
938682	AE1-090 E	1.3206
938691	AE1-091 C	2.8793
938692	AE1-091 E	3.8695
938761	AE1-102 C	0.8726
938762	AE1-102 E	0.5818
938911	AE1-119	91.1295
939161	AE1-146 C O1	12.0475
939162	AE1-146 E O1	5.6261
940031	AE1-245 C O1	0.5249
940032	AE1-245 E O1	3.5127
940841	AE2-072 C	4.0148
940842	AE2-072 E	2.6765
941741	AE2-174 C	1.8521
941742	AE2-174 E	8.6707
941761	AE2-176 C	6.6051
941762	AE2-176 E	4.4034
941781	AE2-181 C	3.3659
941782	AE2-181 E	2.2439
942041	AE2-216	2.5540
942661	AE2-282 C O1	5.1271
942662	AE2-282 E O1	2.6978
942801	AE2-298 C O1	0.8162
942802	AE2-298 E O1	0.5441
943012	AE2-324 BAT	3.9244
943181	AE2-322 C	1.1178

Bus #	Bus	MW Impact
943182	AE2-322 E	0.5464
943581	AF1-029 C O2	0.4076
943582	AF1-029 E O2	0.2717
943791	AF1-047 C	0.5792
943792	AF1-047 E	0.3861
943951	AF1-063 C O2	0.7562
943952	AF1-063 E O2	0.4192
943961	AF1-064 C O2	4.9472
943962	AF1-064 E O2	2.4588
944091	AF1-077 C O2	3.3140
944092	AF1-077 E O2	2.0659
944551	AF1-120 C	1.6465
944552	AF1-120 E	0.8294
945401	AF1-205 C O2	1.5337
945402	AF1-205 E O2	1.0225
945411	AF1-206 C O2	7.4128
945412	AF1-206 E O2	4.9418
945641	AF1-229 C	29.9711
945642	AF1-229 E	19.9807
945651	AF1-230 C	1.0430
945652	AF1-230 E	0.6953
946052	AF1-270 BAT	4.9200
950351	J466	2.1945
950791	J201 C	0.2663
950792	J201 E	1.0653
950942	J325 E	0.3008
951571	J538 C	2.0559
951572	J538 E	8.2236
951941	J602 C	1.9915
951942	J602 E	10.7745
952201	J589 C	1.7272
952202	J589 E	9.3448
952312	J646 E	0.1295
952401	J752 C	1.1196
952402	J752 E	6.0574
952611	J717 C	1.8923
952612	J717 E	10.2378
952761	J728 C	1.7598
952762	J728 E	9.5337
952971	J793	106.7912
953071	J794 C	0.1127
953072	J794 E	0.6095
953271	J701 C	0.5455
953272	J701 E	2.9512
953291	J796	14.9877
953321	J799	17.3219
953361	J806	8.0654
953421	J841	44.1839
953781	J833	9.2240
953811	J839	7.8720
954111	J875	12.0525
955121	J989	5.5952

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
955181	J996	7.1984
955261	J1005	12.5500
955351	J1014 C	3.4125
955352	J1014 E	2.0475
955621	J1046	5.2745
955721	J1056 C	2.9999
955722	J1056 E	16.2301
955781	J1062	21.0980
955831	J1068 C	2.8027
955832	J1068 E	15.1633
955961	J1083	4.2567
956011	J1088	9.4200
956021	J1089	10.7729
956031	J1090	5.9481
956161	J1103	1.4272
956291	J1117	4.9816
956301	J1119	40.4220
956741	J1172	3.3815
956751	J1173	6.6232
956801	J1178	3.9526
LGEE	LGEE	0.5152
WEC	WEC	0.8647
CBM-W2	CBM-W2	10.8354
NY	NY	0.6802
CBM-W1	CBM-W1	64.9144
TVA	TVA	0.8862
O-066	O-066	8.2723
CBM-S1	CBM-S1	5.8192
G-007	G-007	1.2782
MADISON	MADISON	3.3022
MEC	MEC	3.4831
CATAWBA	CATAWBA	0.0980



# Short Circuit

## 12.6 Short Circuit

The following Breakers are overdutied:

None

# Affected Systems

## **13 Affected Systems**

### **13.1 LG&E**

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

### **13.2 MISO**

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

### **13.3 TVA**

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

### **13.4 Duke Energy Progress**

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

### **13.5 NYISO**

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

**Attachment 1**  
System Configuration