



**Generation Interconnection
Feasibility Study Report
for
Queue Project AF1-282
STUART-CLINTON 345 KV
60 MW Capacity / 100 MW Energy**

January, 2020

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1 Preface

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

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

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

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

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

2 General

The Interconnection Customer (IC), has proposed a Solar generating facility located at 39.071048 latitude and - 83.794535 longitude in Hillsboro, Highland County, Ohio. The installed facilities will have a total capability of 100 MW with 60 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is August 20, 2022. **This study does not imply The Dayton Power & Light Company (Dayton) commitment to this in-service date.**

Queue Number	AF1-282
Project Name	STUART-CLINTON 345 KV
State	Ohio
County	Highland
Transmission Owner	Dayton
MFO	100
MWE	100
MWC	60
Fuel	Solar
Basecase Study Year	2023

2.1 Point of Interconnection

AF1-282 will interconnect with The Dayton Power and Light Company transmission system at Dayton's Clay 345 kV Substation. There is a proposed interconnection project, AC1-085, that requires the construction of the Clay Substation three breaker ring bus. The Point of Interconnection (POI) will be the 345kV takeoff structure leaving the Clay Substation. Dayton will own the takeoff structure and all attachment hardware. The Interconnection Customer will own the generator lead line conductor terminating onto the structure.

Attachment 1 shows a one-line diagram of the proposed primary direct connection of the generation project to The Dayton Power and Light transmission system. **Attachment 2** provides the proposed location for the point of interconnection. IC will be responsible for constructing all of the facilities on its side of the POI including the attachment line.

2.2 Cost Summary

The AF1-282 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$15,000
Direct Connection Network Upgrade	\$0
Non Direct Connection Network Upgrades	\$1,675,000
Total Costs	\$1,690,000

In addition, the AF1-282 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	\$135,095,000

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

3 Transmission Owner Scope of Work

4 Attachment Facilities

This report assumes that the Interconnection Customer will construct and own the attachment line from its generating facility into the proposed Point of Interconnection as depicted on the one-line diagram in Attachment 1. The IC will also be responsible for the fiber/OPGW that Dayton requires on the generator line for the communication assisted trip scheme. The costs included below are for the necessary protection system review and any subsequent field changes needed to coordinate with IC 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
Protection System Review and Field Commissioning.	\$15,000
Total Attachment Facility Costs	\$15,000

5 Direct Connection Cost Estimate

The AC1-085 project will be responsible for the connection facilities, therefore, there is no Direct Connection scope of work required for this project.

Should the AC1-085 project elect not to move forward, the AF1-282 project would assume the responsibility of the interconnection facilities.

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
None	\$0
Total Direct Connection Facility Costs	\$0

6 Non-Direct Connection Cost Estimate

The total Non-Direct Connection cost estimate for the AF1-282 project is approximately \$1,555,000.

The scope of the non-direct connection work at the Clay 345kV Substation built for the interconnection of project AC1-085 involves expanding the 345 kV ring bus to accommodate a new 345 kV breaker bay position (fourth) and 345 kV circuit breaker. Dayton will also install revenue class 345 kV metering, fiber line relaying, and make necessary SCADA RTU upgrades to interconnect the AF1-282 generation. Remote end relay setting changes will need to be made at the Stuart and Clinton Substations to facilitate the interconnection of the new generation.

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
Clay Substation: 345 kV Ring Bus Expansion to accommodate additional (4 th) Circuit Breaker Bay including metering, protection and control, and SCADA RTU upgrades.	\$1,525,000
Stuart Substation: Protection System Settings changes	\$75,000
Clinton Substation: Protection System Settings changes	\$75,000
Total Non-Direct Connection Facility Costs	\$1,675,000

7 Schedule

Based on the extent of the Dayton Non-Direct Connection work required to support the AF1-282 generation project, it is expected to take a minimum of **eighteen (18) months** from the date of a fully executed Interconnection Construction Service Agreement to complete the installation. This includes the requirement for the IC to make a preliminary payment to Dayton which funds the Non-Direct Connection work and the first three months of engineering design that is related to the construction of the Attachment Facilities. It further assumes that the IC will provide all rights-of-way, permits, easements, etc. that will be needed. A further assumption is 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 Attachment Facilities and Non-Direct Connection work, and that all system outages will be allowed when requested. Should the AC1-085 project elect not to move forward, the timeline would increase to twenty-four (24) months as that is what would be required to construct the ring bus switchyard.

8 Transmission Owner Analysis

Power Flow Analysis

PJM performed a power flow analysis of the transmission system using a 2023 summer peak load flow model and the results were verified by Dayton. Additionally, Dayton performed an analysis of its underlying transmission <100 kV system. At the Primary POI, the [QUEUE] project contributes to overloads as shown in the “Summer Peak Load Flow” section of the report. The estimated cost of system reinforcements necessary to mitigate these overloads are also provided. At the Primary POI, the [QUEUE] project does not create any issues on the Dayton transmission <100 kV system.

Short Circuit Analysis

PJM performed a short circuit analysis and the results were verified by Dayton. The connection of [QUEUE] project to the system does not result in any newly overdutied circuit breakers on the Dayton transmission system and does not have a significant fault current contribution to existing overdutied circuit breakers.

Stability Analysis

PJM will complete a dynamic stability analysis, if necessary, as part of the System Impact Study. The results of this analysis will be reviewed by Dayton. Should stability concerns be identified in PJM’s study, Dayton will develop appropriate system reinforcement(s) and included the estimated cost of any reinforcement(s) in Dayton’s System Impact Study report.

9 Interconnection Customer Requirements

Requirement from the PJM Open Access Transmission Tariff:

1. An Interconnection Customer entering the New Services Queue on or after October 1, 2012 with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.
2. The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Section 4 of PJM Manual 14D for additional information.

System Protection

The IC must design its Customer Facilities in accordance with all applicable standards, including the standards in Dayton's "Requirements for the connection of Facilities to the Dayton Power & Light company Transmission System" document located at: <https://www.pjm.com/planning/design-engineering/to-tech-standards/private-dayton.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.

Compliance Issues and Interconnection Customer Requirements

The Dayton Power and Light Company (DP&L) has prepared this Facilities Connection Requirements document to ensure compliance with North American Electric Reliability Council (NERC) Reliability Standards and applicable Regional Reliability Organization, sub regional, Power Pool, and individual Transmission Owner planning criteria and facility connection requirements in compliance to NERC Standard FAC-001-2. These connection requirements apply to all generation facilities, transmission facilities, and end-users connecting to the DP&L transmission system. Detailed information outlining DP&L interconnection requirements can be reviewed utilizing the following link:

<https://www.pjm.com/~media/planning/plan-standards/private-dayton/dayton-facilities-connection-requirements.ashx>

Power Factor Requirements

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

10.2 Dayton Requirements

The Interconnection Customer will be required to comply with all Dayton Revenue Metering Requirements for Generation Interconnection Customers as outlined in the link below. The Revenue Metering Requirements may be found within the Dayton Power & Light Co. "Requirements for the Connection of Facilities to the Dayton Power & Light Co. Transmission System" document located at the following link:

<http://www.pjm.com/~media/planning/plan-standards/private-dayton/dayton-facilities-connection-requirements.ashx>

<http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx>

11 Network Impacts

The Queue Project AF1-282 was evaluated as a 100.0 MW (Capacity 60.0 MW) injection tapping the Stuart to Clinton 345 kV line in the Dayton area. Project AF1-282 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-282 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

Summer Peak Load Flow

12 Generation Deliverability

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

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 DC	MW IMPACT
42601372	253100	09ATLNTA	345.0	DAY	253110	09ADKINS	345.0	DAY	1	DAY_P1_AC1-085_ST_FSA-B	single	1195.0	99.96	100.69	DC	8.73
42601375	253100	09ATLNTA	345.0	DAY	253110	09ADKINS	345.0	DAY	1	DAY_P1_161_B3_1	single	1195.0	99.65	100.38	DC	8.74

13 Multiple Facility Contingency

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

ID	FROM BUS#	FROM BUS	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 DC	MW IMPACT
42286758	253014	09CLINTO	345.0	DAY	253027	09GREENE	345.0	DAY	1	DAY_P4_L34542D	breaker	1374.0	99.3	102.34	DC	41.76
42286759	253014	09CLINTO	345.0	DAY	253027	09GREENE	345.0	DAY	1	DAY_P4_L34551F	breaker	1374.0	99.26	102.31	DC	41.75
42286760	253014	09CLINTO	345.0	DAY	253027	09GREENE	345.0	DAY	1	DAY_P4_L34543-1	breaker	1374.0	98.99	102.03	DC	41.77
46923522	253014	09CLINTO	345.0	DAY	253027	09GREENE	345.0	DAY	1	DEOK_P5-5_FOSTER345 BUS1+RELAYFAIL	breaker	1374.0	98.5	101.48	DC	40.79
42286821	926060	AC1-085 TAP	345.0	DAY	942090	AE2-221 TAP	345.0	DAY	1	DEOK_P5-5_FOSTER345 BUS1+RELAYFAIL	breaker	1374.0	98.23	101.49	DC	44.69
42286822	926060	AC1-085 TAP	345.0	DAY	942090	AE2-221 TAP	345.0	DAY	1	DEOK_P2-3_C2 1349_FOSTER	breaker	1374.0	97.65	100.93	DC	44.94
42286860	944520	AF1-117 TAP	345.0	DAY	253100	09ATLNTA	345.0	DAY	1	AEP_P4_#6774_05MAR QUI 345_D	breaker	1195.0	99.32	100.23	DC	10.83

14 Contribution to Previously Identified Overloads

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

ID	FROM BUS#	FROM BUS	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 DC	MW IMPACT
43595955	243453	05BEATTY	345.0	AEP	243454	05BIXBY	345.0	AEP	1	AEP_P4_#3196_05BEATTY 345_302E	breaker	1203.0	135.64	136.95	DC	15.76
43595956	243453	05BEATTY	345.0	AEP	243454	05BIXBY	345.0	AEP	1	AEP_P4_#10715_05COLE 345_C	breaker	1203.0	135.73	136.99	DC	15.18
43596015	243453	05BEATTY	345.0	AEP	244022	05COLE	345.0	AEP	1	AEP_P4_#3195_05BEATTY 345_304E	breaker	1203.0	123.74	124.84	DC	13.17
43596016	243453	05BEATTY	345.0	AEP	244022	05COLE	345.0	AEP	1	AEP_P4_#8094_05BIXBY 345_C	breaker	1203.0	121.86	122.92	DC	12.74
42800335	253014	09CLINTO	345.0	DAY	253027	09GREENE	345.0	DAY	1	DAY_P734569 34598 34524	tower	1374.0	110.32	113.16	DC	38.87
42800336	253014	09CLINTO	345.0	DAY	253027	09GREENE	345.0	DAY	1	DEOK_P7-1_C5 4524FOSTRSUGRCRK34598FOS TERBATH	tower	1374.0	103.14	105.88	DC	37.65

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
41062051	253038	09KILLN	345.0	DAY	242938	05MARQUI	345.0	AEP	1	DAY_P7_34506 34542_1-A	tower	1372.0	106.47	107.14	DC	20.34
41062052	253038	09KILLN	345.0	DAY	242938	05MARQUI	345.0	AEP	1	DAY_P7_34506 34542_1-B	tower	1372.0	103.89	104.56	DC	20.34
42800299	253077	09STUART	345.0	DAY	253038	09KILLN	345.0	DAY	1	DAY_P7_34506 34542_1-A	tower	1374.0	106.32	106.99	DC	20.34
42800300	253077	09STUART	345.0	DAY	253038	09KILLN	345.0	DAY	1	DAY_P7_34506 34542_1-B	tower	1374.0	103.74	104.41	DC	20.34
42800350	253100	09ATLNTA	345.0	DAY	253110	09ADKINS	345.0	DAY	1	DAY_P7_495	tower	1195.0	112.31	113.55	DC	14.81
41061997	253110	09ADKINS	345.0	DAY	243453	05BEATTY	345.0	AEP	1	DAY_P7_495	tower	1372.0	123.21	123.69	DC	14.55
41688385	253110	09ADKINS	345.0	DAY	243453	05BEATTY	345.0	AEP	1	DAY_P4_L34526-3	breaker	1372.0	120.27	120.74	DC	14.31
42800326	926060	AC1-085 TAP	345.0	DAY	942090	AE2-221 TAP	345.0	DAY	1	DAY_P734569 34598 34524	tower	1374.0	110.47	113.6	DC	42.88
42800327	926060	AC1-085 TAP	345.0	DAY	942090	AE2-221 TAP	345.0	DAY	1	DEOK_P7-1_C5 4524FOSTRSUGRCRK34598FOS TERBATH	tower	1374.0	104.43	107.46	DC	41.55
42286660	942090	AE2-221 TAP	345.0	DAY	253014	09CLINTO	345.0	DAY	1	DEOK_P5-5_FOSTER345 BUS1+RELAYFAIL	breaker	1374.0	110.98	114.24	DC	44.69
42286661	942090	AE2-221 TAP	345.0	DAY	253014	09CLINTO	345.0	DAY	1	DEOK_P2-3_C2 1349_FOSTER	breaker	1374.0	110.47	113.75	DC	44.94
42800260	942090	AE2-221 TAP	345.0	DAY	253014	09CLINTO	345.0	DAY	1	DAY_P734569 34598 34524	tower	1374.0	122.65	125.77	DC	42.88
42800261	942090	AE2-221 TAP	345.0	DAY	253014	09CLINTO	345.0	DAY	1	DEOK_P7-1_C5 4524FOSTRSUGRCRK34598FOS TERBATH	tower	1374.0	116.39	119.42	DC	41.55
42800469	944520	AF1-117 TAP	345.0	DAY	253100	09ATLNTA	345.0	DAY	1	DAY_P7_495	tower	1195.0	102.12	103.4	DC	15.25

15 Potential Congestion due to Local Energy Deliverability

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

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

ID	FROM BUS#	FROM BUS	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
43596307	243453	05BEATTY	345.0	AEP	243454	05BIXBY	345.0	AEP	1	AEP_P1-2_#714	operation	1203.0	126.68	127.88	DC	14.44
43596313	243453	05BEATTY	345.0	AEP	243454	05BIXBY	345.0	AEP	1	Base Case	operation	1096.0	100.42	100.89	DC	11.38
43596432	243453	05BEATTY	345.0	AEP	244022	05COLE	345.0	AEP	1	AEP_P1-2_#713	operation	1203.0	115.22	116.26	DC	12.5
42601452	253014	09CLINTO	345.0	DAY	253027	09GREENE	345.0	DAY	1	DAY_P1_160_B3	operation	1374.0	98.37	101.42	DC	41.76

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 PROJECTIONS LOADIN G %	POST PROJECTIONS LOADIN G %	AC DC	MW IMPACT
41379011	253110	09ADKINS	345.0	DAY	243453	05BEATTY	345.0	AEP	1	DAY_P1_AC1-085_ST_FSA-B	operation	1372.0	120.05	120.52	DC	14.29
42601547	926060	AC1-085 TAP	345.0	DAY	942090	AE2-221 TAP	345.0	DAY	1	DAY_P1-2_#762	operation	1374.0	97.19	100.49	DC	45.37
42601328	941510	AE2-148 TAP	345.0	DAY	945630	AF1-228 TAP	345.0	DAY	1	DAY_P1-2_#762	operation	1374.0	108.27	108.78	DC	15.58
42601309	942090	AE2-221 TAP	345.0	DAY	253014	09CLINTO	345.0	DAY	1	DAY_P1-2_#762	operation	1374.0	110.25	113.55	DC	45.37
42601314	942090	AE2-221 TAP	345.0	DAY	253014	09CLINTO	345.0	DAY	1	Base Case	operation	1255.0	99.88	103.39	DC	44.04
41379070	945630	AF1-228 TAP	345.0	DAY	243453	05BEATTY	345.0	AEP	1	DAY_P1-2_#762	operation	1374.0	116.15	116.66	DC	15.58

16 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
41061997,41688385	9	09ADKINS 345.0 kV - 05BEATTY 345.0 kV Ckt 1	<u>AEP</u> AEPO0004a (565) : Rebuild 13.0 miles of 2-983.1 ACAR 30/7 Rail 5 conductor on Beatty-Adkins circuit (3.7 miles of double circuit construction). Bare minimum conductor is 2-1024.5 ACAR 30/7 Rail1 which provide no additional margin. Upgrade other elements previously rated by DP&L. Ratings validation of this equipment is currently underway. This will require relay upgrades at Beatty and Adkins. Project Type : FAC Cost : \$55,000,000 Time Estimate : 24-36 Months AEPO0004b (566) : Replace equipment at Adkins station formerly owned by DP&L that is now owned by AEP. Further investigation is required to see exactly what equipment is to be replaced and whether it can be simply re-rated according to AEP's standards. Project Type : FAC Cost : \$1,000,000 Time Estimate : 36-48 Months	\$56,000,000
42800300,42800299	8	09STUART 345.0 kV - 09KILLEN 345.0 kV Ckt 1	<u>DAY</u> DAYr190028 (2410) : Reconductor Stuart-Killen 345kV line with 795 ACCR high temperature conductor in a twin bundle Project Type : FAC Cost : \$31,000,000 Time Estimate : 42.0 Months DAYr190029 (2411) : Replace 2000A wave trap with 3000A at both Stuart and Killen substations Project Type : FAC Cost : \$200,000 Time Estimate : 12.0 Months DAYr190030 (2412) : Replace substation riser conductor with 2500AAC (parallel) at both Stuart and Killen substations Project Type : FAC Cost : \$200,000 Time Estimate : 12.0 Months DAYr190031 (2413) : Replace 2000A disconnect switch at Killen with 1600A (parallel) Project Type : FAC Cost : \$125,000 Time Estimate : 12.0 Months	\$31,525,000
46923522,42286760, 42800335,42800336, 42286758,42286759	2	09CLINTO 345.0 kV - 09GREENE 345.0 kV Ckt 1	<u>DAY</u> r190005 (2398) : Replace 2000A wave trap with 3000A Project Type : FAC Cost : \$100,000 Time Estimate : 12.0 Months r190007 (2400) : Replace 2000A wave trap with 3000A Project Type : FAC Cost : \$100,000 Time Estimate : 12.0 Months	\$200,000

ID	Index	Facility	Upgrade Description	Cost
42800327,42800326, 42286821,42286822	3	AC1-085 TAP 345.0 kV - AE2-221 TAP 345.0 kV Ckt 1	<u>DAY</u> DAYr190050 (2432) : Replace 2000A wave traps with 3000A at AC1-085 sub and AE2-221 sub Project Type : FAC Cost : \$200,000 Time Estimate : 12.0 Months DAYr190051 (2433) : Replace AC1-085 and AE2-221 substation riser conductor with 2500AAC (parallel) Project Type : FAC Cost : \$200,000 Time Estimate : 12.0 Months DAYr190052 (2434) : Reconductor the AC1-085 Tap to AE2-221 Tap line with twin bundle 1351 ACSR Project Type : FAC Cost : \$19,500,000 Time Estimate : 18.0 Months	\$19,900,000
42286860,42800469	4	AF1-117 TAP 345.0 kV - 09ATLNTA 345.0 kV Ckt 1	<u>DAY</u> DAYr190027 (2409) : Replace Atlanta metering equipment to increase thermal line rating Project Type : FAC Cost : \$100,000 Time Estimate : 12.0 Months	\$100,000
43595955,43595956	5	05BEATTY 345.0 kV - 05BIXBY 345.0 kV Ckt 1	<u>AEP</u> AEPO0003a (564) : Upgrade/Replace Three 345kV 1600A switches and 2-954 ACSR risers at Beatty station Project Type : FAC Cost : \$1,500,000 Time Estimate : 12-18 Months AEPO0003b (708) : 1) A sag study will be required on the 9.5 miles of ACSR ~ 954 ~ 45/7 ~ Bundled - Conductor Section 1 to mitigate the overload. Depending on the sag study results, the cost for this upgrade is expected to be between \$38,000 (no remediation required, just sag study) and \$19 million (complete line reconductor/rebuild). New rating after sag study: S/N:1409 S/E: 1887 . Time Estimate: a) Sag Study: 6-12 months. b) Rebuild: The standard time required for construction differs from state to state. An approximate construction time would be 24 to 36 months after signing an interconnection agreement. Project Type : FAC Cost : \$38,000 Time Estimate : 12-18 Months AEPO0003c (709) : Upgrade/Replace four 345kV 2000A Bixby switches Project Type : FAC Cost : \$1,500,000 Time Estimate : 12-18 Months AEPO0003d (710) : Replace 2-954 ACSR risers at Bixby station Project Type : FAC Cost : \$175,000 Time Estimate : 12-19 Months	\$3,213,000

ID	Index	Facility	Upgrade Description	Cost
43596015,43596016	6	05BEATTY 345.0 kV - 05COLE 345.0 kV Ckt 1	<u>AEP</u> AEPO0001a (560) : Upgrade/Replace 3-345kV 1600A switches at Beatty station Project Type : FAC Cost : \$1,500,000 Time Estimate : 12-18 Months AEPO0001b (561) : 1) A sag study will be required on the 9.7 miles of ACSR ~ 954 ~ 45/7 ~ Bundled - Conductor Section 1 to mitigate the overload. Depending on the sag study results, the cost for this upgrade is expected to be between \$42,000 (no remediation required, just sag study) and \$40 million (complete line reconductor/rebuild). New rating after sag study: S/N:1409 S/E: 1887 . Time Estimate: a) Sag Study: 6-12 months. b) Rebuild: The standard time required for construction differs from state to state. An approximate construction time would be 24 to 36 months after signing an interconnection agreement. Project Type : FAC Cost : \$42,000 Time Estimate : 6-12 Months AEPO0001c (711) : Replace 2-954 ACSR risers at Beatty station Project Type : FAC Cost : \$175,000 Time Estimate : 12-20 Months	\$1,717,000

ID	Index	Facility	Upgrade Description	Cost
41062052,41062051	7	09KILLEN 345.0 kV - 05MARQUI 345.0 kV Ckt 1	<u>AEP</u> AEPO0007a (569) : Perform sag study on Don Marquis-Killen 345kV circuit, 32.1 miles of 2-983.1 ACAR 30/7 Rail5 conductor. Since Killen will be retired, the conductor between Don Marquis and Stuart will become a complete circuit and the whole circuit will need to be sag studied. Perform sag study on Killen-Stuart 345kV circuit, 15.2 miles of 2-983.1 ACAR 30/7 Rail5 conductor. Project Type : FAC Cost : \$190,000 Time Estimate : 6-12 Months <u>DAY</u> DAYr190042 (2424) : Replace 2000A wave trap with 3000A Project Type : FAC Cost : \$100,000 Time Estimate : 12.0 Months DAYr190043 (2425) : Reconductor Killen-Marquis line with 795 ACCR high temperature conductor in a twin bundle Project Type : FAC Cost : \$6,500,000 Time Estimate : 18.0 Months DAYr190044 (2426) : Replace Killen substation riser conductor with 2-1024.5 ACAR 30x7 Project Type : FAC Cost : \$100,000 Time Estimate : 12.0 Months DAYr190045 (2427) : Replace Killen 2000A disconnect switch with 1600A (parallel) Project Type : FAC Cost : \$125,000 Time Estimate : 12.0 Months	\$7,015,000
42601372,42601375, 42800350	1	09ATLNTA 345.0 kV - 09ADKINS 345.0 kV Ckt 1	<u>DAY</u> r190011 (2404) : Replace metering equipment to increase thermal line rating Project Type : FAC Cost : \$100,000 Time Estimate : 12.0 Months	\$100,000

ID	Index	Facility	Upgrade Description	Cost
42800261,42800260, 42286660,42286661	10	AE2-221 TAP 345.0 kV - 09CLINTO 345.0 kV Ckt 1	<u>DAY</u> DAYr190046 (2428) : Replace Clinton 2000A wave trap with 3000A Project Type : FAC Cost : \$100,000 Time Estimate : 12.0 Months DAYr190047 (2429) : Reconductor AE2-221 Tap to Clinton line with twin bundle 1351 ACSR Project Type : FAC Cost : \$15,000,000 Time Estimate : 18.0 Months DAYr190048 (2430) : Replace Clinton substation riser conductor with 2500AAC (parallel) Project Type : FAC Cost : \$100,000 Time Estimate : 12.0 Months DAYr190049 (2431) : Replace Clinton 2000A disconnect switch with 1600A (parallel) Project Type : FAC Cost : \$125,000 Time Estimate : 12.0 Months	\$15,325,000
			TOTAL COST	\$135,095,000

17 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.

17.1 Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
42800350	253100	09ATLNTA	DAY	253110	09ADKINS	DAY	1	DAY_P7_495	tower	1195.0	112.31	113.55	DC	14.81

Bus #	Bus	MW Impact
251830	BIOENGRY	0.0697
253077	09STUART (Deactivation : 09/30/17)	253.2737
342957	1SPURLK1G	4.4777
342960	1SPURLK2G	8.2912
342963	1SPURLK3G	4.3569
342966	1SPURLK4G	4.3569
923522	AB1-169 C OP	162.8770
925921	AC1-068 C	18.8350
925922	AC1-068 E	8.8081
925931	AC1-069 C	18.8350
925932	AC1-069 E	8.8081
926061	AC1-085 C	22.5066
926062	AC1-085 E	36.7214
926791	AC1-165 C	18.6134
926792	AC1-165 E	9.0297
926801	AC1-166 C	18.6134
926802	AC1-166 E	9.0297
930062	AB1-014 E	5.9353
932381	AC2-055 C	1.8209
932382	AC2-055 E	2.9709
932421	AC2-060 C	6.4563
932422	AC2-060 E	3.6317
932461	AC2-066 C	2.1827
932462	AC2-066 E	3.5612
932651	AC2-087 C O1 (Withdrawn : 01/15/2020)	4.7817
932652	AC2-087 E O1 (Withdrawn : 01/15/2020)	3.7931
932661	AC2-088 C O1	3.9951
932662	AC2-088 E O1	3.2877
934491	AD1-073 C	1.3316
934492	AD1-073 E	0.6860
935031	AD1-136 C	0.5618
935032	AD1-136 E	0.4786
936251	AD2-031 C O1	1.4564
936252	AD2-031 E O1	2.3762
938271	AE1-040 C O1	4.1089
938272	AE1-040 E O1	2.0675
938921	AE1-120	3.3697
939141	AE1-144 C O1	6.3909
939142	AE1-144 E O1	3.1716
940531	AE2-038 C O1	4.2633
940532	AE2-038 E O1	2.1117
942091	AE2-221 C	26.6526
942092	AE2-221 E	17.7684

Bus #	Bus	MW Impact
942981	AE2-320 C O1	37.0606
942982	AE2-320 E O1	18.3364
943191	AE2-319 C O1	37.0606
943192	AE2-319 E O1	18.3364
944521	AF1-117 C	81.7633
944522	AF1-117 E	25.1867
944941	AF1-159	0.4469
945681	AF1-233 C O1	6.4080
945682	AF1-233 E O1	3.1657
945911	AF1-256 C	2.0698
945912	AF1-256 E	1.3799
946171	AF1-282 C	8.8842
946172	AF1-282 E	5.9228
946181	AF1-283 C	11.5495
946182	AF1-283 E	7.6996
946511	AF1-315 C O1	1.2778
946512	AF1-315 E O1	0.8519
LGEE	LGEE	1.9722
CPL	CPL	0.3777
WEC	WEC	0.2860
CBM-W2	CBM-W2	13.3743
NY	NY	0.3871
CBM-W1	CBM-W1	7.5685
TVA	TVA	2.3744
O-066	O-066	4.5158
CBM-S2	CBM-S2	4.7280
CBM-S1	CBM-S1	17.2360
G-007	G-007	0.6947
MEC	MEC	1.8798

17.2 Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
42800335	253014	09CLINTO	DAY	253027	09GREENE	DAY	1	DAY_P734569 34598 34524	tower	1374.0	110.32	113.16	DC	38.87

Bus #	Bus	MW Impact
250166	HLCRST AB114	0.8140
251830	BIOENGRY	0.0779
253077	09STUART (Deactivation : 09/30/17)	250.2975
342957	1SPURLK1G	4.1980
342960	1SPURLK2G	7.8641
342963	1SPURLK3G	4.1325
342966	1SPURLK4G	4.1325
923522	AB1-169 C OP	160.9630
925981	AC1-074 C O1	2.9755
925982	AC1-074 E O1	1.2752
926061	AC1-085 C	59.0870
926062	AC1-085 E	96.4050
926951	AC1-182	0.9739
927181	AC1-212 C	-0.1251
927182	AC1-212 E	-1.1848
927183	AC1-212 BAT	1.5411
930062	AB1-014 E	9.5147
932381	AC2-055 C	1.2064
932382	AC2-055 E	1.9683
932421	AC2-060 C	4.2775
932422	AC2-060 E	2.4061
932461	AC2-066 C	3.4989
932462	AC2-066 E	5.7088
932481	AC2-068 C	-2.6203
932482	AC2-068 E	-4.2914
932551	AC2-075 C	0.7067
932552	AC2-075 E	0.3560
932651	AC2-087 C O1 (Withdrawn : 01/15/2020)	3.1680
932652	AC2-087 E O1 (Withdrawn : 01/15/2020)	2.5130
932661	AC2-088 C O1	4.4625
932662	AC2-088 E O1	3.6722
934491	AD1-073 C	0.8822
934492	AD1-073 E	0.4545
935031	AD1-136 C	0.6275
935032	AD1-136 E	0.5346
936251	AD2-031 C O1	6.1741
936252	AD2-031 E O1	10.0735
936381	AD2-048 C	2.4277
936382	AD2-048 E	1.2113
938271	AE1-040 C O1	2.2216
938272	AE1-040 E O1	1.1178
938921	AE1-120	5.4019

Bus #	Bus	MW Impact
939141	AE1-144 C O1	5.9260
939142	AE1-144 E O1	2.9408
940531	AE2-038 C O1	3.9531
940532	AE2-038 E O1	1.9581
941411	AE2-138 C	11.4512
941412	AE2-138 E	4.2354
941981	AE2-210 C O1	3.9458
941982	AE2-210 E O1	1.4842
942091	AE2-221 C	91.0746
942092	AE2-221 E	60.7164
942591	AE2-275 C O1	2.9957
942592	AE2-275 E O1	1.1268
942891	AE2-308 C O1	5.0275
942892	AE2-308 E O1	1.8282
943111	AE2-339 C	1.3843
943112	AE2-339 E	0.6818
943201	AE2-318 C	4.7844
943202	AE2-318 E	2.3352
943771	AF1-045	1.9697
943863	AF1-054 BAT	3.1424
944521	AF1-117 C	3.7203
944522	AF1-117 E	1.1460
944621	AF1-127 C O1	1.6685
944622	AF1-127 E O1	0.8218
944941	AF1-159	3.5745
945681	AF1-233 C O1	5.9527
945682	AF1-233 E O1	2.9408
945861	AF1-251 C	4.1680
945862	AF1-251 E	2.7786
945911	AF1-256 C	1.9248
945912	AF1-256 E	1.2832
946021	AF1-267 C O1	0.8829
946022	AF1-267 E O1	0.4057
946171	AF1-282 C	23.3238
946172	AF1-282 E	15.5492
946181	AF1-283 C	30.3209
946182	AF1-283 E	20.2140
946511	AF1-315 C O1	1.4244
946512	AF1-315 E O1	0.9496
LGEE	LGEE	1.2945
CPL	CPL	0.3903
WEC	WEC	0.0180
CBM-W2	CBM-W2	6.9943
NY	NY	0.1781
TVA	TVA	1.6436
O-066	O-066	1.9354
CBM-S2	CBM-S2	4.3061
CBM-S1	CBM-S1	11.7320
G-007	G-007	0.2954
MEC	MEC	0.5848

17.3 Index 3

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
42800326	926060	AC1-085 TAP	DAY	942090	AE2-221 TAP	DAY	1	DAY_P734569 34598 34524	tower	1374.0	110.47	113.6	DC	42.88

Bus #	Bus	MW Impact
250166	HLCRST AB114	0.8727
251830	BIOENGRY	0.0826
253077	09STUART (Deactivation : 09/30/17)	270.4985
342957	1SPURLK1G	4.4622
342960	1SPURLK2G	8.4450
342963	1SPURLK3G	4.4377
342966	1SPURLK4G	4.4377
923522	AB1-169 C OP	173.9540
925981	AC1-074 C O1	3.1445
925982	AC1-074 E O1	1.3476
926061	AC1-085 C	65.1806
926062	AC1-085 E	106.3474
926951	AC1-182	1.0406
927181	AC1-212 C	-0.1208
927182	AC1-212 E	-1.1441
927183	AC1-212 BAT	1.4881
930062	AB1-014 E	10.2006
932461	AC2-066 C	3.7512
932462	AC2-066 E	6.1203
932481	AC2-068 C	-2.8280
932482	AC2-068 E	-4.6315
932551	AC2-075 C	0.7468
932552	AC2-075 E	0.3762
932661	AC2-088 C O1	4.7332
932662	AC2-088 E O1	3.8950
935031	AD1-136 C	0.6656
935032	AD1-136 E	0.5670
936381	AD2-048 C	2.5107
936382	AD2-048 E	1.2527
938921	AE1-120	5.7913
939141	AE1-144 C O1	6.2171
939142	AE1-144 E O1	3.0853
940531	AE2-038 C O1	4.1473
940532	AE2-038 E O1	2.0543
941411	AE2-138 C	12.2143
941412	AE2-138 E	4.5176
941981	AE2-210 C O1	4.2087
941982	AE2-210 E O1	1.5831
942591	AE2-275 C O1	3.1697
942592	AE2-275 E O1	1.1923
942891	AE2-308 C O1	5.3173
942892	AE2-308 E O1	1.9336

Bus #	Bus	MW Impact
943111	AE2-339 C	1.4695
943112	AE2-339 E	0.7238
943201	AE2-318 C	5.0460
943202	AE2-318 E	2.4629
943771	AF1-045	2.0774
943863	AF1-054 BAT	3.0940
944521	AF1-117 C	3.6452
944522	AF1-117 E	1.1229
944621	AF1-127 C O1	1.7784
944622	AF1-127 E O1	0.8759
945681	AF1-233 C O1	6.2553
945682	AF1-233 E O1	3.0903
945861	AF1-251 C	4.4439
945862	AF1-251 E	2.9626
945911	AF1-256 C	2.0255
945912	AF1-256 E	1.3503
946021	AF1-267 C O1	0.9341
946022	AF1-267 E O1	0.4292
946171	AF1-282 C	25.7292
946172	AF1-282 E	17.1528
946181	AF1-283 C	33.4480
946182	AF1-283 E	22.2986
946511	AF1-315 C O1	1.5052
946512	AF1-315 E O1	1.0035
LGEE	LGEE	1.3658
CPL	CPL	0.3890
WEC	WEC	0.0343
CBM-W2	CBM-W2	7.4693
NY	NY	0.1886
TVA	TVA	1.7178
O-066	O-066	2.0698
CBM-S2	CBM-S2	4.3408
CBM-S1	CBM-S1	12.3029
G-007	G-007	0.3172
MEC	MEC	0.6706

17.4 Index 4

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
42800469	944520	AF1-117 TAP	DAY	253100	09ATLNTA	DAY	1	DAY_P7_495	tower	1195.0	102.12	103.4	DC	15.25

Bus #	Bus	MW Impact
251830	BIOENGRY	0.0706
253077	09STUART (Deactivation : 09/30/17)	260.9026
342957	1SPURLK1G	4.5610
342960	1SPURLK2G	8.4862
342963	1SPURLK3G	4.4594
342966	1SPURLK4G	4.4594
923522	AB1-169 C OP	167.7830
925921	AC1-068 C	-8.0420
925922	AC1-068 E	-3.7608
925931	AC1-069 C	-8.0420
925932	AC1-069 E	-3.7608
925981	AC1-074 C O1	3.4448
925982	AC1-074 E O1	1.4763
926061	AC1-085 C	23.1846
926062	AC1-085 E	37.8274
926791	AC1-165 C	-7.9474
926792	AC1-165 E	-3.8554
926801	AC1-166 C	-7.9474
926802	AC1-166 E	-3.8554
926951	AC1-182	1.2464
930062	AB1-014 E	5.9920
932461	AC2-066 C	2.2035
932462	AC2-066 E	3.5952
932551	AC2-075 C	0.8181
932552	AC2-075 E	0.4121
932661	AC2-088 C O1	4.0439
932662	AC2-088 E O1	3.3278
935031	AD1-136 C	0.5687
935032	AD1-136 E	0.4844
936381	AD2-048 C	2.7941
936382	AD2-048 E	1.3941
938921	AE1-120	3.4019
939141	AE1-144 C O1	6.4721
939142	AE1-144 E O1	3.2118
940531	AE2-038 C O1	4.3174
940532	AE2-038 E O1	2.1385
941411	AE2-138 C	12.8709
941412	AE2-138 E	4.7605
941981	AE2-210 C O1	4.4350
941982	AE2-210 E O1	1.6682
942091	AE2-221 C	27.4554
942092	AE2-221 E	18.3036

Bus #	Bus	MW Impact
942591	AE2-275 C O1	3.4699
942592	AE2-275 E O1	1.3052
942891	AE2-308 C O1	5.8307
942892	AE2-308 E O1	2.1202
943111	AE2-339 C	1.5910
943112	AE2-339 E	0.7836
943201	AE2-318 C	4.3708
943202	AE2-318 E	2.1334
943771	AF1-045	1.7995
944521	AF1-117 C	85.5888
944522	AF1-117 E	26.3652
944621	AF1-127 C O1	1.8822
944622	AF1-127 E O1	0.9271
945681	AF1-233 C O1	6.4948
945682	AF1-233 E O1	3.2086
945861	AF1-251 C	4.6925
945862	AF1-251 E	3.1283
945911	AF1-256 C	2.0990
945912	AF1-256 E	1.3994
946021	AF1-267 C O1	1.0226
946022	AF1-267 E O1	0.4698
946102	AF1-275 BAT	3.4935
946171	AF1-282 C	9.1518
946172	AF1-282 E	6.1012
946181	AF1-283 C	11.8973
946182	AF1-283 E	7.9316
946511	AF1-315 C O1	1.2775
946512	AF1-315 E O1	0.8517
LGEE	LGEE	1.9517
CPL	CPL	0.3731
WEC	WEC	0.2750
CBM-W2	CBM-W2	13.1040
NY	NY	0.3788
CBM-W1	CBM-W1	7.1933
TVA	TVA	2.3464
O-066	O-066	4.4150
CBM-S2	CBM-S2	4.6702
CBM-S1	CBM-S1	17.0400
G-007	G-007	0.6791
MEC	MEC	1.8258

17.5 Index 5

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
43595956	243453	05BEATTY	AEP	243454	05BIXBY	AEP	1	AEP_P4_#10715_05COLE 345_C	breaker	1203.0	135.73	136.99	DC	15.18

Bus #	Bus	MW Impact
250164	08BKJDB1	0.1414
250165	08BKJDB2	0.1414
251827	WILLYESP	0.4536
251828	CLNTESP1	0.4602
251829	CLNTESP2	0.3068
253077	09STUART (Deactivation : 09/30/17)	192.5288
253110	09ADKINS	28.8099
253261	09MON D	0.2517
902531	W2-040 C (Withdrawn : 01/23/2020)	0.8837
902532	W2-040 E (Withdrawn : 01/23/2020)	1.4419
904722	V4-073 E	0.1941
913222	Y1-054 E	1.4787
918802	AA1-099 E	0.3068
923522	AB1-169 C OP	123.8127
925242	AB2-178 E (Withdrawn : 12/10/2019)	1.3999
925921	AC1-068 C	11.9258
925922	AC1-068 E	5.5771
925931	AC1-069 C	11.9258
925932	AC1-069 E	5.5771
926011	AC1-078 C O1	11.5229
926012	AC1-078 E O1	19.2049
926061	AC1-085 C	23.0675
926062	AC1-085 E	37.6365
926101	AC1-089 C O1	4.0839
926102	AC1-089 E O1	6.6631
926791	AC1-165 C	11.7855
926792	AC1-165 E	5.7174
926801	AC1-166 C	11.7855
926802	AC1-166 E	5.7174
926951	AC1-182	1.7315
930062	AB1-014 E	7.7607
932381	AC2-055 C	1.8038
932382	AC2-055 E	2.9431
932421	AC2-060 C	6.3958
932422	AC2-060 E	3.5976
932431	AC2-061 C	4.1543
932432	AC2-061 E	4.2115
932461	AC2-066 C	2.8539
932462	AC2-066 E	4.6564
932481	AC2-068 C	3.0051
932482	AC2-068 E	4.9215
932651	AC2-087 C O1 (Withdrawn : 01/15/2020)	4.7369

Bus #	Bus	MW Impact
932652	AC2-087 E O1 (Withdrawn : 01/15/2020)	3.7575
932661	AC2-088 C O1	3.8959
932662	AC2-088 E O1	3.2060
934491	AD1-073 C	1.3191
934492	AD1-073 E	0.6796
934561	AD1-081 C	2.3046
934562	AD1-081 E	1.1872
935031	AD1-136 C	0.5479
935032	AD1-136 E	0.4667
935041	AD1-140 C O1	11.5655
935042	AD1-140 E O1	9.5615
936251	AD2-031 C O1	2.3235
936252	AD2-031 E O1	3.7910
938051	AE1-007 C	0.8618
938052	AE1-007 E	1.4061
938271	AE1-040 C O1	3.9353
938272	AE1-040 E O1	1.9801
938921	AE1-120	4.4061
939141	AE1-144 C O1	6.6650
939142	AE1-144 E O1	3.3076
940531	AE2-038 C O1	4.4461
940532	AE2-038 E O1	2.2023
941411	AE2-138 C	13.6759
941412	AE2-138 E	5.0582
941511	AE2-148 C	176.4926
941512	AE2-148 E	79.8281
941981	AE2-210 C O1	4.7124
941982	AE2-210 E O1	1.7725
942021	AE2-214 C	61.3740
942022	AE2-214 E	40.9160
942051	AE2-217 C	11.5099
942052	AE2-217 E	7.6733
942061	AE2-218 C	10.3155
942062	AE2-218 E	7.0068
942091	AE2-221 C	28.9998
942092	AE2-221 E	19.3332
942521	AE2-267 C O1	1.3877
942522	AE2-267 E O1	0.8578
942621	AE2-278 C	7.2522
942622	AE2-278 E	4.8374
942951	AE2-315	2.9429
942981	AE2-320 C O1	23.4658
942982	AE2-320 E O1	11.6102
943191	AE2-319 C O1	23.4658
943192	AE2-319 E O1	11.6102
943201	AE2-318 C	6.3757
943202	AE2-318 E	3.1120
943771	AF1-045	2.6249
943943	AF1-062 BAT	20.0860
944521	AF1-117 C	49.9861
944522	AF1-117 E	15.3979
944621	AF1-127 C O1	2.0165

Bus #	Bus	MW Impact
944622	AF1-127 E O1	0.9932
944941	AF1-159	0.7129
945631	AF1-228 C	43.6282
945632	AF1-228 E	29.0854
945681	AF1-233 C O1	6.6577
945682	AF1-233 E O1	3.2890
945821	AF1-247 C	1.3877
945822	AF1-247 E	0.8578
945841	AF1-249 C	0.5989
945842	AF1-249 E	0.2819
945861	AF1-251 C	5.0053
945862	AF1-251 E	3.3368
945911	AF1-256 C	2.1455
945912	AF1-256 E	1.4304
946101	AF1-275	25.5725
946171	AF1-282 C	9.1056
946172	AF1-282 E	6.0704
946181	AF1-283 C	11.8373
946182	AF1-283 E	7.8915
946511	AF1-315 C O1	1.8226
946512	AF1-315 E O1	1.2151
LGEE	LGEE	3.1144
CPL	CPL	0.2097
WEC	WEC	0.7217
CBM-W2	CBM-W2	23.3743
NY	NY	0.9445
CBM-W1	CBM-W1	22.3304
TVA	TVA	3.4062
O-066	O-066	11.2896
CBM-S2	CBM-S2	4.2599
CBM-S1	CBM-S1	25.5174
G-007	G-007	1.7410
MEC	MEC	3.9566

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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
43596015	243453	05BEATTY	AEP	244022	05COLE	AEP	1	AEP_P4_#3195_05BEATTY 345_304E	breaker	1203.0	123.74	124.84	DC	13.17

Bus #	Bus	MW Impact
247964	Y1-063 BAT	0.3062
250164	08BKJDB1	0.1221
250165	08BKJDB2	0.1221
251827	WILLYESP	0.3864
251828	CLNTESP1	0.4043
251829	CLNTESP2	0.2696
253077	09STUART (Deactivation : 09/30/17)	170.8071
253110	09ADKINS	25.3067
253261	09MON D	0.2050
902531	W2-040 C (Withdrawn : 01/23/2020)	0.7288
902532	W2-040 E (Withdrawn : 01/23/2020)	1.1891
904722	V4-073 E	0.1611
913222	Y1-054 E	1.2662
918802	AA1-099 E	0.2696
923522	AB1-169 C OP	109.8438
925242	AB2-178 E (Withdrawn : 12/10/2019)	1.2092
925921	AC1-068 C	10.4859
925922	AC1-068 E	4.9037
925931	AC1-069 C	10.4859
925932	AC1-069 E	4.9037
925981	AC1-074 C O1	3.4396
925982	AC1-074 E O1	1.4741
926011	AC1-078 C O1	4.7584
926012	AC1-078 E O1	7.9307
926061	AC1-085 C	20.0108
926062	AC1-085 E	32.6492
926101	AC1-089 C O1	3.6623
926102	AC1-089 E O1	5.9754
926791	AC1-165 C	10.3626
926792	AC1-165 E	5.0271
926801	AC1-166 C	10.3626
926802	AC1-166 E	5.0271
926951	AC1-182	1.4999
930062	AB1-014 E	6.7608
932381	AC2-055 C	1.7366
932382	AC2-055 E	2.8334
932421	AC2-060 C	6.1575
932422	AC2-060 E	3.4636
932431	AC2-061 C	3.7241
932432	AC2-061 E	3.7754
932461	AC2-066 C	2.4862
932462	AC2-066 E	4.0565

Bus #	Bus	MW Impact
932481	AC2-068 C	2.4559
932482	AC2-068 E	4.0221
932551	AC2-075 C	0.8169
932552	AC2-075 E	0.4115
932651	AC2-087 C O1 (Withdrawn : 01/15/2020)	4.5604
932652	AC2-087 E O1 (Withdrawn : 01/15/2020)	3.6176
932661	AC2-088 C O1	3.4190
932662	AC2-088 E O1	2.8136
934491	AD1-073 C	1.2700
934492	AD1-073 E	0.6542
934561	AD1-081 C	0.9517
934562	AD1-081 E	0.4903
935031	AD1-136 C	0.4808
935032	AD1-136 E	0.4096
935041	AD1-140 C O1	8.3962
935042	AD1-140 E O1	6.9414
936251	AD2-031 C O1	2.3877
936252	AD2-031 E O1	3.8958
936381	AD2-048 C	2.8334
936382	AD2-048 E	1.4137
938051	AE1-007 C	0.7043
938052	AE1-007 E	1.1492
938271	AE1-040 C O1	4.3077
938272	AE1-040 E O1	2.1675
938921	AE1-120	3.8384
939141	AE1-144 C O1	5.8769
939142	AE1-144 E O1	2.9165
940531	AE2-038 C O1	3.9204
940532	AE2-038 E O1	1.9419
941411	AE2-138 C	11.9578
941412	AE2-138 E	4.4227
941511	AE2-148 C	154.4305
941512	AE2-148 E	69.8494
941981	AE2-210 C O1	4.1203
941982	AE2-210 E O1	1.5498
942061	AE2-218 C	7.9874
942062	AE2-218 E	5.4254
942091	AE2-221 C	24.9318
942092	AE2-221 E	16.6212
942521	AE2-267 C O1	1.1814
942522	AE2-267 E O1	0.7303
942951	AE2-315	2.4419
942981	AE2-320 C O1	20.6326
942982	AE2-320 E O1	10.2084
943191	AE2-319 C O1	20.6326
943192	AE2-319 E O1	10.2084
943201	AE2-318 C	5.5321
943202	AE2-318 E	2.7002
943771	AF1-045	2.2775
944521	AF1-117 C	43.9679
944522	AF1-117 E	13.5441
944621	AF1-127 C O1	1.7620

Bus #	Bus	MW Impact
944622	AF1-127 E O1	0.8678
944941	AF1-159	1.3824
945631	AF1-228 C	38.2221
945632	AF1-228 E	25.4814
945681	AF1-233 C O1	5.8720
945682	AF1-233 E O1	2.9009
945821	AF1-247 C	1.1814
945822	AF1-247 E	0.7303
945841	AF1-249 C	0.5126
945842	AF1-249 E	0.2412
945861	AF1-251 C	4.3749
945862	AF1-251 E	2.9166
945911	AF1-256 C	1.8921
945912	AF1-256 E	1.2614
946102	AF1-275 BAT	18.6700
946171	AF1-282 C	7.8990
946172	AF1-282 E	5.2660
946181	AF1-283 C	10.2687
946182	AF1-283 E	6.8458
946511	AF1-315 C O1	1.5829
946512	AF1-315 E O1	1.0553
LGEE	LGEE	2.6157
CPL	CPL	0.2514
WEC	WEC	0.4158
CBM-W2	CBM-W2	17.8624
NY	NY	0.7250
CBM-W1	CBM-W1	11.5217
TVA	TVA	2.7944
O-066	O-066	8.6486
CBM-S2	CBM-S2	4.1443
CBM-S1	CBM-S1	21.1040
G-007	G-007	1.3322
MEC	MEC	2.6028

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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
41062051	253038	09KILLEN	DAY	242938	05MARQUI	AEP	1	DAY_P7_34506 34542_1-A	tower	1372.0	106.47	107.14	DC	20.34

Bus #	Bus	MW Impact
250164	08BKJDB1	0.1315
250165	08BKJDB2	0.1315
251827	WILLYESP	0.4460
251828	CLNTESP1	0.3871
251829	CLNTESP2	0.2581
253077	09STUART (Deactivation : 09/30/17)	461.4416
902531	W2-040 C (Withdrawn : 01/23/2020)	0.5727
902532	W2-040 E (Withdrawn : 01/23/2020)	0.9344
904722	V4-073 E	0.1255
913222	Y1-054 E	1.4751
918802	AA1-099 E	0.2581
923522	AB1-169 C OP	296.7470
925242	AB2-178 E (Withdrawn : 12/10/2019)	1.3020
925921	AC1-068 C	6.6522
925922	AC1-068 E	3.1109
925931	AC1-069 C	6.6522
925932	AC1-069 E	3.1109
925981	AC1-074 C O1	6.0171
925982	AC1-074 E O1	2.5788
926061	AC1-085 C	26.2741
926062	AC1-085 E	42.8683
926101	AC1-089 C O1	3.6846
926102	AC1-089 E O1	6.0118
926791	AC1-165 C	6.5739
926792	AC1-165 E	3.1891
926801	AC1-166 C	6.5739
926802	AC1-166 E	3.1891
926951	AC1-182	2.3555
930062	AB1-014 E	11.3792
932461	AC2-066 C	4.1846
932462	AC2-066 E	6.8275
932481	AC2-068 C	1.9444
932482	AC2-068 E	3.1843
932551	AC2-075 C	1.4291
932552	AC2-075 E	0.7199
932661	AC2-088 C O1	6.3233
932662	AC2-088 E O1	5.2036
935031	AD1-136 C	0.8892
935032	AD1-136 E	0.7575
935041	AD1-140 C O1	6.0722
935042	AD1-140 E O1	5.0201
936251	AD2-031 C O1	1.9159

Bus #	Bus	MW Impact
936252	AD2-031 E O1	3.1259
936381	AD2-048 C	4.8805
936382	AD2-048 E	2.4350
936571	AD2-072 C O1	4.2702
936572	AD2-072 E O1	2.0937
938051	AE1-007 C	0.5576
938052	AE1-007 E	0.9098
938271	AE1-040 C O1	2.1426
938272	AE1-040 E O1	1.0781
938921	AE1-120	6.4605
939141	AE1-144 C O1	11.3551
939142	AE1-144 E O1	5.6351
940531	AE2-038 C O1	7.5748
940532	AE2-038 E O1	3.7520
941411	AE2-138 C	22.4007
941412	AE2-138 E	8.2852
941511	AE2-148 C	19.2747
941512	AE2-148 E	8.7180
941981	AE2-210 C O1	7.7187
941982	AE2-210 E O1	2.9034
942061	AE2-218 C	6.7476
942062	AE2-218 E	4.5833
942091	AE2-221 C	26.1997
942092	AE2-221 E	17.4665
942411	AE2-254 C O1	2.0288
942412	AE2-254 E O1	1.3525
942521	AE2-267 C O1	1.2986
942522	AE2-267 E O1	0.8027
942591	AE2-275 C O1	5.8970
942592	AE2-275 E O1	2.2181
942891	AE2-308 C O1	9.9185
942892	AE2-308 E O1	3.6067
942951	AE2-315	1.9022
942981	AE2-320 C O1	13.0892
942982	AE2-320 E O1	6.4761
943111	AE2-339 C	2.7505
943112	AE2-339 E	1.3547
943191	AE2-319 C O1	13.0892
943192	AE2-319 E O1	6.4761
943201	AE2-318 C	8.4800
943202	AE2-318 E	4.1391
943771	AF1-045	3.4912
944211	AF1-089 C O1	1.6314
944212	AF1-089 E O1	0.4991
944521	AF1-117 C	39.4834
944522	AF1-117 E	12.1626
944621	AF1-127 C O1	3.2724
944622	AF1-127 E O1	1.6118
944941	AF1-159	0.5879
945541	AF1-219 C O1	1.0344
945542	AF1-219 E O1	0.3357
945631	AF1-228 C	4.5114

Bus #	Bus	MW Impact
945632	AF1-228 E	3.0076
945681	AF1-233 C O1	11.3885
945682	AF1-233 E O1	5.6262
945821	AF1-247 C	1.2986
945822	AF1-247 E	0.8027
945841	AF1-249 C	0.5690
945842	AF1-249 E	0.2678
945861	AF1-251 C	8.1629
945862	AF1-251 E	5.4419
945911	AF1-256 C	3.6862
945912	AF1-256 E	2.4575
946021	AF1-267 C O1	1.7305
946022	AF1-267 E O1	0.7951
946171	AF1-282 C	5.4968
946172	AF1-282 E	3.6645
946181	AF1-283 C	7.1459
946182	AF1-283 E	4.7639
946511	AF1-315 C O1	2.4671
946512	AF1-315 E O1	1.6447
LGEE	LGEE	3.2981
WEC	WEC	0.6505
CBM-W2	CBM-W2	19.9508
NY	NY	0.7405
CBM-W1	CBM-W1	21.7424
TVA	TVA	2.7216
O-066	O-066	9.1325
CBM-S1	CBM-S1	22.6376
G-007	G-007	1.4123
MEC	MEC	3.4624
CATAWBA	CATAWBA	0.0735

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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
42800299	253077	09STUART	DAY	253038	09KILLEN	DAY	1	DAY_P7_34506 34542_1-A	tower	1374.0	106.32	106.99	DC	20.34

Bus #	Bus	MW Impact
250164	08BKJDB1	0.1315
250165	08BKJDB2	0.1315
251827	WILLYESP	0.4460
251828	CLNTESP1	0.3871
251829	CLNTESP2	0.2581
253077	09STUART (Deactivation : 09/30/17)	461.4416
902531	W2-040 C (Withdrawn : 01/23/2020)	0.5727
902532	W2-040 E (Withdrawn : 01/23/2020)	0.9344
904722	V4-073 E	0.1255
913222	Y1-054 E	1.4751
918802	AA1-099 E	0.2581
923522	AB1-169 C OP	296.7470
925242	AB2-178 E (Withdrawn : 12/10/2019)	1.3020
925921	AC1-068 C	6.6522
925922	AC1-068 E	3.1109
925931	AC1-069 C	6.6522
925932	AC1-069 E	3.1109
925981	AC1-074 C O1	6.0171
925982	AC1-074 E O1	2.5788
926061	AC1-085 C	26.2741
926062	AC1-085 E	42.8683
926101	AC1-089 C O1	3.6846
926102	AC1-089 E O1	6.0118
926791	AC1-165 C	6.5739
926792	AC1-165 E	3.1891
926801	AC1-166 C	6.5739
926802	AC1-166 E	3.1891
926951	AC1-182	2.3555
930062	AB1-014 E	11.3792
932461	AC2-066 C	4.1846
932462	AC2-066 E	6.8275
932481	AC2-068 C	1.9444
932482	AC2-068 E	3.1843
932551	AC2-075 C	1.4291
932552	AC2-075 E	0.7199
932661	AC2-088 C O1	6.3233
932662	AC2-088 E O1	5.2036
935031	AD1-136 C	0.8892
935032	AD1-136 E	0.7575
935041	AD1-140 C O1	6.0722
935042	AD1-140 E O1	5.0201
936251	AD2-031 C O1	1.9159

Bus #	Bus	MW Impact
936252	AD2-031 E O1	3.1259
936381	AD2-048 C	4.8805
936382	AD2-048 E	2.4350
936571	AD2-072 C O1	4.2702
936572	AD2-072 E O1	2.0937
938051	AE1-007 C	0.5576
938052	AE1-007 E	0.9098
938271	AE1-040 C O1	2.1426
938272	AE1-040 E O1	1.0781
938921	AE1-120	6.4605
939141	AE1-144 C O1	11.3551
939142	AE1-144 E O1	5.6351
940531	AE2-038 C O1	7.5748
940532	AE2-038 E O1	3.7520
941411	AE2-138 C	22.4007
941412	AE2-138 E	8.2852
941511	AE2-148 C	19.2747
941512	AE2-148 E	8.7180
941981	AE2-210 C O1	7.7187
941982	AE2-210 E O1	2.9034
942061	AE2-218 C	6.7476
942062	AE2-218 E	4.5833
942091	AE2-221 C	26.1997
942092	AE2-221 E	17.4665
942411	AE2-254 C O1	2.0288
942412	AE2-254 E O1	1.3525
942521	AE2-267 C O1	1.2986
942522	AE2-267 E O1	0.8027
942591	AE2-275 C O1	5.8970
942592	AE2-275 E O1	2.2181
942891	AE2-308 C O1	9.9185
942892	AE2-308 E O1	3.6067
942951	AE2-315	1.9022
942981	AE2-320 C O1	13.0892
942982	AE2-320 E O1	6.4761
943111	AE2-339 C	2.7505
943112	AE2-339 E	1.3547
943191	AE2-319 C O1	13.0892
943192	AE2-319 E O1	6.4761
943201	AE2-318 C	8.4800
943202	AE2-318 E	4.1391
943771	AF1-045	3.4912
944211	AF1-089 C O1	1.6314
944212	AF1-089 E O1	0.4991
944521	AF1-117 C	39.4834
944522	AF1-117 E	12.1626
944621	AF1-127 C O1	3.2724
944622	AF1-127 E O1	1.6118
944941	AF1-159	0.5879
945541	AF1-219 C O1	1.0344
945542	AF1-219 E O1	0.3357
945631	AF1-228 C	4.5114

Bus #	Bus	MW Impact
945632	AF1-228 E	3.0076
945681	AF1-233 C O1	11.3885
945682	AF1-233 E O1	5.6262
945821	AF1-247 C	1.2986
945822	AF1-247 E	0.8027
945841	AF1-249 C	0.5690
945842	AF1-249 E	0.2678
945861	AF1-251 C	8.1629
945862	AF1-251 E	5.4419
945911	AF1-256 C	3.6862
945912	AF1-256 E	2.4575
946021	AF1-267 C O1	1.7305
946022	AF1-267 E O1	0.7951
946171	AF1-282 C	5.4968
946172	AF1-282 E	3.6645
946181	AF1-283 C	7.1459
946182	AF1-283 E	4.7639
946511	AF1-315 C O1	2.4671
946512	AF1-315 E O1	1.6447
LGEE	LGEE	3.2981
WEC	WEC	0.6505
CBM-W2	CBM-W2	19.9508
NY	NY	0.7405
CBM-W1	CBM-W1	21.7424
TVA	TVA	2.7216
O-066	O-066	9.1325
CBM-S1	CBM-S1	22.6376
G-007	G-007	1.4123
MEC	MEC	3.4624
CATAWBA	CATAWBA	0.0735

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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
41061997	253110	09ADKINS	DAY	243453	05BEATTY	AEP	1	DAY_P7_495	tower	1372.0	123.21	123.69	DC	14.55

Bus #	Bus	MW Impact
253077	09STUART (Deactivation : 09/30/17)	211.4734
253110	09ADKINS	49.4595
923522	AB1-169 C OP	135.9957
925921	AC1-068 C	18.7459
925922	AC1-068 E	8.7665
925931	AC1-069 C	18.7459
925932	AC1-069 E	8.7665
926061	AC1-085 C	18.7921
926062	AC1-085 E	30.6609
926791	AC1-165 C	18.5254
926792	AC1-165 E	8.9870
926801	AC1-166 C	18.5254
926802	AC1-166 E	8.9870
930062	AB1-014 E	5.7627
932381	AC2-055 C	1.5076
932382	AC2-055 E	2.4597
932421	AC2-060 C	5.3453
932422	AC2-060 E	3.0068
932461	AC2-066 C	2.1192
932462	AC2-066 E	3.4576
932651	AC2-087 C O1 (Withdrawn : 01/15/2020)	3.9589
932652	AC2-087 E O1 (Withdrawn : 01/15/2020)	3.1404
932661	AC2-088 C O1	3.3103
932662	AC2-088 E O1	2.7241
934491	AD1-073 C	1.1025
934492	AD1-073 E	0.5679
935031	AD1-136 C	0.4655
935032	AD1-136 E	0.3966
936251	AD2-031 C O1	1.4141
936252	AD2-031 E O1	2.3072
938271	AE1-040 C O1	3.4222
938272	AE1-040 E O1	1.7219
938921	AE1-120	3.2718
939141	AE1-144 C O1	6.2123
939142	AE1-144 E O1	3.0829
940531	AE2-038 C O1	4.1441
940532	AE2-038 E O1	2.0527
942091	AE2-221 C	22.2538
942092	AE2-221 E	14.8359
942981	AE2-320 C O1	36.8853
942982	AE2-320 E O1	18.2497
943191	AE2-319 C O1	36.8853
943192	AE2-319 E O1	18.2497

Bus #	Bus	MW Impact
944521	AF1-117 C	81.3627
944522	AF1-117 E	25.0633
944941	AF1-159	0.4339
945681	AF1-233 C O1	6.2302
945682	AF1-233 E O1	3.0779
945911	AF1-256 C	2.0132
945912	AF1-256 E	1.3421
946171	AF1-282 C	3.9315
946172	AF1-282 E	2.6210
946181	AF1-283 C	5.1110
946182	AF1-283 E	3.4073
LGEE	LGEE	1.8227
CPL	CPL	0.2044
WEC	WEC	0.2035
CBM-W2	CBM-W2	11.2285
NY	NY	0.5336
CBM-W1	CBM-W1	4.2909
TVA	TVA	2.0076
O-066	O-066	6.2765
CBM-S2	CBM-S2	3.2137
CBM-S1	CBM-S1	15.0037
G-007	G-007	0.9672
MEC	MEC	1.4635

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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
42800260	942090	AE2-221 TAP	DAY	253014	09CLINTO	DAY	1	DAY_P734569 34598 34524	tower	1374.0	122.65	125.77	DC	42.88

Bus #	Bus	MW Impact
250166	HLCRST AB114	0.8727
251830	BIOENGRY	0.0826
253077	09STUART (Deactivation : 09/30/17)	270.4985
342957	1SPURLK1G	4.4622
342960	1SPURLK2G	8.4450
342963	1SPURLK3G	4.4377
342966	1SPURLK4G	4.4377
923522	AB1-169 C OP	173.9540
925981	AC1-074 C O1	3.1445
925982	AC1-074 E O1	1.3476
926061	AC1-085 C	65.1806
926062	AC1-085 E	106.3474
926951	AC1-182	1.0406
927181	AC1-212 C	-0.1208
927182	AC1-212 E	-1.1441
927183	AC1-212 BAT	1.4881
930062	AB1-014 E	10.2006
932461	AC2-066 C	3.7512
932462	AC2-066 E	6.1203
932481	AC2-068 C	-2.8280
932482	AC2-068 E	-4.6315
932551	AC2-075 C	0.7468
932552	AC2-075 E	0.3762
932661	AC2-088 C O1	4.7332
932662	AC2-088 E O1	3.8950
935031	AD1-136 C	0.6656
935032	AD1-136 E	0.5670
936381	AD2-048 C	2.5107
936382	AD2-048 E	1.2527
938921	AE1-120	5.7913
939141	AE1-144 C O1	6.2171
939142	AE1-144 E O1	3.0853
940531	AE2-038 C O1	4.1473
940532	AE2-038 E O1	2.0543
941411	AE2-138 C	12.2143
941412	AE2-138 E	4.5176
941981	AE2-210 C O1	4.2087
941982	AE2-210 E O1	1.5831
942091	AE2-221 C	100.7514
942092	AE2-221 E	67.1676
942591	AE2-275 C O1	3.1697
942592	AE2-275 E O1	1.1923

Bus #	Bus	MW Impact
942891	AE2-308 C O1	5.3173
942892	AE2-308 E O1	1.9336
943111	AE2-339 C	1.4695
943112	AE2-339 E	0.7238
943201	AE2-318 C	5.0460
943202	AE2-318 E	2.4629
943771	AF1-045	2.0774
943863	AF1-054 BAT	3.0940
944521	AF1-117 C	3.6452
944522	AF1-117 E	1.1229
944621	AF1-127 C O1	1.7784
944622	AF1-127 E O1	0.8759
945681	AF1-233 C O1	6.2553
945682	AF1-233 E O1	3.0903
945861	AF1-251 C	4.4439
945862	AF1-251 E	2.9626
945911	AF1-256 C	2.0255
945912	AF1-256 E	1.3503
946021	AF1-267 C O1	0.9341
946022	AF1-267 E O1	0.4292
946171	AF1-282 C	25.7292
946172	AF1-282 E	17.1528
946181	AF1-283 C	33.4480
946182	AF1-283 E	22.2986
946511	AF1-315 C O1	1.5052
946512	AF1-315 E O1	1.0035
LGEE	LGEE	1.3658
CPL	CPL	0.3890
WEC	WEC	0.0343
CBM-W2	CBM-W2	7.4693
NY	NY	0.1886
TVA	TVA	1.7178
O-066	O-066	2.0698
CBM-S2	CBM-S2	4.3408
CBM-S1	CBM-S1	12.3029
G-007	G-007	0.3172
MEC	MEC	0.6706

18 Affected Systems

18.1 LG&E

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

18.2 MISO

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

18.3 TVA

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

18.4 Duke Energy Progress

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

18.5 NYISO

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

19 Short Circuit

The following Breakers are overduty:

None

Contingency Name	Contingency Definition
DAY_P4_L34551F	CONTINGENCY 'DAY_P4_L34551F' DISCONNECT BUS 253110 / 253110 ADKINS 345 DISCONNECT BUS 253100 / 253100 ATLANTA 345 END
DAY_P734569 34598 34524	CONTINGENCY 'DAY_P734569 34598 34524' OPEN BRANCH FROM BUS 249566 TO BUS 249578 CKT 1 / OPEN BRANCH FROM BUS 249566 TO BUS 253006 CKT 1 / 249566 08FOSTER 345 253006 09BATH 345 1 OPEN BRANCH FROM BUS 249566 TO BUS 253079 CKT 1 / 249566 08FOSTER 345 253079 09SUGRCK 345 1 END
DAY_P4_L34543-1	CONTINGENCY 'DAY_P4_L34543-1' OPEN LINE FROM BUS 253110 TO BUS 253100 CKT 1 /* 09ADKINS 345 - 09ATLNTA 345 REMOVE UNIT 1 FROM BUS 253110 /* 09ADKINS 345 - REMOVE UNIT 2 FROM BUS 253110 /* 09ADKINS 345 - REMOVE UNIT 3 FROM BUS 253110 /* 09ADKINS 345 - REMOVE UNIT 4 FROM BUS 253110 /* 09ADKINS 345 - REMOVE UNIT 5 FROM BUS 253110 /* 09ADKINS 345 - REMOVE UNIT 6 FROM BUS 253110 /* 09ADKINS 345 - END
Base Case	
DAY_P1_160_B3	CONTINGENCY 'DAY_P1_160_B3' OPEN BRANCH FROM BUS 253110 TO BUS 253100 CKT 1 / 253110 09ADKINS 345 253100 09ATLNTA 345 1 OPEN BRANCH FROM BUS 253100 TO BUS 253099 CKT 1 / 253100 09ATLNTA 345 253099 09ATLNTA 69.0 1 END
DAY_P1-2_#762	CONTINGENCY 'DAY_P1-2_#762' OPEN BRANCH FROM BUS 243453 TO BUS 253110 CKT 1 / 243453 05BEATTY 345 253110 09ADKINS 345 1 END
DAY_P1_161_B3_1	CONTINGENCY 'DAY_P1_161_B3_1' OPEN BRANCH FROM BUS 253014 TO BUS 253027 CKT 1 / 253014 09CLINTO 345 253027 09GREENE 345 1 OPEN BRANCH FROM BUS 253014 TO BUS 253013 CKT 1 / 253014 09CLINTO 345 253013 09CLINTO 69.0 1 OPEN BRANCH FROM BUS 253014 TO BUS 253013 CKT 2 / 253014 09CLINTO 345 253013 09CLINTO 69.0 2 END
AEP_P4_#3195_05BEATTY 345_304E	CONTINGENCY 'AEP_P4_#3195_05BEATTY 345_304E' OPEN BRANCH FROM BUS 243453 TO BUS 243454 CKT 1 / 243453 05BEATTY 345 243454 05BIXBY 345 1 OPEN BRANCH FROM BUS 243453 TO BUS 243468 CKT 4 / 243453 05BEATTY 345 243468 05BEATTX 138 4 END

Contingency Name	Contingency Definition
DAY_P7_34506 34542_1-B	CONTINGENCY 'DAY_P7_34506 34542_1-B' OPEN BRANCH FROM BUS 243453 TO BUS 253110 CKT 1 / 243453 05BEATTY 345 253110 09ADKINS 345 1 OPEN BRANCH FROM BUS 941510 TO BUS 253248 CKT 1 / 941510 AE2-148 TAP 345 253248 09SCHARL 345 1 END
DAY_P7_34506 34542_1-A	CONTINGENCY 'DAY_P7_34506 34542_1-A' OPEN BRANCH FROM BUS 243453 TO BUS 253110 CKT 1 / 243453 05BEATTY 345 253110 09ADKINS 345 1 OPEN BRANCH FROM BUS 243453 TO BUS 945630 CKT 1 / 243453 05BEATTY 345 941510 AF1-228 TAP 345 1 END
DEOK_P5-5_FOSTER345 BUS1+RELAYFAIL	CONTINGENCY 'DEOK_P5-5_FOSTER345 BUS1+RELAYFAIL' OPEN BRANCH FROM BUS 249566 TO BUS 250035 CKT 1 / 249566 08FOSTER 345 250035 08FTRM11 138 1 OPEN BRANCH FROM BUS 249566 TO BUS 249578 CKT 1 / 249566 08FOSTER 345 249578 08HILCRT 345 1 OPEN BRANCH FROM BUS 249566 TO BUS 253079 CKT 1 / 249566 08FOSTER 345 253079 09SUGRCK 345 1 END
DAY_P4_L34542D	CONTINGENCY 'DAY_P4_L34542D' DISCONNECT BUS 253100 / 253100 ATLANTA 345 REMOVE UNIT 1 FROM BUS 253110 /* 09ADKINS 345 - REMOVE UNIT 2 FROM BUS 253110 /* 09ADKINS 345 - REMOVE UNIT 3 FROM BUS 253110 /* 09ADKINS 345 - REMOVE UNIT 4 FROM BUS 253110 /* 09ADKINS 345 - REMOVE UNIT 5 FROM BUS 253110 /* 09ADKINS 345 - REMOVE UNIT 6 FROM BUS 253110 /* 09ADKINS 345 - END
AEP_P4_#10715_05COLE 345_C	CONTINGENCY 'AEP_P4_#10715_05COLE 345_C' OPEN BRANCH FROM BUS 244022 TO BUS 243457 CKT 1 / 244022 05COLE 345 243457 05HAYDEN 345 1 OPEN BRANCH FROM BUS 244022 TO BUS 244023 CKT 1 / 244022 05COLE 345 244023 05COLE 138 1 END
AEP_P4_#8094_05BIXBY 345_C	CONTINGENCY 'AEP_P4_#8094_05BIXBY 345_C' OPEN BRANCH FROM BUS 243453 TO BUS 243454 CKT 1 / 243453 05BEATTY 345 243454 05BIXBY 345 1 OPEN BRANCH FROM BUS 941520 TO BUS 243454 CKT 1 / 941520 AE2-149 TAP 345 243454 05BIXBY 345 1 END
DEOK_P7-1_C5 4524FOSTRSUGRCRK34598FOSTERBATH	CONTINGENCY 'DEOK_P7-1_C5 4524FOSTRSUGRCRK34598FOSTERBATH' OPEN BRANCH FROM BUS 249566 TO BUS 253079 CKT 1 / 249566 08FOSTER 345 253079 09SUGRCK 345 1 OPEN BRANCH FROM BUS 249566 TO BUS 253006 CKT 1 / 249566 08FOSTER 345 253006 09BATH 345 1 END

Contingency Name	Contingency Definition
AEP_P1-2_#714	CONTINGENCY 'AEP_P1-2_#714' OPEN BRANCH FROM BUS 244022 TO BUS 243457 CKT 1 / 244022 05COLE 345 243457 05HAYDEN 345 1 END
AEP_P1-2_#713	CONTINGENCY 'AEP_P1-2_#713' OPEN BRANCH FROM BUS 243453 TO BUS 243454 CKT 1 / 243453 05BEATTY 345 243454 05BIXBY 345 1 END
DEOK_P2-3_C2 1349_FOSTER	CONTINGENCY 'DEOK_P2-3_C2 1349_FOSTER' OPEN BRANCH FROM BUS 249566 TO BUS 253006 CKT 1 / 249566 08FOSTER 345 253006 09BATH 345 1 OPEN BRANCH FROM BUS 249566 TO BUS 249578 CKT 1 / 249566 08FOSTER 345 249578 08HILCRT 345 1 END
DAY_P7_495	CONTINGENCY 'DAY_P7_495' OPEN BRANCH FROM BUS 249566 TO BUS 253006 CKT 1 / 249566 08FOSTER 345 253006 09BATH 345 1 OPEN BRANCH FROM BUS 253014 TO BUS 253027 CKT 1 / 253014 09CLINTO 345 253027 09GREENE 345 1 OPEN BRANCH FROM BUS 253014 TO BUS 253013 CKT 1 / 253014 09CLINTO 345 253013 09CLINTO 69.0 1 OPEN BRANCH FROM BUS 253014 TO BUS 253013 CKT 2 / 253014 09CLINTO 345 253013 09CLINTO 69.0 1 END
DAY_P1_AC1-085_ST_FSA-B	CONTINGENCY 'DAY_P1_AC1-085_ST_FSA-B' OPEN BRANCH FROM BUS 253014 TO BUS 942090 CKT 1 END
AEP_P4_#6774_05MARQUI 345_D	CONTINGENCY 'AEP_P4_#6774_05MARQUI 345_D' OPEN BRANCH FROM BUS 246888 TO BUS 242938 CKT 1 / 246888 05BIERSR 345 242938 05MARQUI 345 1 OPEN BRANCH FROM BUS 242938 TO BUS 253038 CKT 1 / 242938 05MARQUI 345 253038 09KILLEN 345 1 END
AEP_P4_#3196_05BEATTY 345_302E	CONTINGENCY 'AEP_P4_#3196_05BEATTY 345_302E' OPEN BRANCH FROM BUS 243453 TO BUS 244022 CKT 1 / 243453 05BEATTY 345 244022 05COLE 345 1 OPEN BRANCH FROM BUS 243453 TO BUS 243468 CKT 4 / 243453 05BEATTY 345 243468 05BEATTX 138 4 END
DAY_P4_L34526-3	CONTINGENCY 'DAY_P4_L34526-3' OPEN LINE FROM BUS 253027 TO BUS 253006 CKT 1 /* 09GREENE 345 - 09BATH 345 OPEN LINE FROM BUS 253027 TO BUS 253014 CKT 1 /* 09GREENE 345 - 09CLINTO 345 OPEN LINE FROM BUS 253014 TO BUS 253013 CKT 1 /* 09CLINTON 69 - 09CLINTO 345 OPEN LINE FROM BUS 253014 TO BUS 253013 CKT 2 /* 09CLINTON 69 - 09CLINTO 345 END