Generation Interconnection

Feasibility Study Report

for

Queue Project AF1-175

DONALD C COOK-JACKSON ROAD 345 KV

91.2 MW Capacity / 152 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.

PJM utilizes manufacturer models to ensure the performance of turbines is properly captured during the simulations performed for stability verification and, where applicable, for compliance with low voltage ride through requirements. Turbine manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is contained in Attachment B of Manual 14G. Manufacturer models may be updated from time to time, for various reasons such as to reflect changes to the control systems or to more accurately represent the capabilities turbines and controls which are currently available in the field. Additionally, as new turbine models are developed, turbine manufacturers provide such new models which must be used in the conduct of these studies. PJM needs adequate time to evaluate the new models in order to reduce delays to the System Impact Study process timeline for the Interconnection Customer as well as other Interconnection Customers in the study group. Therefore, PJM will require that any Interconnection Customer with a new manufacturer model must supply that model to PJM, along with a $10,000 fully refundable deposit, no later than three (3) months prior to the starting date of the System Impact Study (See Section 4.3 for starting dates) for the Interconnection Request which shall specify the use of the new model. The Interconnection Customer will be required to submit a completed dynamic model study request form (Attachment B-1 of Manual 14G) in order to document the request for the study.

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

2 General

The Interconnection Customer (IC), has proposed a Solar generating facility located in St. Joseph County, IN. The installed facilities will have a total capability of 152 MW with 91.2 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is 4/30/2023. This study does not imply a TO commitment to this in-service date.

Queue Number	**AF1-175**
Project Name	DONALD C COOK-JACKSON ROAD 345 KV
State	Indiana
County	St. Joseph
Transmission Owner	AEP
MFO	152
MWE	152
MWC	91.2
Fuel	Solar
Basecase Study Year	2023

2.1 Point of Interconnection

AF1-175 will interconnect with the AEP transmission system tapping the DC Cook to Jackson Road 345 kV line.

To accommodate the interconnection on the DC Cook to Jackson Road 345 kV circuit, a new three (3) circuit breaker 345 kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus will be constructed (see Figure 1). Installation of associated protection and control equipment, 345 kV line risers, SCADA, and 345 kV revenue metering will also be required. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.

2.2 Cost Summary

This project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$350,000
Direct Connection Network Upgrade	$8,000,000
Non Direct Connection Network Upgrades	$1,900,000
Total Costs	$10,250,000

In addition, this project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	$176,542,102

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

3 Transmission Owner Scope of Work

4 Attachment Facilities

The total preliminary cost estimate for the Attachment work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
345 kV Revenue Metering	$350,000
Total Attachment Facility Costs	$350,000

5 Direct Connection Cost Estimate

The total preliminary cost estimate for the Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Construct a new three (3) circuit breaker 345 kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus (See Figure 1). Installation of associated protection and control equipment, 345 kV line risers and SCADA will also be required.	$8,000,000
Total Direct Connection Facility Costs	$8,000,000

6 Non-Direct Connection Cost Estimate

The total preliminary cost estimate for the Non-Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Upgrade line protections & Controls at the 345kV remote end Substation #1	$350,000
Upgrade line protections & Controls at the 345kV remote end Substation #2	$350,000
345 kV Transmission Line Cut In	$1,200,000
Total Non-Direct Connection Facility Costs	$1,900,000

7 Incremental Capacity Transfer Rights (ICTRs)

Will be determined at a later study phase

8 Schedule

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

9 Interconnection Customer Requirements

It is understood that the Interconnection Customer is responsible for all costs associated with this interconnection. The costs above are reimbursable to AEP. The cost of the Interconnection Customer's generating plant and the costs for the line connecting the generating plant to AEP's 345kV Facilities are not included in this report; these are assumed to be the Interconnection Customer's responsibility.

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

Requirement from the PJM Open Access Transmission Tariff:

1. An Interconnection Customer entering the New Services Queue on or after October 1, 2012 with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.
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.

10 Revenue Metering and SCADA Requirements

10.1 PJM Requirements

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

10.2 AEP Requirements

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

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

11 Network Impacts

The Queue Project AF1-175 was evaluated as a 152.0 MW (Capacity 91.2 MW) injection tapping the DC Cook to Jackson Road 345 kV line in the AEP area. Project AF1-175 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-175 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

Summer Peak Load Flow

12 Generation Deliverability

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

None

13 Multiple Facility Contingency

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

None

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	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
43496555	243215	05COOK	345.0	AEP	243229	05OLIVE	345.0	AEP	1	AEP_P4_#8621_05COOK 345_K	breaker	1409.0	153.21	155.53	DC	32.14
43496556	243215	05COOK	345.0	AEP	243229	05OLIVE	345.0	AEP	1	AEP_P4_#7443_05DUMONT 765_A	breaker	1409.0	146.1	147.83	DC	26.79
43496887	243215	05COOK	345.0	AEP	243229	05OLIVE	345.0	AEP	1	AEP_P1-2_#358	single	1409.0	127.03	128.23	DC	16.95
43497169	243234	05TWINB	345.0	AEP	256000	18ARGNTA	345.0	METC	1	AEP_P7-1_#10999	tower	956.0	197.52	198.06	DC	11.39
41011930	264612	19MON12	345.0	ITCT	241901	02LALLENDORF	345.0	ATSI	1	ATSI-P7-1-TE-138-025T-A	tower	1244.0	238.68	238.73	DC	13.58
41588054	264612	19MON12	345.0	ITCT	241901	02LALLENDORF	345.0	ATSI	1	ATSI-P2-3-TE-345-023T	breaker	1244.0	212.62	212.79	DC	12.52
41588055	264612	19MON12	345.0	ITCT	241901	02LALLENDORF	345.0	ATSI	1	ATSI-P2-3-TE-345-022T	breaker	1244.0	212.97	213.11	DC	12.52

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	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT

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
43496886	243215	05COOK	345.0	AEP	243229	05OLIVE	345.0	AEP	1	AEP_P1-2_#358	operation	1409.0	146.76	148.49	DC	28.25
41261973	264612	19MON12	345.0	ITCT	241901	02LALLENDORF	345.0	ATSI	1	ATSI-P1-2-TE-345-605T	operation	1244.0	212.96	213.1	DC	12.52

16 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
41588055,41588054, 41011930	3	19MON12 345.0 kV - 02LALLENDORF 345.0 kV Ckt 1	**ATSI** **TE-014B (1792) : Reconductor the Lallendorf-Monroe 345 kV line and the line drop at Lallendorf with 1272 ACSS 45/7 bundled (2 conductor per phase) with OPGW. Replace the wave trap with a new 4500 Amp unit. Replace the substation conductor at Lallendorf with 1590 ACSS bundled (2 conductor per phase). Replace the bitronics meter with a 15 Amp SATEC PM174 unit. Change relay settings for the SEL 421 at Lallendorf to meet a Summer Normal rating of 3171 MVA and Summer emergency rating of 3171 MVA. ITC would need to replace their section of limiting conductor and provide estimates for their replacement.** **Project Type : FAC** **Cost : $18,373,500** **Time Estimate : 30.0 Months** **ITCT** **NonPJMArea (446) : The external (i.e. Non-PJM) Transmission Owner, ITCT, will not evaluate this violation until the impact study phase.** **Project Type : FAC** **Cost : $0** **Time Estimate : 0.0 Months**	$18,373,500

ID	Index	Facility	Upgrade Description	Cost
43496556,43496555, 43496887	1	05COOK 345.0 kV - 05OLIVE 345.0 kV Ckt 1	AEP **AEPI0020a (252) : Rebuild / reconductor 23.6 miles of ACSR ~ 954 ~ 45/7 ~ RAIL - Conductor section 1** **Project Type : FAC** **Cost : $47,200,000** **Time Estimate : 24- 36 months Months** **AEPI0020b (253) : Replace 2 Cook circuit breakers (3000A)** **Project Type : FAC** **Cost : $2,000,000** **Time Estimate : 12-18 months Months** **AEPI0020c (254) : Replace 2 Olive circuit breakers (3000A)** **Project Type : FAC** **Cost : $2,000,001** **Time Estimate : 12-18 months Months** **AEPI0020d (255) : An engineering study will need to be conducted to determine if the Olive Compliance Trip limits 3313 Amps 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.** **Project Type : FAC** **Cost : $25,000** **Time Estimate : 12-18 months Months** **AEPI0020e (256) : An engineering study will need to be conducted to determine if the cookCompliance Trip limits 3313 Amps 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.** **Project Type : FAC** **Cost : $25,001** **Time Estimate : 12-18 months Months** **AEPI0020J (261) : A Sag Study will be required on the 23.6 miles section of ACSR ~ 954 ~ 45/7 ~ RAIL line to mitigate the overload. New ratings after the sag study : S/N: 1409 MVA , S/E: 1887 MVA. Depending on the sag study results, cost for this upgrade is expected to be between $93,600 (no remediations required just sag study) and $47.2million (complete line reconductor/rebuild required)** **Project Type : FAC** **Cost : $93,600** **Time Estimate : sag study : 6-12 months Months**	$51,343,602

ID	Index	Facility	Upgrade Description	Cost
43497169	2	05TWIN B 345.0 kV - 18ARGNTA 345.0 kV Ckt 1	AEP AEPI0013b (235) : Replace Twin branch Wavetrap (2500A) Project Type : FAC Cost : $200,000 Time Estimate : 12-18 months Months AEPI0013c (236) : Replace three Twin branch 3000A CT's Project Type : FAC Cost : $1,800,000 Time Estimate : 12-18 months Months AEPI0013d (237) : Replace two Twin Branch breakers (3000A) Project Type : FAC Cost : $2,000,000 Time Estimate : 12-18 months Months AEPI0013e (238) :)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 Project Type : FAC Cost : $25,000 Time Estimate : 12-18 months Months AEPI0013h (241) : Rebuild/Reconductor 51.4 miles of ACSR ~ 954 ~ 45/7 ~ RAIL conductor section 1 Project Type : FAC Cost : $102,800,000 Time Estimate : 24-36 months Months	$106,825,000
			TOTAL COST	$176,542,102

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
43496555	243215	05COOK	AEP	243229	05OLIVE	AEP	1	AEP_P4_#8621_05COOK 345_K	breaker	1409.0	153.21	155.53	DC	32.14

Bus #	Bus	MW Impact
238979	02NAPMUN	1.9993
243440	05CKG1	52.9327
244412	05WTRV SLR C	0.0454
247528	05COVRT1	7.7516
247529	05COVRT2	7.7516
247530	05COVRT3	7.7516
247531	05COVRT4	4.6524
247532	05COVRT5	4.6524
247533	05COVRT6	4.6524
247604	X1-042	0.0658
247651	AA2-116	269.1752
247966	05WTRV SLR E	0.3252
925961	AC1-072	0.7191
926581	AC1-141	24.6428
931951	AB1-107 1	14.7089
931961	AB1-107 2	33.0882
934891	AD1-118	3.7824
936141	AD2-020 C O1	4.9442
936142	AD2-020 E O1	3.0432
936601	AD2-075	37.3491
938261	AE1-039	0.1257
938911	AE1-119	29.7190
939683	AE1-198 BAT	6.0360
940262	AE2-008 BAT	9.0080
941781	AE2-181 C	1.5636
941782	AE2-181 E	1.0424
942661	AE2-282 C O1	2.4158
942662	AE2-282 E O1	1.2712
942883	AE2-307 BAT	4.5082
943021	AE2-325 C	1.3272
943022	AE2-325 E	0.8827
943961	AF1-064 C O1	0.9574
943962	AF1-064 E O1	0.4758
944161	AF1-084 C	6.1101
944162	AF1-084 E	3.4898
944551	AF1-120 C	0.7758
944552	AF1-120 E	0.3908
944961	AF1-161 C	1.0583
944962	AF1-161 E	1.0583
945101	AF1-175 C O1	19.2833
945102	AF1-175 E O1	12.8556
945111	AF1-176 C O1	5.5132

Bus #	Bus	MW Impact
945112	AF1-176 E O1	5.1109
945401	AF1-205 C O1	0.6873
945402	AF1-205 E O1	0.4582
945411	AF1-206 C O1	3.4823
945412	AF1-206 E O1	2.3216
950311	G934 C	4.9140
950312	G934 E	19.6560
950351	J466	3.8109
950791	J201 C	0.5455
950792	J201 E	2.1819
950871	J246 C	0.2214
950872	J246 E	0.8855
950942	J325 E	0.4962
951531	J533 C	6.3248
951532	J533 E	25.2992
951571	J538 C	3.4263
951572	J538 E	13.7052
951941	J602 C	4.3755
951942	J602 E	23.6725
952161	J571	0.9906
952201	J589 C	4.7727
952202	J589 E	25.8213
952312	J646 E	0.1851
952401	J752 C	2.0130
952402	J752 E	10.8910
952611	J717 C	4.5328
952612	J717 E	24.5237
952761	J728 C	4.2154
952762	J728 E	22.8372
952881	J758	28.8680
952971	J793	153.2462
953071	J794 C	0.2914
953072	J794 E	1.5767
953271	J701 C	0.9910
953272	J701 E	5.3614
953291	J796	34.0384
953321	J799	18.7923
953361	J806	20.3340
953421	J841	99.7191
953771	J832	15.5530
953781	J833	9.8460
953811	J839	11.8830
953941	J857	17.5080
954111	J875	16.3965
954381	J906 C	2.7873
954382	J906 E	15.0797
954591	J937	88.2269
955021	J978 C	2.6171
955022	J978 E	14.1589
955071	J984 C	5.1106
955072	J984 E	27.6494
955121	J989	10.4504

Bus #	Bus	MW Impact
955181	J996	7.8096
955261	J1005	28.4860
955341	J1013	10.3384
955351	J1014 C	6.1795
955352	J1014 E	3.7077
955591	J1043 C	3.5122
955592	J1043 E	62.2362
955621	J1046	4.2655
955721	J1056 C	2.9156
955722	J1056 E	15.7744
955781	J1062	17.0620
955801	J1064 C	5.5882
955802	J1064 E	30.2338
955811	J1065 C	4.9898
955812	J1065 E	26.9962
955831	J1068 C	3.1656
955832	J1068 E	17.1264
955861	J1071	17.5960
955961	J1083	9.2778
956011	J1088	21.0630
956021	J1089	23.7830
956031	J1090	11.3994
956161	J1103	2.5928
956291	J1117	10.6096
956301	J1119	75.0600
956741	J1172	6.7335
956751	J1173	8.5280
956801	J1178	8.6151
DUCKCREEK	DUCKCREEK	5.6573
NEWTON	NEWTON	3.3610
FARMERCITY	FARMERCITY	0.2219
G-007A	G-007A	1.9588
VFT	VFT	5.2954
CBM-W1	CBM-W1	17.4765
PRAIRIE	PRAIRIE	8.1339
COFFEEN	COFFEEN	1.9015
EDWARDS	EDWARDS	1.7986
CHEOAH	CHEOAH	0.5445
TILTON	TILTON	2.3001
GIBSON	GIBSON	1.1553
CALDERWOOD	CALDERWOOD	0.5492
BLUEG	BLUEG	2.4616
TRIMBLE	TRIMBLE	0.7746
CATAWBA	CATAWBA	0.1992

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
43497169	243234	05TWIN B	AEP	256000	18ARGNTA	METC	1	AEP_P7-1_#10999	tower	956.0	197.52	198.06	DC	11.39

Bus #	Bus	MW Impact
247651	AA2-116	55.4930
247966	05WTRV SLR E	0.1196
247967	05OLIV SLR E	0.1310
247969	Z2-116 E	0.0763
926581	AC1-141	5.0803
931951	AB1-107 1	-20.5615
931961	AB1-107 2	-46.4644
933281	AC2-140 C	1.7468
933282	AC2-140 E	0.0919
934252	AD1-052 E1	-0.3531
934262	AD1-052 E2	-0.3531
936141	AD2-020 C O1	3.1779
936142	AD2-020 E O1	1.9561
936631	AD2-079 C O1	0.6843
936632	AD2-079 E O1	0.4562
938261	AE1-039	0.0418
938671	AE1-089 C	7.1307
938672	AE1-089 E	9.7887
939391	AE1-170 C O1	3.5546
939392	AE1-170 E O1	4.9088
940261	AE2-008	4.3663
942681	AE2-284	2.2428
943021	AE2-325 C	0.8530
943022	AE2-325 E	0.5673
944161	AF1-084 C	1.4648
944162	AF1-084 E	0.8366
944931	AF1-158 C O1	2.5685
944932	AF1-158 E O1	1.7124
944961	AF1-161 C	0.6803
944962	AF1-161 E	0.6803
945101	AF1-175 C O1	3.0794
945102	AF1-175 E O1	2.0529
945111	AF1-176 C O1	3.5965
945112	AF1-176 E O1	3.3340
950002	G736 E	10.4840
950022	J299 E	3.8522
950101	J390	41.2495
950111	J391	2.6280
950171	J405 C	0.9455
950172	J405 E	1.1325
950181	J407 C	2.1320
950182	J407 E	8.5280

Bus #	Bus	MW Impact
950401	J041 C	0.9461
950402	J041 E	3.7843
950452	J436 E	7.8495
950462	J437 E	7.8495
950471	J438 C	1.7637
950472	J438 E	7.0550
950481	J442 C	2.0968
950482	J442 E	8.3872
950501	J449 C	2.1784
950502	J449 E	8.7135
950522	J455 E	15.5640
950561	G830 C	1.0361
950562	G830 E	4.1445
951031	J344 C	1.7532
951032	J344 E	5.2596
951192	J432 E	5.1176
951202	J460 E	10.4440
951221	J475 C	2.0764
951222	J475 E	8.3056
951241	J485	2.5280
951262	J488 E	7.9452
951292	J493 E	7.8825
951301	J495 C	2.6350
951302	J495 E	7.9050
951351	J500 C	5.0130
951352	J500 E	20.0520
951381	J504	2.6865
951391	J505	5.8140
951402	J506 E	10.2480
951412	J510 E	13.9065
951421	J514	1.6038
951441	J523 C	1.6137
951442	J523 E	1.0758
951451	J524 C	3.1074
951452	J524 E	2.0716
951472	J526 E	15.6660
951491	J528 C	2.0000
951492	J528 E	8.0000
951501	J529 C	2.5990
951502	J529 E	10.3960
951511	J530 C	2.6425
951512	J530 E	10.5700
951541	J534 C	2.6060
951542	J534 E	10.4240
951551	J535 C	2.1596
951552	J535 E	8.6386
951631	J456 C	1.2414
951632	J456 E	6.7161
951701	J587 C	1.6293
951702	J587 E	8.8147
951721	J643	10.9970
951741	J474 C	1.1776

Bus #	Bus	MW Impact
951742	J474 E	6.3709
951801	J512 C	2.0303
951802	J512 E	10.9847
951811	J513 C	0.7924
951812	J513 E	4.2869
951821	J541 C	3.1674
951822	J541 E	17.1366
951841	J555 C	1.1337
951842	J555 E	6.1337
951861	J569 C	0.8081
951862	J569 E	4.3719
952021	J614 C	0.5564
952022	J614 E	3.0102
952061	J302 C	0.8233
952062	J302 E	4.4540
952131	J503 C	0.8151
952132	J503 E	4.4099
952191	J583 C	1.5705
952192	J583 E	8.4966
952211	J590 C	0.7284
952212	J590 E	3.9408
952231	J598 C	2.3756
952232	J598 E	12.8524
952251	J641	7.2310
952271	J644	5.6320
952381	J703	7.3927
952391	J704	3.1666
952431	J760	1.7637
952511	J584 C	0.5444
952512	J584 E	2.9452
952551	J718	2.6869
952581	J740 C	1.6392
952582	J740 E	8.8688
952651	J756 C	1.6775
952652	J756 E	9.0760
952781	J748 C	1.6124
952782	J748 E	8.7236
952871	J757 C	2.4292
952872	J757 E	13.1425
952952	G517 E	6.7964
952991	J713 C	2.4509
952992	J713 E	13.2601
953001	J785 C	0.8577
953002	J785 E	4.6401
953011	J885 C	0.5321
953012	J885 E	2.8791
953021	J628 C	3.2985
953022	J628 E	17.8455
953031	J545 C	1.2362
953032	J545 E	6.6883
953061	J722 C	1.6355
953062	J722 E	8.8485

Bus #	Bus	MW Impact
953082	J836 E	10.4780
953091	J916	0.1047
953111	J807 C	0.7962
953112	J807 E	4.3077
953151	J831	2.3616
953161	J837 C	1.6401
953162	J837 E	8.8732
953171	J838 C	0.8196
953172	J838 E	4.4344
953201	J715 C	0.9015
953202	J715 E	4.8775
953231	J447 C	1.2400
953232	J447 E	6.7085
953331	J801	4.0337
953491	J947	11.9220
953522	J580 E	15.9833
953551	J705 C	0.8170
953552	J705 E	4.4200
953561	J706 C	0.8170
953562	J706 E	4.4200
953571	J720 C	1.6236
953572	J720 E	8.7844
953601	J743 C	1.7403
953602	J743 E	9.4153
953632	J803 E	1.7043
953661	J816	3.1698
953681	J818	8.7240
953691	J819 C	0.8922
953692	J819 E	4.8271
953701	J821 C	0.8748
953702	J821 E	4.7326
953741	J826 C	0.7895
953742	J826 E	4.2715
953821	J840 C	1.2163
953822	J840 E	6.5807
953871	J847	5.6088
953891	J849	7.2150
953901	J850	14.5500
953921	J855 C	0.8377
953922	J855 E	4.5323
953951	J859	7.8389
954001	J864	2.8484
954051	J869	2.6774
954061	J870	10.7400
954071	J871	5.3700
954091	J873 C	1.6776
954092	J873 E	9.0764
954101	J874	7.8195
954131	J877	12.9700
954141	J878	11.9500
954161	J880 C	1.2252
954162	J880 E	6.6288

Bus #	Bus	MW Impact
954181	J884	5.3180
954191	J886	8.7210
954221	J889 C	1.2369
954222	J889 E	6.6921
954291	J897 C	1.5668
954292	J897 E	8.4766
954301	J898 C	0.8432
954302	J898 E	4.5618
954331	J901 C	1.6467
954332	J901 E	8.9093
954371	J905	2.1132
954421	J913 C	8.4064
954511	J926 C	0.8614
954512	J926 E	4.6604
954521	J927 C	0.8274
954522	J927 E	4.4766
954532	J929 E	1.3080
954561	J933 C	1.6327
954562	J933 E	8.8333
954661	J946	10.5740
954691	J732	30.9274
954702	J844 E	8.2070
954721	J750 C	1.2107
954722	J750 E	6.5503
954741	J928 C	0.7203
954742	J928 E	3.8970
954751	J351	55.1310
954782	J951 E	4.2416
954792	J952 E	2.9057
954821	J955	52.6344
954851	J958 C	0.8154
954852	J958 E	4.4116
954861	J959 C	1.2692
954862	J959 E	6.8668
954901	J963	0.5545
954921	J966 C	3.1331
954922	J966 E	16.9509
954931	J967 C	1.2617
954932	J967 E	6.8263
954941	J968 C	1.6392
954942	J968 E	8.8688
954951	J971 C	2.0319
954952	J971 E	10.9931
954981	J974 C	2.2152
954982	J974 E	11.9848
954991	J975 C	1.2362
954992	J975 E	6.6883
955011	J977 C	2.4458
955012	J977 E	13.2322
955051	J981 C	1.6748
955052	J981 E	9.0612
955061	J982 C	2.4327

Bus #	Bus	MW Impact
955062	J982 E	13.1613
955091	J986	8.5034
955171	J995	5.1200
955191	J997	10.4720
955201	J998	2.5385
955211	J999	5.3900
955221	J1000	2.7990
955231	J1001	2.0908
955241	J1002	5.6905
955251	J1003	2.9120
955271	J1006	5.2240
955291	J1008	2.6375
955301	J1009	24.0960
955311	J1010	23.9960
955321	J1011	23.9960
955391	J1021 C	1.5600
955392	J1021 E	8.4400
955401	J1022 C	1.1843
955402	J1022 E	6.4072
955431	J1025 C	2.3419
955432	J1025 E	12.6701
955501	J1032	2.7305
955531	J1037	0.8022
955542	J1038 E	1.7215
955561	J1040 C	2.6160
955562	J1040 E	10.4640
955571	J1041	1.0414
955581	J1042 C	1.7796
955582	J1042 E	10.0844
955601	J1044 C	5.9350
955602	J1044 E	5.9350
955611	J1045	1.0434
955631	J1047	11.8700
955661	J1050 C	1.8034
955662	J1050 E	9.7571
955671	J1051	2.9435
955691	J1053	17.6580
955701	J1054	1.6116
955711	J1055 C	1.2250
955712	J1055 E	6.6274
955731	J1057	6.5087
955741	J1058	18.5430
955771	J1061	16.3830
955841	J1069 C	1.6392
955842	J1069 E	8.8688
955871	J1072	8.0880
955971	J1084	8.4180
955981	J1085 C	2.5932
955982	J1085 E	14.0298
955991	J1086	6.2472
956051	J1092	5.4240
956111	J1098	2.0896

Bus #	Bus	MW Impact
956141	J1101	1.1628
956151	J1102	3.7009
956171	J1104	5.9200
956181	J1105	10.7300
956191	J1106 C	3.4087
956192	J1106 E	18.4422
956211	J1108	7.9845
956221	J1109 C	1.7073
956222	J1109 E	9.2368
956231	J1110	5.3660
956271	J1114 C	1.5987
956272	J1114 E	8.6493
956281	J1115 C	1.6230
956282	J1115 E	8.7810
956321	J1121	11.3700
956351	J1124	5.3940
956371	J1127	2.9097
956381	J1128	8.0235
956391	J1129	3.8201
956411	J1131	5.5280
956421	J1132	2.5025
956431	J1135	2.6185
956461	J1140	5.3440
956481	J1143	5.3380
956541	J1149	10.5360
956571	J1153	8.8260
956581	J1154	4.3913
956671	J1164	10.3780
956711	J1169	2.5765
956721	J1170	10.5740
956731	J1171	5.8470
956761	J1174	15.7980
956771	J1175 C	2.4645
956772	J1175 E	13.3335
956781	J1176 C	1.2018
956782	J1176 E	6.5020
956791	J1177 C	2.3756
956792	J1177 E	12.8524
956811	J1179	16.1400
956831	J1181 C	1.6839
956832	J1181 E	9.1101
956841	J1182	12.5525
956852	J1183 E	0.0779
956891	J1187 C	1.2387
956892	J1187 E	6.7019
956901	J1188	2.9230
LGEE	LGEE	0.9379
CPLE	CPLE	0.2686
WEC	WEC	1.3617
CBM-W2	CBM-W2	18.9189
NY	NY	0.5707
TVA	TVA	2.2456

Bus #	Bus	MW Impact
O-066	O-066	6.0950
CBM-S2	CBM-S2	3.6472
CBM-S1	CBM-S1	13.7342
G-007	G-007	0.9350
MADISON	MADISON	5.0944
MEC	MEC	5.6266

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
41011930	264612	19MON12	ITCT	241901	02LALLENDORF	ATSI	1	ATSI-P7-1-TE-138-025T-A	tower	1244.0	238.68	238.73	DC	13.58

Bus #	Bus	MW Impact
244357	05GRANGER EL	-0.1884
244412	05WTRV SLR C	0.0333
247528	05COVRT1	4.2120
247529	05COVRT2	4.2120
247530	05COVRT3	4.2120
247531	05COVRT4	2.5280
247532	05COVRT5	2.5280
247533	05COVRT6	2.5280
247604	X1-042	0.0446
247651	AA2-116	75.1876
247966	05WTRV SLR E	0.2383
247967	05OLIV SLR E	0.1700
247969	Z2-116 E	0.0911
274788	**SE CHICAG;5U (Deativation : 06/01/20)**	**2.1081**
274789	**SE CHICAG;6U (Deativation : 06/01/20)**	**2.1137**
274790	**SE CHICAG;7U (Deativation : 06/01/20)**	**2.1415**
274791	**SE CHICAG;8U (Deativation : 06/01/20)**	**2.1415**
274792	**SE CHICAG;9U (Deativation : 06/01/20)**	**2.1461**
274793	**SE CHICAG;0U (Deativation : 06/01/20)**	**2.1461**
274794	**SE CHICAG;1U (Deativation : 06/01/20)**	**2.1461**
274795	**SE CHICAG;2U (Deativation : 06/01/20)**	**2.1461**
274881	PILOT HIL;1E	7.5410
275149	KELLYCK ;1E	7.5410
276169	Z1-107 E	1.0639
294392	P-010 E	2.4582
910542	X3-005 E	0.3072
925961	AC1-072	0.3907
926581	AC1-141	6.8834
927091	AC1-204 1	29.5652
927101	AC1-204 2	29.5605
927451	AC1-142A 1	1.7038
927461	AC1-142A 2	1.7038
930501	AB1-091 O1	29.6442
931951	AB1-107 1	-33.9244
931961	AB1-107 2	-110.3845
932601	AC2-080 C O1	1.3835
932602	AC2-080 E O1	9.2585
932931	AC2-117	2.5446
933281	AC2-140 C	2.3734
933282	AC2-140 E	0.1249

Bus #	Bus	MW Impact
933411	AC2-154 C	1.0234
933412	AC2-154 E	1.6698
934252	AD1-052 E1	-0.5409
934262	AD1-052 E2	-0.5409
934721	AD1-100 C	7.9535
934722	AD1-100 E	37.1161
936141	AD2-020 C O1	4.9995
936142	AD2-020 E O1	3.0772
936371	AD2-047 C O1	1.8314
936372	AD2-047 E O1	8.9415
936461	AD2-060	0.5710
936601	AD2-075	20.2942
936631	AD2-079 C O1	0.8397
936632	AD2-079 E O1	0.5598
937041	AD2-138 C	1.8730
937042	AD2-138 E	8.7690
937321	**AD2-175 C (Withdrawn : 12/10/2019)**	**6.6295**
937322	**AD2-175 E (Withdrawn : 12/10/2019)**	**4.4197**
937401	AD2-194 1	3.1793
937411	AD2-194 2	3.1788
938261	AE1-039	0.0852
938511	AE1-070 1	3.7357
938521	AE1-070 2	3.4172
938671	AE1-089 C	8.3201
938672	AE1-089 E	11.4214
939351	AE1-166 C O1	2.2032
939352	AE1-166 E O1	2.0337
939391	AE1-170 C O1	4.8447
939392	AE1-170 E O1	6.6903
939631	AE1-193 C	3.6564
939632	AE1-193 E	24.4701
939641	AE1-194 C	3.6564
939642	AE1-194 E	24.4701
939651	AE1-195 C	3.6564
939652	AE1-195 E	24.4701
939681	AE1-198 C	10.8568
939682	AE1-198 E	9.2255
940261	AE2-008	5.0946
940581	AE2-045 C O1	6.2788
940582	AE2-045 E O1	8.6200
940621	AE2-049 C O1	1.9652
940622	AE2-049 E O1	1.3101
940631	AE2-050 C O1	2.5604
940632	AE2-050 E O1	1.7069
940752	AE2-062 E	0.0283
940762	**AE2-063 E (Withdrawn : 01/14/2020)**	**0.0283**
941551	AE2-152 C O1	2.5422
941552	AE2-152 E O1	1.6948
941561	AE2-153 C O1	1.8900
941562	AE2-153 E O1	8.8489
942681	AE2-284	3.0568
942881	AE2-307 C O1	4.6941

Bus #	Bus	MW Impact
942882	AE2-307 E O1	1.7069
942911	AE2-310 C O1	1.9082
942912	AE2-310 E O1	0.5127
943001	AE2-323 C	3.8881
943002	AE2-323 E	1.9064
943021	AE2-325 C	1.3420
943022	AE2-325 E	0.8925
943781	AF1-046 C	0.9619
943782	AF1-046 E	0.6412
944161	AF1-084 C	2.3965
944162	AF1-084 E	1.3688
944911	AF1-156 C	2.5612
944912	AF1-156 E	1.7075
944931	AF1-158 C O1	3.2647
944932	AF1-158 E O1	2.1765
944961	AF1-161 C	1.0702
944962	AF1-161 E	1.0702
945101	AF1-175 C O1	3.6698
945102	AF1-175 E O1	2.4465
945111	AF1-176 C O1	6.2118
945112	AF1-176 E O1	5.7585
945351	AF1-200 FTIR	67.1721
945501	AF1-215 C O1	5.5044
945502	AF1-215 E O1	3.6696
946521	AF1-316 C O1	1.4743
946522	AF1-316 E O1	2.2114
950311	G934 C	4.3998
950312	G934 E	17.5992
950351	J466	7.2879
950791	J201 C	0.8608
950792	J201 E	3.4430
950871	J246 C	0.2252
950872	J246 E	0.9007
950942	J325 E	1.0051
951531	J533 C	6.4336
951532	J533 E	25.7344
951941	J602 C	6.3289
951942	J602 E	34.2411
952161	J571	0.4900
952201	J589 C	5.3352
952202	J589 E	28.8648
952312	J646 E	0.4419
952401	J752 C	3.7023
952402	J752 E	20.0307
952611	J717 C	5.9975
952612	J717 E	32.4478
952761	J728 C	5.5775
952762	J728 E	30.2163
952881	J758	20.3460
952971	J793	363.3782
953071	J794 C	0.3523
953072	J794 E	1.9059

Bus #	Bus	MW Impact
953271	J701 C	1.8013
953272	J701 E	9.7455
953291	J796	47.7904
953321	J799	53.4001
953361	J806	17.9590
953421	J841	141.4319
953771	J832	16.2900
953781	J833	27.4140
953811	J839	26.5970
953941	J857	13.1222
954111	J875	13.9350
954381	J906 C	1.5403
954382	J906 E	8.3337
954591	J937	34.0956
955021	J978 C	2.0531
955022	J978 E	11.1079
955071	J984 C	4.5758
955072	J984 E	24.7562
955121	J989	17.9504
955261	J1005	40.1780
955351	J1014 C	7.6465
955352	J1014 E	4.5879
955591	J1043 C	2.4246
955592	J1043 E	42.9639
955621	J1046	12.5920
955721	J1056 C	9.3597
955722	J1056 E	50.6383
955781	J1062	50.3680
955801	J1064 C	3.3790
955802	J1064 E	18.2810
955811	J1065 C	4.7365
955812	J1065 E	25.6255
955831	J1068 C	8.6050
955832	J1068 E	46.5550
955861	J1071	10.5550
955961	J1083	11.5626
956011	J1088	29.1885
956021	J1089	33.6532
956031	J1090	14.8194
956161	J1103	4.7130
956291	J1117	13.4128
956301	J1119	107.7900
956741	J1172	10.9190
956751	J1173	6.6416
956801	J1178	10.7367
LGEE	LGEE	1.4793
CPLE	CPLE	0.3036
WEC	WEC	1.8730
CBM-W2	CBM-W2	27.9443
NY	NY	1.0474
CBM-W1	CBM-W1	184.8102
TVA	TVA	3.2718

Bus #	Bus	MW Impact
O-066	O-066	11.3098
CBM-S2	CBM-S2	4.7280
CBM-S1	CBM-S1	20.3117
G-007	G-007	1.7368
MADISON	MADISON	6.6024
MEC	MEC	7.8942

Affected Systems

18 Affected Systems

18.1 LG&E

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

18.2 MISO

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

18.3 TVA

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

18.4 Duke Energy Progress

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

18.5 NYISO

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

19 Contingency Descriptions

Contingency Name	Contingency Definition
AEP_P1-2_#358	CONTINGENCY 'AEP_P1-2_#358' OPEN BRANCH FROM BUS 243205 TO BUS 243206 CKT 1 / 243205 05COOK 765 243206 05DUMONT 765 1 END
ATSI-P2-3-TE-345-022T	CONTINGENCY 'ATSI-P2-3-TE-345-022T' /* ALLEN JCT BK-34531 345 DISCONNECT BRANCH FROM BUS 238530 TO BUS 256583 CKT 1 /* 02ALLEN 345 18LENAWEE 345 DISCONNECT BRANCH FROM BUS 238530 TO BUS 239018 CKT 1 /* 02ALLEN 345 02FULTON 345 END
ATSI-P2-3-TE-345-023T	CONTINGENCY 'ATSI-P2-3-TE-345-023T' /* ALLEN JCT BK-34532 345 DISCONNECT BRANCH FROM BUS 238530 TO BUS 256583 CKT 1 /* 02ALLEN 345 18LENAWEE 345 DISCONNECT BRANCH FROM BUS 238530 TO BUS 239344 CKT 3 /* 02ALLEN 345 02ALLEN-2 138 END
AEP_P7-1_#10999	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
AEP_P4_#7443_05DUMONT 765_A	CONTINGENCY 'AEP_P4_#7443_05DUMONT 765_A' OPEN BRANCH FROM BUS 243205 TO BUS 243206 CKT 1 / 243205 05COOK 765 243206 05DUMONT 765 1 OPEN BRANCH FROM BUS 243206 TO BUS 246999 CKT 1 / 243206 05DUMONT 765 246999 05SORENS 765 1 END
ATSI-P7-1-TE-138-025T-A	CONTINGENCY 'ATSI-P7-1-TE-138-025T-A' /* ALLEN-MAJ-MONROE & LEMO-MAJESTIC 345KV DISCONNECT BRANCH FROM BUS 264594 TO BUS 256583 CKT 1 /* 19LULU 345 18LENAWEE 345 DISCONNECT BRANCH FROM BUS 264594 TO BUS 264839 CKT 1 /* 19LULU 345 19MILAN 345 DISCONNECT BRANCH FROM BUS 264594 TO BUS 955720 CKT 1 /* 19LULU 345 J1056 TAP 345 DISCONNECT BRANCH FROM BUS 238889 TO BUS 955620 CKT 1 /* 02LEMOYN 345 19MAJTC 345 END
AEP_P4_#8621_05COOK 345_K	CONTINGENCY 'AEP_P4_#8621_05COOK 345_K' OPEN BRANCH FROM BUS 243205 TO BUS 243215 CKT 4 / 243205 05COOK 765 243215 05COOK 345 4 OPEN BRANCH FROM BUS 243215 TO BUS 920210 CKT 1 / 243215 05COOK 345 920210 AA2-116 TAPK 345 1 OPEN BRANCH FROM BUS 243224 TO BUS 920210 CKT 1 / 243224 05KENZIE 345 920210 AA2-116 TAPK 345 1 END
ATSI-P1-2-TE-345-605T	CONTINGENCY 'ATSI-P1-2-TE-345-605T' /*LINE OUTAGE: AJ TO ITC MOROCCO DISCONNECT BRANCH FROM BUS 238530 TO BUS 256583 CKT 1 END

Short Circuit

20 Short Circuit

The following Breakers are overduty

Bus Number	Bus Name	BREAKER	Type	Capacity (Amps)	Duty Percentage Post Queue	Duty Percentage Pre Queue

22 Network Impacts – Option 2

The Queue Project AF1-175 was evaluated as a 152.0 MW (Capacity 91.2 MW) injection tapping the DC Cook to Olive 345 kV line in the AEP area. Project AF1-175 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-175 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

Summer Peak Load Flow

23 Generation Deliverability

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

None

24 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	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
4349665 1	938670	AE1-089 TAP	345.0	AEP	243219	05DUMONT	345.0	AEP	1	AEP_P4_#8167_05OLIVE	breaker	1409.0	99.12	103.48	DC	61.29

25 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	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
4349668 6	243229	05OLIVE	345.0	AEP	274804	UNIV PKN;RP	345.0	CE	1	COMED_P4_023-65-BT2-3__	breaker	971.0	103.49	104.07	DC	11.2
4349668 7	243229	05OLIVE	345.0	AEP	274804	UNIV PKN;RP	345.0	CE	1	COMED_P4_112-65-BT4-5__	breaker	971.0	103.43	104.0	DC	11.2
4349668 8	243229	05OLIVE	345.0	AEP	274804	UNIV PKN;RP	345.0	CE	1	COMED_P4_112-65-BT3-4__	breaker	971.0	103.43	104.0	DC	11.2
4349668 9	243229	05OLIVE	345.0	AEP	274804	UNIV PKN;RP	345.0	CE	1	COMED_P4_023-65-BT4-5__	breaker	971.0	103.41	103.99	DC	11.2
5189381 4	920210	AA2-116 TAP	345.0	AEP	243224	05KENZIE	345.0	AEP	1	AEP_P7-1_#10997-B	tower	1409.0	108.37	110.83	DC	34.81
5189342 8	945100	AF1-175 TAP	345.0	AEP	243229	05OLIVE	345.0	AEP	1	AEP_P1-2_#358	single	1409.0	127.02	131.98	DC	69.93
5189343 3	945100	AF1-175 TAP	345.0	AEP	243229	05OLIVE	345.0	AEP	1	AEP_P1-3_#8684_05COOK 765_4	single	1409.0	100.72	105.69	DC	70.12

26 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
4349705 6	24322 9	05OLIV E	345. 0	AEP	27480 4	UNIV PK N;RP	345. 0	CE	1	COMED_P1 -2_695_B2	operatio n	971.0	103.41	103.99	DC	11.2
4349708 2	93867 0	AE1- 089 TAP	345. 0	AEP	24321 9	05DUMON T	345. 0	AEP	1	AEP_P1- 2_#11219	operatio n	1409. 0	97.04	100.79	DC	52.81
5189342 7	94510 0	AF1- 175 TAP	345. 0	AEP	24322 9	05OLIVE	345. 0	AEP	1	AEP_P1- 2_#358	operatio n	1409. 0	146.75	154.56	DC	116.56

27 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.

27.1 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
43496651	938670	AE1-089 TAP	AEP	243219	05DUMONT	AEP	1	AEP_P4_#8167_05OLIVE	breaker	1409.0	99.12	103.48	DC	61.29

Bus #	Bus	MW Impact
244130	05ST.JOE CTR	41.9000
247900	05FR-11G E	5.5906
247901	05FR-12G E	5.4978
247902	05FR-21G E	5.8762
247903	05FR-22G E	5.6263
247904	05FR-3G E	11.3954
247905	05FR-4G E	8.9250
247906	05MDL-1G E	13.2148
247907	05MDL-2G E	6.6198
247912	05MDL-3G E	6.6198
247913	05MDL-4G E	6.6198
247943	T-127 E	6.6198
922912	AB1-080	2.4830
930042	AB1-006 E	14.3981
932601	AC2-080 C O1	4.1787
932602	AC2-080 E O1	27.9653
935271	AD1-137 C	4.6410
935272	AD1-137 E	31.0590
937041	AD2-138 C	5.6573
937042	AD2-138 E	26.4867
938671	AE1-089 C	84.8689
938672	AE1-089 E	116.5040
939631	AE1-193 C	2.7852
939632	AE1-193 E	18.6391
939641	AE1-194 C	2.7852
939642	AE1-194 E	18.6391
939651	AE1-195 C	2.7852
939652	AE1-195 E	18.6391
939681	AE1-198 C	8.2698
939682	AE1-198 E	7.0272
940261	AE2-008	51.9672
940581	AE2-045 C O1	18.9650
940582	AE2-045 E O1	26.0366
941571	AE2-154 C	1.4253
941572	AE2-154 E	9.5387
945101	AF1-175 C O2	36.7718
945102	AF1-175 E O2	24.5146
945391	AF1-204 C O2	1.8715
945392	AF1-204 E O2	5.6145
945421	AF1-207 C O2	4.0117
945422	AF1-207 E O2	17.1023

Bus #	Bus	MW Impact
945501	AF1-215 C O2	46.9782
945502	AF1-215 E O2	31.3188
946581	AF1-322 C	3.6839
946582	AF1-322 E	5.0873
951811	J513 C	1.0373
951812	J513 E	5.6118
952581	J740 C	2.8645
952582	J740 E	15.4975
953161	J837 C	2.8659
953162	J837 E	15.5053
953171	J838 C	1.4322
953172	J838 E	7.7488
954421	J913 C	14.6896
954941	J968 C	2.8645
954942	J968 E	15.4975
955821	J1067	14.2344
955841	J1069 C	2.8645
955842	J1069 E	15.4975
LGEE	LGEE	0.2579
WEC	WEC	0.2010
CBM-W2	CBM-W2	7.7314
NY	NY	0.2721
CBM-W1	CBM-W1	12.3974
TVA	TVA	0.6272
O-066	O-066	3.2928
CBM-S1	CBM-S1	3.8255
G-007	G-007	0.5096
MADISON	MADISON	2.1793
MEC	MEC	1.3236
CATAWBA	CATAWBA	0.0315

27.2 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
43496688	243229	05OLIVE	AEP	274804	UNIV PK N;RP	CE	1	COMED_P4_112-65-BT3-4__	breaker	971.0	103.43	104.0	DC	11.2

Bus #	Bus	MW Impact
276153	W2-048 E	-0.6480
276165	Z1-106 BAT2	1.0368
276166	Z1-106 BAT1	1.0367
276171	Z1-107 BAT	2.2022
276172	Z1-108 BAT	2.0414
909052	X2-022 E	-9.3707
918052	AA1-018 E OP	-12.3149
920273	AA2-123 BAT	2.0020
938671	AE1-089 C	6.2578
938672	AE1-089 E	8.5904
939683	AE1-198 BAT	5.5402
939733	**AE1-204 BAT (Withdrawn : 11/18/2019)**	**0.4539**
940261	AE2-008	3.8318
941732	AE2-173 BAT	4.0990
942883	AE2-307 BAT	8.2642
942913	AE2-310 BAT	4.2988
943383	AF1-009 BAT	2.4450
943403	AF1-011 BAT	2.7042
943423	AF1-013 BAT	2.4450
943803	AF1-048 BAT	5.2174
943922	AF1-060 BAT	1.1471
945101	AF1-175 C O2	3.0264
945102	AF1-175 E O2	2.0176
945352	AF1-200 NFTW	107.5047
945501	AF1-215 C O2	4.0942
945502	AF1-215 E O2	2.7295
946163	AF1-281 BAT	1.8644
946533	AF1-317 BAT	4.6475
946683	AF1-332 BAT	4.6475
950311	G934 C	1.9947
950312	G934 E	7.9788
950351	J466	1.8999
950791	J201 C	0.2566
950792	J201 E	1.0266
950871	J246 C	0.0924
950872	J246 E	0.3696
950942	J325 E	0.2522
951531	J533 C	2.6400
951532	J533 E	10.5600
951571	J538 C	1.8837
951572	J538 E	7.5348

Bus #	Bus	MW Impact
951811	J513 C	0.8217
951812	J513 E	4.4455
951941	J602 C	2.0124
951942	J602 E	10.8876
952161	J571	0.4273
952201	J589 C	2.0467
952202	J589 E	11.0733
952312	J646 E	0.0997
952401	J752 C	0.9906
952402	J752 E	5.3594
952581	J740 C	1.8458
952582	J740 E	9.9862
952611	J717 C	2.0268
952612	J717 E	10.9657
952761	J728 C	1.8849
952762	J728 E	10.2115
952881	J758	13.1480
952971	J793	82.4267
953071	J794 C	0.1273
953072	J794 E	0.6888
953161	J837 C	1.8467
953162	J837 E	9.9912
953171	J838 C	0.9229
953172	J838 E	4.9931
953271	J701 C	0.4858
953272	J701 E	2.6282
953291	J796	15.4561
953321	J799	11.5120
953361	J806	9.6671
953421	J841	45.3773
953771	J832	6.5860
953781	J833	6.0830
953811	J839	6.2610
953941	J857	8.1580
954111	J875	9.3045
954381	J906 C	1.0594
954382	J906 E	5.7316
954421	J913 C	9.4656
954591	J937	36.3372
954751	J351	36.4626
954941	J968 C	1.8458
954942	J968 E	9.9862
955021	J978 C	1.0433
955022	J978 E	5.6447
955071	J984 C	2.0745
955072	J984 E	11.2235
955121	J989	5.0952
955141	J992	10.6440
955181	J996	4.8688
955261	J1005	12.9340
955341	J1013	5.1880
955351	J1014 C	3.1735

Bus #	Bus	MW Impact
955352	J1014 E	1.9041
955591	J1043 C	1.3484
955592	J1043 E	23.8936
955621	J1046	2.9770
955721	J1056 C	1.8826
955722	J1056 E	10.1854
955781	J1062	11.9080
955801	J1064 C	2.1141
955802	J1064 E	11.4379
955811	J1065 C	2.0658
955812	J1065 E	11.1762
955821	J1067	12.4248
955831	J1068 C	1.9069
955832	J1068 E	10.3171
955841	J1069 C	1.8458
955842	J1069 E	9.9862
955861	J1071	6.7680
955961	J1083	4.5045
956011	J1088	9.6855
956021	J1089	10.9667
956031	J1090	5.7375
956161	J1103	1.2710
956251	J1112	8.3070
956291	J1117	5.1400
956301	J1119	38.1720
956741	J1172	3.2005
956751	J1173	4.9400
956801	J1178	4.1828
DUCKCREEK	DUCKCREEK	9.0174
LGEE	LGEE	0.5209
NEWTON	NEWTON	1.7933
CPLE	CPLE	0.5854
FARMERCITY	FARMERCITY	0.3148
G-007A	G-007A	3.9343
VFT	VFT	10.5909
PRAIRIE	PRAIRIE	7.4494
COFFEEN	COFFEEN	1.7943
CBM-S2	CBM-S2	3.8379
EDWARDS	EDWARDS	2.9792
TILTON	TILTON	0.9072

27.3 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
51893814	920210	AA2-116 TAP	AEP	243224	05KENZIE	AEP	1	AEP_P7-1_#10997-B	tower	1409.0	108.37	110.83	DC	34.81

Bus #	Bus	MW Impact
243440	05CKG1	32.4790
247528	05COVRT1	3.9050
247529	05COVRT2	3.9050
247530	05COVRT3	3.9050
247531	05COVRT4	2.3437
247532	05COVRT5	2.3437
247533	05COVRT6	2.3437
247651	AA2-116	408.7924
925961	AC1-072	0.3622
926581	AC1-141	37.4247
933281	AC2-140 C	2.0624
933282	AC2-140 E	0.1085
936601	AD2-075	18.8152
940262	AE2-008 BAT	5.6024
942682	AE2-284 BAT	19.5450
943023	AE2-325 BAT	7.4709
943783	AF1-046 BAT	3.6650
944963	AF1-161 BAT	7.1560
945101	AF1-175 C O2	20.8884
945102	AF1-175 E O2	13.9256
945113	AF1-176 BAT	13.4771
950311	G934 C	2.0772
950312	G934 E	8.3088
950351	J466	1.5369
950791	J201 C	0.2224
950792	J201 E	0.8898
950871	J246 C	0.0930
950872	J246 E	0.3720
951531	J533 C	2.6568
951532	J533 E	10.6272
951941	J602 C	1.7915
951942	J602 E	9.6925
952161	J571	0.3725
952201	J589 C	1.9840
952202	J589 E	10.7340
952401	J752 C	0.8142
952402	J752 E	4.4048
952611	J717 C	1.8683
952612	J717 E	10.1077
952761	J728 C	1.7374
952762	J728 E	9.4126

Bus #	Bus	MW Impact
952881	J758	10.6660
953071	J794 C	0.1207
953072	J794 E	0.6532
953271	J701 C	0.4012
953272	J701 E	2.1704
953291	J796	14.0102
953361	J806	7.5573
953421	J841	41.0179
953771	J832	6.4550
953941	J857	6.4824
954381	J906 C	1.1764
954382	J906 E	6.3646
954591	J937	31.6827
955021	J978 C	1.1042
955022	J978 E	5.9738
955071	J984 C	2.1603
955072	J984 E	11.6877
955121	J989	4.2096
955261	J1005	11.7280
955591	J1043 C	1.5134
955592	J1043 E	26.8174
955801	J1064 C	2.4065
955802	J1064 E	13.0195
955811	J1065 C	2.0873
955812	J1065 E	11.2927
955861	J1071	7.4010
956011	J1088	8.5650
956021	J1089	9.6798
956161	J1103	1.0496
956291	J1117	4.0576
956741	J1172	2.7375
DUCKCREEK	DUCKCREEK	2.4009
NEWTON	NEWTON	1.3001
FARMERCITY	FARMERCITY	0.0936
G-007A	G-007A	0.5346
VFT	VFT	1.4448
CBM-W1	CBM-W1	6.0674
PRAIRIE	PRAIRIE	3.3166
COFFEEN	COFFEEN	0.7626
EDWARDS	EDWARDS	0.7665
CHEOAH	CHEOAH	0.2467
TILTON	TILTON	0.8518
GIBSON	GIBSON	0.4728
CALDERWOOD	CALDERWOOD	0.2485
BLUEG	BLUEG	1.0208
TRIMBLE	TRIMBLE	0.3200
CATAWBA	CATAWBA	0.1029

27.4 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
51893428	945100	AF1-175 TAP	AEP	243229	05OLIVE	AEP	1	AEP_P1-2_#358	single	1409.0	127.02	131.98	DC	69.93

Bus #	Bus	MW Impact
238564	02BAYSG1	1.1735
238885	02LEMOG1	1.2102
238886	02LEMOG2	1.2102
238887	02LEMOG3	1.2102
238888	02LEMOG4	1.2102
238979	02NAPMUN	2.0091
239202	02STRYCT	0.0950
239293	02BS-PKR	0.1024
241902	Y1-069 GE	6.6015
243071	05BERRINSP G	0.0835
243440	05CKG1	42.5161
243441	05CKG2	47.9875
244412	05WTRV SLR C	0.0468
246397	05ELKHART HY	0.0274
246416	05TWIN BRCH1	0.0366
246422	05MAYFLWER	0.0392
246431	05BUCHANAN	0.0064
246536	05MOTTVILL	0.0215
247528	05COVRT1	6.4182
247529	05COVRT2	6.4182
247530	05COVRT3	6.4182
247531	05COVRT4	3.8521
247532	05COVRT5	3.8521
247533	05COVRT6	3.8521
247604	X1-042	0.0639
247620	Y3-023	0.0465
247643	Z2-116 C	0.0114
247651	AA2-116	182.2897
925961	AC1-072	0.5954
926581	AC1-141	16.6885
931951	AB1-107 1	14.7473
931961	AB1-107 2	33.1622
933281	AC2-140 C	11.3799
934891	AD1-118	3.7933
936141	AD2-020 C O1	7.8533
936601	AD2-075	30.9241
936631	AD2-079 C O1	0.7630
938261	AE1-039	0.1220
938911	AE1-119	29.8045
939391	AE1-170 C O1	7.7761
941781	AE2-181 C	1.5735
942661	AE2-282 C O1	2.4294

Bus #	Bus	MW Impact
942681	AE2-284	9.2572
943021	AE2-325 C	3.9774
943961	AF1-064 C O2	1.8133
944161	AF1-084 C	7.2034
944551	AF1-120 C	1.4720
944961	AF1-161 C	3.1718
945101	AF1-175 C O2	69.9331
945111	AF1-176 C O2	16.1004
945401	AF1-205 C O2	1.2982
945411	AF1-206 C O2	6.6374
950311	G934 C	4.2894
950351	J466	3.3693
950791	J201 C	0.4806
950871	J246 C	0.1935
951531	J533 C	5.5300
951571	J538 C	3.0717
951941	J602 C	3.8501
952161	J571	0.8774
952201	J589 C	4.1817
952401	J752 C	1.7782
952611	J717 C	3.9812
952761	J728 C	3.7025
952881	J758	25.6600
952971	J793	136.1792
953071	J794 C	0.2556
953271	J701 C	0.8752
953291	J796	29.9180
953321	J799	16.8569
953361	J806	18.0931
953421	J841	87.6658
953771	J832	13.6230
953781	J833	8.8380
953811	J839	10.5450
953941	J857	15.5725
954111	J875	14.6805
954381	J906 C	2.4281
954591	J937	78.3294
955021	J978 C	2.2835
955071	J984 C	4.4610
955121	J989	9.2328
955181	J996	7.0248
955261	J1005	25.0380
955341	J1013	9.2728
955351	J1014 C	5.5100
955591	J1043 C	3.0536
955621	J1046	3.8570
955721	J1056 C	2.6236
955781	J1062	15.4280
955801	J1064 C	4.8566
955811	J1065 C	4.3633
955831	J1068 C	2.8376
955861	J1071	15.3400

Bus #	Bus	MW Impact
955961	J1083	8.2509
956011	J1088	18.5460
956021	J1089	20.9423
956031	J1090	10.1520
956161	J1103	2.2900
956291	J1117	9.4200
956301	J1119	66.9180
956741	J1172	5.9370
956751	J1173	7.6424
956801	J1178	7.6616
DUCKCREEK	DUCKCREEK	5.5525
NEWTON	NEWTON	3.3761
FARMERCITY	FARMERCITY	0.2188
G-007A	G-007A	1.4769
VFT	VFT	3.9990
CBM-W1	CBM-W1	9.6077
PRAIRIE	PRAIRIE	8.1184
COFFEEN	COFFEEN	1.8931
EDWARDS	EDWARDS	1.7626
CHEOAH	CHEOAH	0.5756
TILTON	TILTON	2.3278
GIBSON	GIBSON	1.1701
CALDERWOOD	CALDERWOOD	0.5800
BLUEG	BLUEG	2.5016
TRIMBLE	TRIMBLE	0.7869
CATAWBA	CATAWBA	0.2303

Affected Systems

28 Affected Systems

28.1 LG&E

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

28.2 MISO

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

28.3 TVA

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

28.4 Duke Energy Progress

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

28.5 NYISO

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

29 Contingency Descriptions

Contingency Name	Contingency Definition
AEP_P1-3_#8684_05COOK 765_4	CONTINGENCY 'AEP_P1-3_#8684_05COOK 765_4' OPEN BRANCH FROM BUS 243205 TO BUS 243215 CKT 4 / 243205 05COOK 765 243215 05COOK 345 4 END
AEP_P1-2_#358	CONTINGENCY 'AEP_P1-2_#358' OPEN BRANCH FROM BUS 243205 TO BUS 243206 CKT 1 / 243205 05COOK 765 243206 05DUMONT 765 1 END
AEP_P4_#8167_05OLIVE	CONTINGENCY 'AEP_P4_#8167_05OLIVE' OPEN BRANCH FROM BUS 243229 TO BUS 274804 CKT 1 / 243229 05OLIVE 345 274804 UNIV PK N;RP 345 1 OPEN BRANCH FROM BUS 243229 TO BUS 243353 CKT 2 / 243229 05OLIVE 345 243353 05OLIVE 138 2 END
AEP_P7-1_#10997-B	CONTINGENCY 'AEP_P7-1_#10997-B' OPEN BRANCH FROM BUS 243215 TO BUS 243223 CKT 1 / 243215 05COOK 345 243223 05JACKSON RD 345 1 OPEN BRANCH FROM BUS 945100 TO BUS 243229 CKT 1 / 945100 AF1-175 TAP 345 243229 05OLIVE 345 1 END
COMED_P1-2_695_B2	CONTINGENCY 'COMED_P1-2_695_B2' OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTO; 765 1 END
COMED_P4_112-65-BT3-4__	CONTINGENCY 'COMED_P4_112-65-BT3-4__' TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765 TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1 / WILTO;3M 345 WILTO; 765 TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1 / WILTO;3M 345 WILTO; B 345 TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1 / WILTO;3M 345 WILTO;3C 33 END
COMED_P4_023-65-BT4-5__	CONTINGENCY 'COMED_P4_023-65-BT4-5__' TRIP BRANCH FROM BUS 275168 TO BUS 270607 CKT 1 / COLLI;2M 345 COLLI; 765 TRIP BRANCH FROM BUS 275168 TO BUS 270697 CKT 1 / COLLI;2M 345 COLLI; R 345 TRIP BRANCH FROM BUS 275168 TO BUS 275268 CKT 1 / COLLI;2M 345 COLLI;2C 33 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765 END
AEP_P1-2_#11219	CONTINGENCY 'AEP_P1-2_#11219' OPEN BRANCH FROM BUS 243207 TO BUS 255204 CKT N1 / 243207 05GRNTWN 765 255204 17REYNOLDS 765 N1 END

Contingency Name	Contingency Definition
COMED_P4_023-65-BT2-3__	CONTINGENCY 'COMED_P4_023-65-BT2-3__' TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765 TRIP BRANCH FROM BUS 270607 TO BUS 270630 CKT 1 / COLLI; 765 PLANO; 765 END
COMED_P4_112-65-BT4-5__	CONTINGENCY 'COMED_P4_112-65-BT4-5__' TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1 / WILTO;4M 345 WILTO; 765 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1 / WILTO;4M 345 WILTO; R 345 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1 / WILTO;4M 345 WILTO;4C 33 END

Short Circuit

30 Short Circuit

The following Breakers are overduty

Bus Number	Bus Name	BREAKER	Type	Capacity (Amps)	Duty Percentage Post Queue	Duty Percentage Pre Queue