



**Generation Interconnection
Feasibility Study Report
for
Queue Project AF1-116
MARION COUNTY 161 KV
72 MW Capacity / 120 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 Washington County, KY. The installed facilities will have a total capability of 120 MW with 72 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is 12/29/2023. This study does not imply a TO commitment to this in-service date.

Queue Number	AF1-116
Project Name	MARION COUNTY 161 KV
State	KY
County	Washington
Transmission Owner	EKPC
MFO	120
MWE	120
MWC	72
Fuel	Solar
Basecase Study Year	2023

2.1 Point of Interconnection

AF1-116 will interconnect with the EKPC transmission system tapping the Marion 161 kV substation.

2.2 Cost Summary

The AF1-116 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$1,220,000
Direct Connection Network Upgrade	\$0
Non Direct Connection Network Upgrades	\$0
Total Costs	\$1,220,000

In addition, the AF1-116 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	\$3,085,000

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
Install necessary equipment (a 161 kV isolation switch structure and associated switch, plus interconnection metering, fiber-optic connection and telecommunications equipment, circuit breaker and associated switches, bus supports and bus, and relay panels) at Marion County substation, to accept the IC generator lead line/bus (Estimated time to implement is 12 months)	\$1,220,000
Total Attachment Facility Costs	\$1,220,000

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

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

7 Incremental Capacity Transfer Rights (ICTRs)

Will be determined at a later study phase

8 Interconnection Customer Requirements

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.

9 Revenue Metering and SCADA Requirements

9.1 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 Sections 24.1 and 24.2.

9.2 EKPC Requirements

The Interconnection Customer will be required to comply with all EKPC Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "EKPC Facility Connection Requirements" document located at the following link:

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

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 EKPC Requirements

[Please enter any TO revenue metering and SCADA Requirements]

11 Network Impacts

The Queue Project AF1-116 was evaluated as a 120.0 MW (Capacity 72.0 MW) injection tapping the Marion 161 kV substation in the EKPC area. Project AF1-116 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-116 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 D C	MW IMPACT
42436503	342757	5LAUREL DAM	161.0	EKPC	342754	5LAUREL CO	161.0	EKPC	1	EKPC_P1-2_COOP-ELIHU161	single	200.0	98.09	100.4	DC	4.62

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 D C	MW IMPACT
41535202	341563	2GREEN CO	69.0	EKPC	342325	2SUMMERSVIL	69.0	EKPC	1	EKPC_P4-2_MAR W38-1014	breaker	39.0	79.18	111.9	DC	12.76
41797763	341563	2GREEN CO	69.0	EKPC	342325	2SUMMERSVIL	69.0	EKPC	1	EKPC_P2-3_MAR W38-1014	bus	39.0	79.18	111.9	DC	12.76
41966562	342703	5CASEY CO	161.0	EKPC	342760	5LIBERTY J	161.0	EKPC	1	EKPC_P2-3_MAR W38-1004	bus	153.0	46.3	115.66	DC	106.11
41966563	342703	5CASEY CO	161.0	EKPC	342760	5LIBERTY J	161.0	EKPC	1	EKPC_P2-3_MAR W38-1004-B	bus	153.0	42.51	111.87	DC	106.11
42149713	342703	5CASEY CO	161.0	EKPC	342760	5LIBERTY J	161.0	EKPC	1	EKPC_P4-2_MAR W38-1004	breaker	153.0	46.24	115.59	DC	106.11
40985534	342769	5MARION CO	161.0	EKPC	324280	4MARION CO	138.0	LGEE	1	EKPC_P7-1_COOP 161 DBL 2	tower	220.0	76.86	102.58	DC	56.57
41966424	342769	5MARION CO	161.0	EKPC	342775	5MARION IP T	161.0	EKPC	1	EKPC_P2-3_MAR W38-1014	bus	131.0	73.28	164.89	DC	120.0
41966466	342769	5MARION CO	161.0	EKPC	342703	5CASEY CO	161.0	EKPC	1	EKPC_P2-3_MAR W38-1004	bus	153.0	62.81	141.24	DC	120.0
41966467	342769	5MARION CO	161.0	EKPC	342703	5CASEY CO	161.0	EKPC	1	EKPC_P2-3_MAR W38-1004-B	bus	153.0	58.5	136.93	DC	120.0
42149418	342769	5MARION CO	161.0	EKPC	342775	5MARION IP T	161.0	EKPC	1	EKPC_P4-2_MAR W38-1014	breaker	131.0	73.28	164.89	DC	120.0
42149487	342769	5MARION CO	161.0	EKPC	342703	5CASEY CO	161.0	EKPC	1	EKPC_P4-2_MAR W38-1004	breaker	153.0	62.75	141.18	DC	120.0

ID	FROM BUS#	FROM BUS	kV	FRO M BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Ratin g MVA	PRE PROJEC T LOADIN G %	POST PROJEC T LOADIN G %	AC D C	MW IMPAC T
41966574	342817	STAYLOR COJ	161.0	EKPC	342818	STAYLRCO	161.0	EKPC	1	EKPC_P2-3_MAR W38-1014	bus	105.0	88.69	115.1	DC	27.73
42149719	342817	STAYLOR COJ	161.0	EKPC	342818	STAYLRCO	161.0	EKPC	1	EKPC_P4-2_MAR W38-1014	breake r	105.0	88.69	115.1	DC	27.73
41535147	342818	STAYLR CO	161.0	EKPC	324751	2TAYLOR CO	69.0	LGEE	1	EKPC_P4-2_MAR W38-1014	breake r	104.0	89.55	116.21	DC	27.73
41797735	342818	STAYLR CO	161.0	EKPC	324751	2TAYLOR CO	69.0	LGEE	1	EKPC_P2-3_MAR W38-1014	bus	104.0	89.55	116.21	DC	27.73
41535141	942410	AE2-254 TAP	69.0	EKPC	341515	2GARRARD CO	69.0	EKPC	1	EKPC_P4-2_MAR W38-1004	breake r	63.0	94.55	116.7	DC	13.95
41797727	942410	AE2-254 TAP	69.0	EKPC	341515	2GARRARD CO	69.0	EKPC	1	EKPC_P2-3_MAR W38-1004	bus	63.0	95.27	117.42	DC	13.95
41797728	942410	AE2-254 TAP	69.0	EKPC	341515	2GARRARD CO	69.0	EKPC	1	EKPC_P2-3_MAR W38-1004-B	bus	63.0	94.16	116.31	DC	13.95

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	FRO M BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Ratin g MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPAC T
40985420	342286	2SOMERSE T	69.0	EKPC	342287	2SOMERSE T KU	69.0	EKPC	1	EKPC_P7-1_COOP 161 DBL 2	tower	115.0	116.2	120.82	DC	11.74
40985320	342287	2SOMERSE T KU	69.0	EKPC	324531	2FERGUSO N SO	69.0	LGEE	1	EKPC_P7-1_COOP 161 DBL 2	tower	105.0	128.9	140.44	DC	12.1
40985357	342718	5COOPER2	161.0	EKPC	324141	5ELIHU	161.0	LGEE	1	EKPC_P7-1_LAUR L 161 DBL	tower	277.0	121.0	127.8	DC	18.85
41200143	342718	5COOPER2	161.0	EKPC	324141	5ELIHU	161.0	LGEE	1	EKPC_P1-2_LAUR-L DAM161	single	277.0	110.07	114.16	DC	11.34
41534948	342718	5COOPER2	161.0	EKPC	324141	5ELIHU	161.0	LGEE	1	EKPC_P4-5_LAUR L 550-1024	breake r	277.0	120.96	127.76	DC	18.85

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 LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPAC T
41200202	324010	7TRIMBL REAC	345.0	LGEE	248000	06CLIFTY	345.0	OV E C	1	AEP_P1-2_#363	operatio n	1451.0	121.77	123.0	DC	17.89
41200203	324010	7TRIMBL REAC	345.0	LGEE	248000	06CLIFTY	345.0	OV E C	1	Base Case	operatio n	1134.0	118.55	120.11	DC	17.7
41200141	342718	5COOPER2	161.0	EKPC	324141	5ELIHU	161.0	LGEE	1	EKPC_P1-2_LAUR-L DAM161	operatio n	277.0	120.8	127.62	DC	18.9
41200144	342718	5COOPER2	161.0	EKPC	324141	5ELIHU	161.0	LGEE	1	Base Case	operatio n	219.0	103.54	110.97	DC	16.25
42436501	342769	5MARION CO	161.0	EKPC	342775	5MARIO N I P T	161.0	EKPC	1	EKPC_P1-3_MAR 161/138	operatio n	131.0	53.25	102.01	DC	63.88
41200060	342838	7SPURLOK	345.0	EKPC	253077	09STUAR T	345.0	DAY	1	Base Case	operatio n	1240.0	119.65	120.14	DC	13.56

16 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
40985420	10	2SOMERSET 69.0 kV - 2SOMERSET KU 69.0 kV Ckt 1	r0080 (82) : Replace the 500 MCM copper jumpers at the Somerset substation using 750 MCM copper or equivalent Project Type : FAC Cost : \$10,000 Time Estimate : 6.0 Months	\$10,000
40985534	4	5MARION CO 161.0 kV - 4MARION CO 138.0 kV Ckt 1	r0074 (76) : Increase the maximum operating temperature of the 636 MCM ACSR conductor in the Marion County-Lebanon 161 kV line section to 293 degrees F (0.1 mile) Project Type : FAC Cost : \$10,000 Time Estimate : 6.0 Months	\$10,000
40985320	11	2SOMERSET KU 69.0 kV - 2FERGUSON SO 69.0 kV Ckt 1	r0077 (79) : LGEE violation (non PJM area). EKPC emergency rating is 152 MVA. The external (i.e. Non-PJM) Transmission Owner, LGEE, will not evaluate this violation until the impact study phase. Project Type : FAC Cost : \$0 Time Estimate : 0.0 Months	\$0
41966424,42149418	5	5MARION CO 161.0 kV - 5MARION IP T 161.0 kV Ckt 1	r0036 (38) : Increase the maximum operating temperature of the Marion County-Marion County Industrial 161 kV line section 795 MCM conductor to 176 degrees F (4.0 miles) Project Type : FAC Cost : \$390,000 Time Estimate : 7.0 Months	\$390,000
41797735,41535147	8	5TAYLR CO 161.0 kV - 2TAYLOR CO 69.0 kV Ckt 1	r0019 (21) : LGEE violation (non PJM area). EKPC emergency rating is 381 MVA. The external (i.e. Non-PJM) Transmission Owner, LGEE, will not evaluate this violation until the impact study phase. Project Type : FAC Cost : \$0 Time Estimate : 0.0 Months	\$0
42149487,41966466, 41966467	6	5MARION CO 161.0 kV - 5CASEY CO 161.0 kV Ckt 1	r0053 (55) : Change the Zone 3 relay setting at Casey County associated with the line protection to at least 256 MVA LTE rating. Project Type : FAC Cost : \$0 Time Estimate : 6.0 Months r0054 (56) : Increase the maximum operating temperature of the 636 MCM ACSR conductor in the Marion County-Casey County 161 kV line section to 212 degrees F (17.2 miles) Project Type : FAC Cost : \$1,680,000 Time Estimate : 14.0 Months	\$1,680,000

ID	Index	Facility	Upgrade Description	Cost
42149719,41966574	7	5TAYLOR CO J 161.0 kV - 5TAYLRCO 161.0 kV Ckt 1	r0019 (21) : LGEE violation (non PJM area). EKPC emergency rating is 381 MVA. The external (i.e. Non-PJM) Transmission Owner, LGEE, will not evaluate this violation until the impact study phase. Project Type : FAC Cost : \$0 Time Estimate : 0.0 Months	\$0
42436503	1	5LAUREL DAM 161.0 kV - 5LAUREL CO 161.0 kV Ckt 1	r0013 (15) : Increase the maximum operating temperature of the Laurel County-Laurel Dam 161 kV line section 795 MCM conductor to 167 degrees F (~0.2 miles) Project Type : FAC Cost : \$35,000 Time Estimate : 6.0 Months	\$35,000
41200143,40985357, 41534948	12	5SCOOPER2 161.0 kV - 5ELIHU 161.0 kV Ckt 1	r0076 (78) : Increase the maximum operating temperature of the 795 MCM ACSR conductor in the Cooper-Elihu 161 kV line section to 275 degrees F (6.7 miles) Project Type : FAC Cost : \$660,000 Time Estimate : 9.0 Months	\$660,000
42149713,41966563, 41966562	3	5CASEY CO 161.0 kV - 5LIBERTY J 161.0 kV Ckt 1	r0015 (17) : Change the Zone 3 relay setting at Casey County associated with the line protection to at least 182 MVA LTE rating. Project Type : FAC Cost : \$0 Time Estimate : 6.0 Months	\$0
41797728,41535141, 41797727	9	AE2-254 TAP 69.0 kV - 2GARRARD CO 69.0 kV Ckt 1	r0032 (34) : Increase the maximum operating temperature of the 266 MCM ACSR conductor in the Garrard County-Ae2-254 Tap 69 kV line section to 266 degrees F (0.25 miles) Project Type : FAC Cost : \$20,000 Time Estimate : 5.0 Months	\$20,000
41797763,41535202	2	2GREEN CO 69.0 kV - 2SUMMERSVIL 69.0 kV Ckt 1	r0048 (50) : Increase the maximum operating temperature of the 4/0 ACSR conductor in the Green County-Summersville 69 kV line section to 212 degrees F (4.2 miles) Project Type : FAC Cost : \$280,000 Time Estimate : 11.0 Months	\$280,000
			TOTAL COST	\$3,085,000

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
42436503	342757	5LAUREL DAM	EKPC	342754	5LAUREL CO	EKPC	1	EKPC_P1-2_COOP-ELIHU161	single	200.0	98.09	100.4	DC	4.62

Bus #	Bus	MW Impact
342900	1COOPER1 G	3.5524
342903	1COOPER2 G	6.9078
342945	1LAUREL 1G	4.6887
939131	AE1-143 C	4.1171
940831	AE2-071 C	1.1057
943701	AF1-038 C	3.2486
943821	AF1-050 C	1.8983
944151	AF1-083 C O1	1.8985
944511	AF1-116 C	4.6174
945381	AF1-203 C	0.6318
LGEE	LGEE	0.0656
CPLE	CPLE	0.0595
WEC	WEC	0.0441
CBM-W2	CBM-W2	3.4562
NY	NY	0.0420
CBM-W1	CBM-W1	1.5012
TVA	TVA	1.0318
CBM-S2	CBM-S2	0.9075
CBM-S1	CBM-S1	5.2909
MADISON	MADISON	0.8387
MEC	MEC	0.4211

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
41797763	341563	2GREEN CO	EKPC	342325	2SUMMERSVIL	EKPC	1	EKPC_P2-3_MAR W38-1014	bus	39.0	79.18	111.9	DC	12.76

Bus #	Bus	MW Impact
939131	AE1-143 C	6.8264
939132	AE1-143 E	3.3813
943821	AF1-050 C	1.4089
943822	AF1-050 E	0.9392
944151	AF1-083 C O1	3.5089
944152	AF1-083 E O1	2.3393
944511	AF1-116 C	7.6558
944512	AF1-116 E	5.1038
DUCKCREEK	DUCKCREEK	0.0058
NEWTON	NEWTON	0.0161
CPLE	CPLE	0.0761
G-007A	G-007A	0.0288
VFT	VFT	0.0774
CBM-W2	CBM-W2	0.9009
TVA	TVA	0.4746
CBM-S2	CBM-S2	0.8612
EDWARDS	EDWARDS	0.0046
CBM-S1	CBM-S1	1.9426
TILTON	TILTON	0.0391
MADISON	MADISON	0.2742
MEC	MEC	0.0763
GIBSON	GIBSON	0.0977
BLUEG	BLUEG	0.4652
TRIMBLE	TRIMBLE	0.1352

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
42149713	342703	5CASEY CO	EKPC	342760	5LIBERTY J	EKPC	1	EKPC_P4-2_MAR W38-1004	breaker	153.0	46.24	115.59	DC	106.11

Bus #	Bus	MW Impact
939131	AE1-143 C	56.7708
939132	AE1-143 E	28.1201
944511	AF1-116 C	63.6682
944512	AF1-116 E	42.4454
LGEE	LGEE	0.0228
WEC	WEC	0.0022
CBM-W2	CBM-W2	0.0082
CBM-W1	CBM-W1	0.0751
O-066	O-066	0.0067
CHEOAH	CHEOAH	0.0125
G-007	G-007	0.0010
MEC	MEC	0.0064
CALDERWOOD	CALDERWOOD	0.0129
CATAWBA	CATAWBA	0.0042

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
40985534	342769	5MARION CO	EKPC	324280	4MARION CO	LGEE	1	EKPC_P7-1_COOP 161 DBL 2	tower	220.0	76.86	102.58	DC	56.57

Bus #	Bus	MW Impact
342900	1COOPER1 G	2.3816
342903	1COOPER2 G	4.6183
939131	AE1-143 C	30.2645
939132	AE1-143 E	14.9908
940041	AE1-246 C O1	4.8812
940042	AE1-246 E O1	2.3771
940051	AE1-247 C O1	8.2926
940052	AE1-247 E O1	4.1070
940831	AE2-071 C	1.5242
940832	AE2-071 E	1.0161
943701	AF1-038 C	4.1616
943702	AF1-038 E	2.7744
943821	AF1-050 C	6.8447
943822	AF1-050 E	4.5631
944151	AF1-083 C O1	10.2934
944152	AF1-083 E O1	6.8622
944511	AF1-116 C	33.9415
944512	AF1-116 E	22.6277
944981	AF1-163 C O1 (Withdrawn : 12/11/2019)	2.5405
944982	AF1-163 E O1 (Withdrawn : 12/11/2019)	1.4761
945381	AF1-203 C	0.4616
945382	AF1-203 E	0.3077
CPLE	CPLE	0.2342
G-007A	G-007A	0.0288
VFT	VFT	0.0710
CBM-W2	CBM-W2	3.1695
NY	NY	0.0006
TVA	TVA	1.4952
CBM-S2	CBM-S2	2.6819
EDWARDS	EDWARDS	0.0032
CBM-S1	CBM-S1	5.8532
TILTON	TILTON	0.0787
MADISON	MADISON	1.0685
MEC	MEC	0.2733
GIBSON	GIBSON	0.1742
BLUEG	BLUEG	0.8524
TRIMBLE	TRIMBLE	0.2827

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
42149418	342769	5MARION CO	EKPC	342775	5MARION IPT	EKPC	1	EKPC_P4-2_MAR W38-1014	breaker	131.0	73.28	164.89	DC	120.0

Bus #	Bus	MW Impact
939131	AE1-143 C	64.2000
939132	AE1-143 E	31.8000
944511	AF1-116 C	72.0000
944512	AF1-116 E	48.0000

17.6 Index 6

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
42149487	342769	5MARION CO	EKPC	342703	5CASEY CO	EKPC	1	EKPC_P4-2_MAR W38-1004	breaker	153.0	62.75	141.18	DC	120.0

Bus #	Bus	MW Impact
939131	AE1-143 C	64.2000
939132	AE1-143 E	31.8000
944511	AF1-116 C	72.0000
944512	AF1-116 E	48.0000

17.7 Index 7

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
42149719	342817	5TAYLOR CO J	EKPC	342818	5TAYLR CO	EKPC	1	EKPC_P4-2_MAR W38-1014	breaker	105.0	88.69	115.1	DC	27.73

Bus #	Bus	MW Impact
939131	AE1-143 C	14.8334
939132	AE1-143 E	7.3474
943821	AF1-050 C	3.8722
943822	AF1-050 E	2.5814
944151	AF1-083 C O1	7.6246
944152	AF1-083 E O1	5.0831
944511	AF1-116 C	16.6356
944512	AF1-116 E	11.0904
CPLE	CPLE	0.0701
G-007A	G-007A	0.0192
VFT	VFT	0.0452
WEC	WEC	0.0069
CBM-W2	CBM-W2	1.2531
CBM-W1	CBM-W1	0.2877
TVA	TVA	0.4858
CBM-S2	CBM-S2	0.8034
CBM-S1	CBM-S1	2.0107
TILTON	TILTON	0.0063
MADISON	MADISON	0.3588
MEC	MEC	0.1319
GIBSON	GIBSON	0.0300
BLUEG	BLUEG	0.2066
TRIMBLE	TRIMBLE	0.0701

17.8 Index 8

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT	
41797735	342818	5TAYLR	CO	EKPC	324751	2TAYLOR CO	LGEE	1	EKPC_P2-3_MAR W38-1014	bus	104.0	89.55	116.21	DC	27.73

Bus #	Bus	MW Impact
939131	AE1-143 C	14.8334
939132	AE1-143 E	7.3474
943821	AF1-050 C	3.8722
943822	AF1-050 E	2.5814
944151	AF1-083 C O1	7.6246
944152	AF1-083 E O1	5.0831
944511	AF1-116 C	16.6356
944512	AF1-116 E	11.0904
CPL	CPL	0.0701
G-007A	G-007A	0.0192
VFT	VFT	0.0452
WEC	WEC	0.0069
CBM-W2	CBM-W2	1.2531
CBM-W1	CBM-W1	0.2877
TVA	TVA	0.4858
CBM-S2	CBM-S2	0.8034
CBM-S1	CBM-S1	2.0107
TILTON	TILTON	0.0063
MADISON	MADISON	0.3588
MEC	MEC	0.1319
GIBSON	GIBSON	0.0300
BLUEG	BLUEG	0.2066
TRIMBLE	TRIMBLE	0.0701

17.9 Index 9

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
41797727	942410	AE2-254 TAP	EKPC	341515	2GARRARD CO	EKPC	1	EKPC_P2-3_MAR W38-1004	bus	63.0	95.27	117.42	DC	13.95

Bus #	Bus	MW Impact
939131	AE1-143 C	7.4658
939132	AE1-143 E	3.6980
942411	AE2-254 C O1	25.1193
942412	AE2-254 E O1	16.7462
943701	AF1-038 C	1.0409
943702	AF1-038 E	0.6939
944511	AF1-116 C	8.3729
944512	AF1-116 E	5.5819
CPLE	CPLE	0.0681
G-007A	G-007A	0.0144
VFT	VFT	0.0387
CBM-W2	CBM-W2	0.8108
TVA	TVA	0.3668
CBM-S2	CBM-S2	0.7687
EDWARDS	EDWARDS	0.0014
CBM-S1	CBM-S1	1.3547
TILTON	TILTON	0.0189
MADISON	MADISON	0.3185
MEC	MEC	0.0651
GIBSON	GIBSON	0.0295
BLUEG	BLUEG	0.2257
TRIMBLE	TRIMBLE	0.0762

17.10 Index 10

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
40985420	342286	2SOMERSET	EKPC	342287	2SOMERSET KU	EKPC	1	EKPC_P7-1_COOP 161 DBL 2	tower	115.0	116.2	120.82	DC	11.74

Bus #	Bus	MW Impact
342900	1COOPER1 G	4.4802
342903	1COOPER2 G	8.6895
939131	AE1-143 C	5.3375
939132	AE1-143 E	2.6438
940041	AE1-246 C O1	4.2392
940042	AE1-246 E O1	2.0644
940051	AE1-247 C O1	7.2019
940052	AE1-247 E O1	3.5668
940831	AE2-071 C	1.2979
940832	AE2-071 E	0.8652
943701	AF1-038 C	6.1942
943702	AF1-038 E	4.1294
943821	AF1-050 C	1.1896
943822	AF1-050 E	0.7931
944151	AF1-083 C O1	1.2604
944152	AF1-083 E O1	0.8403
944511	AF1-116 C	3.1726
944512	AF1-116 E	2.1150
944981	AF1-163 C O1 (Withdrawn : 12/11/2019)	2.1292
944982	AF1-163 E O1 (Withdrawn : 12/11/2019)	1.2371
945381	AF1-203 C	0.3931
945382	AF1-203 E	0.2620
LGEE	LGEE	0.0120
CPL	CPL	0.0304
WEC	WEC	0.0479
LGE-0012019	LGE-0012019	5.0391
CBM-W2	CBM-W2	3.5463
NY	NY	0.0431
CBM-W1	CBM-W1	1.6763
TVA	TVA	1.0696
O-066	O-066	0.5242
CBM-S2	CBM-S2	0.5953
CBM-S1	CBM-S1	5.3335
G-007	G-007	0.0811
MADISON	MADISON	0.7540
MEC	MEC	0.4481

17.11 Index 11

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
40985320	342287	2SOMERSET KU	EKPC	324531	2FERGUSON SO	LGEE	1	EKPC_P7-1_COOP 161 DBL 2	tower	105.0	128.9	140.44	DC	12.1

Bus #	Bus	MW Impact
342900	1COOPER1 G	4.3847
342903	1COOPER2 G	8.5042
939131	AE1-143 C	6.4726
939132	AE1-143 E	3.2061
940041	AE1-246 C O1	5.3429
940042	AE1-246 E O1	2.6019
940051	AE1-247 C O1	9.0769
940052	AE1-247 E O1	4.4954
940831	AE2-071 C	1.6418
940832	AE2-071 E	1.0946
943701	AF1-038 C	8.4535
943702	AF1-038 E	5.6357
943821	AF1-050 C	1.3743
943822	AF1-050 E	0.9162
944151	AF1-083 C O1	1.3582
944152	AF1-083 E O1	0.9055
944511	AF1-116 C	7.2590
944512	AF1-116 E	4.8394
944981	AF1-163 C O1 (Withdrawn : 12/11/2019)	2.6865
944982	AF1-163 E O1 (Withdrawn : 12/11/2019)	1.5610
945381	AF1-203 C	0.4972
945382	AF1-203 E	0.3315
CPL	CPL	0.0642
WEC	WEC	0.0617
LGE-0012019	LGE-0012019	5.1436
CBM-W2	CBM-W2	4.6028
NY	NY	0.0442
CBM-W1	CBM-W1	2.1893
TVA	TVA	1.4140
O-066	O-066	0.5174
CBM-S2	CBM-S2	1.0057
CBM-S1	CBM-S1	6.9779
G-007	G-007	0.0801
MADISON	MADISON	0.9919
MEC	MEC	0.5800

17.12 Index 12

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
41534948	342718	5COOPER2	EKPC	324141	5ELIHU	LGEE	1	EKPC_P4-5_LAURL S50-1024	breaker	277.0	120.96	127.76	DC	18.85

Bus #	Bus	MW Impact
342900	1COOPER1 G	8.9959
342903	1COOPER2 G	17.5008
342945	1LAUREL 1G	5.4447
939131	AE1-143 C	10.0845
939132	AE1-143 E	4.9951
940041	AE1-246 C O1	9.0965
940042	AE1-246 E O1	4.4299
940051	AE1-247 C O1	15.4539
940052	AE1-247 E O1	7.6537
940831	AE2-071 C	2.5752
940832	AE2-071 E	1.7168
943701	AF1-038 C	6.6859
943702	AF1-038 E	4.4573
943821	AF1-050 C	4.5500
943822	AF1-050 E	3.0334
944151	AF1-083 C O1	4.6078
944152	AF1-083 E O1	3.0719
944511	AF1-116 C	11.3098
944512	AF1-116 E	7.5398
944981	AF1-163 C O1 (Withdrawn : 12/11/2019)	8.6420
944982	AF1-163 E O1 (Withdrawn : 12/11/2019)	5.0212
945381	AF1-203 C	1.4716
945382	AF1-203 E	0.9810
CPLE	CPLE	0.0886
WEC	WEC	0.0728
LGE-0012019	LGE-0012019	7.9453
CBM-W2	CBM-W2	6.5438
NY	NY	0.0912
CBM-W1	CBM-W1	2.5020
TVA	TVA	2.1098
O-066	O-066	1.0685
CBM-S2	CBM-S2	1.4912
CBM-S1	CBM-S1	10.2410
G-007	G-007	0.1654
MADISON	MADISON	1.5745
MEC	MEC	0.7802

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
EKPC_P2-3_MAR W38-1004	CONTINGENCY 'EKPC_P2-3_MAR W38-1004' /* MARION CO OPEN BRANCH FROM BUS 324280 TO BUS 342769 CKT 1 /* 324280 4MARIONL 138.00 342769 5MARION CO 161.00 OPEN BRANCH FROM BUS 342733 TO BUS 342817 CKT 1 /* 342733 5GREEN CO 161.00 342817 5TAYLOR CO J161.00 OPEN BRANCH FROM BUS 342817 TO BUS 342818 CKT 1 /* 342817 5TAYLOR CO J161.00 342818 5TAYLR CO 161.00 OPEN BRANCH FROM BUS 342805 TO BUS 944150 CKT 1 /* 342805 5SALOMA T 161.00 342817 5TAYLOR CO J161.00 OPEN BRANCH FROM BUS 342802 TO BUS 342805 CKT 1 /* 342802 5SALOMA 161.00 342805 5SALOMA T 161.00 OPEN BRANCH FROM BUS 342775 TO BUS 342805 CKT 1 /* 342775 5MARION IP T161.00 342805 5SALOMA T 161.00 OPEN BRANCH FROM BUS 342772 TO BUS 342775 CKT 1 /* 342772 5MARION IP 161.00 342775 5MARION IP T161.00 OPEN BRANCH FROM BUS 342769 TO BUS 342775 CKT 1 /* 342769 5MARION CO 161.00 342775 5MARION IP T161.00 END
EKPC_P2-3_MAR W38-1014	CONTINGENCY 'EKPC_P2-3_MAR W38-1014' /* MARION CO OPEN BRANCH FROM BUS 324280 TO BUS 342769 CKT 1 /* 324280 4MARIONL 138.00 342769 5MARION CO 161.00 OPEN BRANCH FROM BUS 342703 TO BUS 342769 CKT 1 /* 342703 5CASEY CO 161.00 342769 5MARION CO 161.00 OPEN BRANCH FROM BUS 341269 TO BUS 342703 CKT 1 /* 341269 2CASEY CO 69.000 342703 5CASEY CO 161.00 OPEN BRANCH FROM BUS 342703 TO BUS 342760 CKT 1 /* 342703 5CASEY CO 161.00 342760 5LIBERTY J 161.00 END
EKPC_P4-5_LAURL S50-1024	CONTINGENCY 'EKPC_P4-5_LAURL S50-1024' /* LAUREL CO OPEN BUS 342754 /* 5LAUREL CO DROPS BUS OPEN BRANCH FROM BUS 324688 TO BUS 342781 CKT 1 /* 324688 2PITTSKU 69.000 342781 5PITTSBURG 161.00 OPEN BRANCH FROM BUS 342781 TO BUS 342820 CKT 1 /* 342781 5PITTSBURG 161.00 342820 5TYNER 161.00 END
EKPC_P1-2_LAUR-L DAM161	CONTINGENCY 'EKPC_P1-2_LAUR-L DAM161' /* LAUREL CO - LAUREL DAM OPEN BRANCH FROM BUS 342754 TO BUS 342757 CKT 1 /* 342754 5LAUREL CO 161.00 342757 5LAUREL DAM 161.00 END
EKPC_P2-3_MAR W38-1004-B	CONTINGENCY 'EKPC_P2-3_MAR W38-1004-B' /* MARION CO OPEN BRANCH FROM BUS 324280 TO BUS 342769 CKT 1 /* 324280 4MARIONL 138.00 342769 5MARION CO 161.00 OPEN BRANCH FROM BUS 342733 TO BUS 342817 CKT 1 /* 342733 5GREEN CO 161.00 342817 5TAYLOR CO J161.00 OPEN BRANCH FROM BUS 342817 TO BUS 342818 CKT 1 /* 342817 5TAYLOR CO J161.00 342818 5TAYLR CO 161.00 OPEN BRANCH FROM BUS 342805 TO BUS 944150 CKT 1 /* 342805 5SALOMA T 161.00 342817 5TAYLOR CO J161.00 END

Contingency Name	Contingency Definition
EKPC_P1-3_MAR 161/138	CONTINGENCY 'EKPC_P1-3_MAR 161/138' /* OPEN BRANCH FROM BUS 324280 TO BUS 342769 CKT 1 /* 324280 4MARIONL 138.00 342769 5MARION CO 161.00 END
EKPC_P1-2_COOP-ELIHU161	CONTINGENCY 'EKPC_P1-2_COOP-ELIHU161' /* COOPER - KU ELIHU OPEN BRANCH FROM BUS 324141 TO BUS 342718 CKT 1 /* 324141 5ELIHU 161.00 342718 5COOPER2 161.00 END
EKPC_P7-1_COOP 161 DBL 2	CONTINGENCY 'EKPC_P7-1_COOP 161 DBL 2' /* COOPER - ELIHU 161 & COOPER - LAUREL DAM 161 OPEN BRANCH FROM BUS 324141 TO BUS 342718 CKT 1 /* 324141 5ELIHU 161.00 342718 5COOPER2 161.00 OPEN BRANCH FROM BUS 342718 TO BUS 342757 CKT 1 /* 342718 5COOPER2 161.00 342757 5LAUREL DAM 161.00 END
EKPC_P4-2_MAR W38-1004	CONTINGENCY 'EKPC_P4-2_MAR W38-1004' /* MARION CO OPEN BRANCH FROM BUS 324280 TO BUS 342769 CKT 1 /* 324280 4MARIONL 138.00 342769 5MARION CO 161.00 OPEN BRANCH FROM BUS 342805 TO BUS 944150 CKT 1 /* 342805 5SALOMA T 161.00 944150 AF1-083 TAP 161.00 OPEN BRANCH FROM BUS 342802 TO BUS 342805 CKT 1 /* 342802 5SALOMA 161.00 342805 5SALOMA T 161.00 OPEN BRANCH FROM BUS 342775 TO BUS 342805 CKT 1 /* 342775 5MARION IP T161.00 342805 5SALOMA T 161.00 OPEN BRANCH FROM BUS 342772 TO BUS 342775 CKT 1 /* 342772 5MARION IP 161.00 342775 5MARION IP T161.00 OPEN BRANCH FROM BUS 342769 TO BUS 342775 CKT 1 /* 342769 5MARION CO 161.00 342775 5MARION IP T161.00 END
EKPC_P7-1_LAURL 161 DBL	CONTINGENCY 'EKPC_P7-1_LAURL 161 DBL' /* LAUREL CO - LAUREL DAM 161 & LAUREL CO - TYNER 161 OPEN BRANCH FROM BUS 342754 TO BUS 342757 CKT 1 /* 342754 5LAUREL CO 161.00 342757 5LAUREL DAM 161.00 OPEN BRANCH FROM BUS 342754 TO BUS 342781 CKT 1 /* 342754 5LAUREL CO 161.00 342781 5PITTSBURG 161.00 OPEN BRANCH FROM BUS 342781 TO BUS 342820 CKT 1 /* 342781 5PITTSBURG 161.00 342820 5TYNER 161.00 END
AEP_P1-2_#363	CONTINGENCY 'AEP_P1-2_#363' OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1 / 243208 05JEFRSO 765 243209 05ROCKPT 765 1 END
Base Case	

Contingency Name	Contingency Definition
EKPC_P4-2_MAR W38-1014	CONTINGENCY 'EKPC_P4-2_MAR W38-1014' /* MARION CO OPEN BRANCH FROM BUS 324280 TO BUS 342769 CKT 1 /* 324280 4MARIONL 138.00 342769 5MARION CO 161.00 OPEN BRANCH FROM BUS 342703 TO BUS 342769 CKT 1 /* 342703 5CASEY CO 161.00 342769 5MARION CO 161.00 OPEN BRANCH FROM BUS 341269 TO BUS 342703 CKT 1 /* 341269 2CASEY CO 69.000 342703 5CASEY CO 161.00 OPEN BRANCH FROM BUS 342703 TO BUS 342760 CKT 1 /* 342703 5CASEY CO 161.00 342760 5LIBERTY J 161.00 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