Generation Interconnection

Feasibility Study Report

for

Queue Project AF1-256

FLEMINGSBURG-SPURLOCK 138 KV

48 MW Capacity / 80 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.

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 Fleming County, KY. The installed facilities will have a total capability of 80 MW with 48 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is 6/1/2023. This study does not imply a TO commitment to this in-service date.

Queue Number	AF1-256
Project Name	FLEMINGSBURG-SPURLOCK 138 KV
State	Kentucky
County	Fleming
Transmission Owner	EKPC
MFO	80
MWE	80
MWC	48
Fuel	Solar
Basecase Study Year	2023

2.1 Point of Interconnection

AF1-256 will interconnect with the EKPC transmission system tapping the Flemingsburg to Spurlock 138 kV line.

2.2 Cost Summary

The AF1-256 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$565,000
Direct Connection Network Upgrade	$5,020,000
Non Direct Connection Network Upgrades	$2,175,000
Total Costs	$7,760,000

In addition, the AF1-256 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	$85,873,701

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.

	Total Cost
Install necessary equipment (a 138 kV isolation switch structure and associated switch, plus interconnection metering, fiber-optic connection and telecommunications equipment, circuit breaker and associated switches, and relay panel) at the new North Fleming switching station, to accept the IC generator lead line/bus (Estimated time to implement is 24 months)	$565,000
Total Attachment Facility Costs	$565,000

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 138 kV switching station ("North Fleming Switching") to facilitate connection of the IC solar generation project to the existing Spurlock-Flemingsburg 138 kV line (Estimated time to implement is 24 months)	$5,020,000
Total Direct Connection Facility Costs	$5,020,000

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
Construct facilities to loop the existing Spurlock-Flemingsburg 138 kV line into the new North Fleming switching station (Estimated time to implement is 24 months)	$520,000
Modify relays and/or settings at Spurlock substation for the existing line to the new North Fleming switching station (Estimated time to implement is 9 months)	$65,000
Modify relays and/or settings at Goddard substation for the existing line to the new North Fleming switching station (Estimated time to implement is 9 months)	$65,000
Install OPGW on the North Fleming-Goddard 138 kV line (11.2 miles) (Estimated time to implement is 18 months)	$1,525,000
Total Non-Direct Connection Facility Costs	$2,175,000

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 AF1-256 was evaluated as a 80.0 MW (Capacity 48.0 MW) injection tapping the Flemingsburg to Spurlock 138 kV line in the EKPC area. Project AF1-256 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-256 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

Summer Peak Load Flow

12 Generation Deliverability

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

None

13 Multiple Facility Contingency

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

ID	FROM BUS#	FROM BUS	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
41665396	342571	4CRANSTON	138.0	EKPC	342649	4ROWANCO	138.0	EKPC	1	EKPC_P4-6_SPURN39-92T	breaker	255.0	87.05	105.58	DC	47.24
41665395	342589	4GODDARD	138.0	EKPC	342571	4CRANSTON	138.0	EKPC	1	EKPC_P4-6_SPURN39-92T	breaker	255.0	87.13	105.65	DC	47.24
41665310	342649	4ROWANCO	138.0	EKPC	324302	4RODBURN	138.0	LGEE	1	EKPC_P4-6_SPURN39-92T	breaker	191.0	90.48	112.65	DC	42.33
41665273	945910	AF1-256 TAP	138.0	EKPC	342664	4SPURLOCK	138.0	EKPC	1	EKPC_P4-2_GODDARD E5-824	breaker	255.0	84.55	115.92	DC	80.0
41665274	945910	AF1-256 TAP	138.0	EKPC	342664	4SPURLOCK	138.0	EKPC	1	EKPC_P4-2_GODDARD E5-834	breaker	255.0	84.55	115.92	DC	80.0
41876127	945910	AF1-256 TAP	138.0	EKPC	342664	4SPURLOCK	138.0	EKPC	1	EKPC_P2-3_GODDARD E5-834	bus	255.0	84.55	115.92	DC	80.0
41876128	945910	AF1-256 TAP	138.0	EKPC	342664	4SPURLOCK	138.0	EKPC	1	EKPC_P2-2_GODDARD 138	bus	255.0	84.55	115.92	DC	80.0

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
43958234	246800		138.0	AEP	247034	05EMERSS	138.0	AEP	1	DAY_P734541 34553	tower	185.0	111.06	112.84	DC	7.32
43957450	246946	05WLDCAT	138.0	AEP	243019	05HILLSB	138.0	AEP	1	DAY_P4_L34553-1	breaker	185.0	120.49	121.64	DC	4.71
43958138	246946	05WLDCAT	138.0	AEP	243019	05HILLSB	138.0	AEP	1	DAY_P734541 34553	tower	185.0	163.8	165.58	DC	7.32
43958235	247034	05EMERSS	138.0	AEP	246946	05WLDCAT	138.0	AEP	1	DAY_P734541 34553	tower	185.0	109.82	111.6	DC	7.32
41050424	250054	08LONGBR	138.0	DEO&K	250077	08MTZION	138.0	DEO&K	1	DAY_P734541 34553	tower	284.0	116.41	119.55	DC	8.86
41050475	250077	08MTZION	138.0	DEO&K	249991	08BUFTN1	138.0	DEO&K	1	DAY_P734541 34553	tower	298.0	106.62	109.6	DC	8.86
43573455	324267	4KENTON	138.0	LGEE	246800		138.0	AEP	1	DAY_P734541 34553	tower	185.0	114.09	115.87	DC	7.32
41050495	342091	2PLUMVILLE	69.0	EKPC	341923	2MURPHYSVIL	69.0	EKPC	1	DAY_P734541 34553	tower	63.0	104.2	107.43	DC	4.52

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
41664888	342091	2PLUMVILLE	69.0	EKPC	341923	2MURPHYSVIL	69.0	EKPC	1	EKPC_P4-6_SPUR N39-92T	breaker	63.0	135.86	165.52	DC	18.69
41050400	342559	4BOONECO	138.0	EKPC	250054	08LONGBR	138.0	DEO&K	1	DAY_P734541 34553	tower	284.0	123.74	126.87	DC	8.86
41050476	342661	4SPUR-KENT-R	138.0	EKPC	324267	4KENTON	138.0	LGEE	1	DAY_P734541 34553	tower	281.0	108.4	109.62	DC	7.48
41050514	342664	4SPURLOCK	138.0	EKPC	342661	4SPUR-KENT-R	138.0	EKPC	1	DAY_P734541 34553	tower	291.0	104.78	105.95	DC	7.48
41050367	342838	7SPURLOCK	345.0	EKPC	253077	09STUART	345.0	DAY	1	DEOK_P7-1_C5 CIRCUIT1883&4545REDBANKSILGRVZIMMER	tower	1532.0	130.05	132.26	DC	33.69
41351751	342838	7SPURLOCK	345.0	EKPC	253077	09STUART	345.0	DAY	1	DEOK_P1-3_B3 SILVER GROVE 345/138 TB23*	single	1532.0	120.52	121.84	DC	20.21
41665067	342838	7SPURLOCK	345.0	EKPC	253077	09STUART	345.0	DAY	1	DEOK_P2-3_C2 816_SILVERGROVE	breaker	1532.0	130.21	132.42	DC	33.71
41665068	342838	7SPURLOCK	345.0	EKPC	253077	09STUART	345.0	DAY	1	DEOK_P2-3_C2 1493_RED BANK	breaker	1532.0	130.11	132.31	DC	33.69
41876010	342838	7SPURLOCK	345.0	EKPC	253077	09STUART	345.0	DAY	1	DEOK_P2-2_C1 SILVER GROVE 345 BUS	bus	1532.0	130.04	132.25	DC	33.69

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
43957905	246946	05WLDCAT	138.0	AEP	243019	05HILLSB	138.0	AEP	1	DAY-P1-STU SPUR	operation	185.0	120.03	121.18	DC	4.72
41351789	342583	4FLEMINGSBRG	138.0	EKPC	342589	4GODDARD	138.0	EKPC	1	EKPC_P1-2_SPUR-GODD 138-B	operation	217.0	99.35	136.22	DC	80.0
41351791	342583	4FLEMINGSBRG	138.0	EKPC	342589	4GODDARD	138.0	EKPC	1	Base Case	operation	197.0	84.81	102.86	DC	35.57
41351748	342838	7SPURLOCK	345.0	EKPC	253077	09STUART	345.0	DAY	1	Base Case	operation	1240.0	134.77	137.3	DC	31.2
41351749	342838	7SPURLOCK	345.0	EKPC	253077	09STUART	345.0	DAY	1	DEOK_P1-3_B3 SILVER GROVE 345/138 TB23*	operation	1532.0	130.0	132.21	DC	33.69

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
41352053	939140	AE1-144 TAP	138.0	EKPC	342634	4PLUMVILLE	138.0	EKPC	1	EKPC_P1-2_SPUR-GODD 138-B	operation	186.0	95.2	116.44	DC	39.5

16 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
41665310	3	4ROWAN CO 138.0 kV - 4RODBURN 138.0 kV Ckt 1	r0045 (1555) : Replace the 800A wave trap at Rodburn substation with 1200A equipment. Project Type : FAC Cost : $90,000 Time Estimate : 9.0 Months r0046 (1556) : LGEE violation (non PJM area). EKPC emergency rating at 255 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 : 9.0 Months	$90,000
41050400	12	4BOONE CO 138.0 kV - 08LONGBR 138.0 kV Ckt 1	r0010 (1519) : Upgrade bus and jumpers associated with Boone 138 kV bus using 2-500 MCM 37 CU conductor or equivalent Project Type : FAC Cost : $170,000 Time Estimate : 6.0 Months r0052 (1562) : Replace the 954 MCM ACSR line conductor in the Boone County-Longbranch 138 kV line with 954 MCM ACSS conductor (2.3 miles) Project Type : FAC Cost : $2,590,000 Time Estimate : 14.0 Months	$2,760,000
41050476	13	4SPUR-KENT-R 138.0 kV - 4KENTON 138.0 kV Ckt 1	n6041 (1512) : Replace the 5% 1200A reactor at Spurlock with a 7.5% 1600A reactor Project Type : FAC Cost : $600,000 Time Estimate : 9.0 Months	$600,000
41665396	1	4CRANSTON 138.0 kV - 4ROWAN CO 138.0 kV Ckt 1	r0059 (1569) : Increase the maximum operating temperature of the 795 MCM ACSR conductor in the Goddard-Cranston 138 kV line section to 275 degrees F (7.5 miles) Project Type : FAC Cost : $680,000 Time Estimate : 9.0 Months	$680,000

ID	Index	Facility	Upgrade Description	Cost
43958138,43957450	6	05WLDCAT 138.0 kV - 05HILLSB 138.0 kV Ckt 1	**N5472 (1780) : A Sag Study will be required on the 10 miles ofACSR ~ 477 ~ 26/7 ~ HAWK- Conductor to mitigate the overload. Depending on the sag study results, the cost for this upgrade is expected to be between $40,000 (no remediations required, just sag study) and $15 million (complete line reconductor/rebuild). New rating after sag study: S/N: 185 S/E: 257. 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 : $186,000** **Time Estimate : 6-12 Months** **N5857 (1781) : Rebuild / reconductor 10 miles of ACSR ~ 477 ~ 26/7 ~ HAWK- Conductor Section 1. Estimated cost: $15 million.** **Project Type : FAC** **Cost : $15,040,000** **Time Estimate : 24-36 Months**	$15,226,000
41050475	9	08MTZION 138.0 kV - 08BUFTN1 138.0 kV Ckt 1	**n6785 (1691) : Rebuild the line and Substation Bus Conductor on the Buffington terminal at Mt. Zion, Replace equipment at Buffington** **Project Type : FAC** **Cost : $4,973,025** **Time Estimate : 30.0 Months**	$4,973,025
43958235	7	05EMERSS 138.0 kV - 05WLDCAT 138.0 kV Ckt 1	**AEPO0006a (1756) : Perform sag study on AEP's portion of Wildcat-Kenton 138kV circuit, , 1.3 miles of 477 ACSR 26/7 Hawk.** **Project Type : FAC** **Cost : $20,000** **Time Estimate : 6-12 Months**	$20,000
41665395	2	4GODDARD 138.0 kV - 4CRANSTON 138.0 kV Ckt 1	**r0057 (1567) : Increase the maximum operating temperature of the 795 MCM ACSR conductor in the Goddard-Cranston 138 kV line section to 275 degrees F (12.7 miles)** **Project Type : FAC** **Cost : $1,150,000** **Time Estimate : 12.0 Months**	$1,150,000

ID	Index	Facility	Upgrade Description	Cost
41664888,41050495	11	2PLUMVILLE 69.0 kV - 2MURPHYSVIL 69.0 kV Ckt 1	r0060 (1570) : Rebuild the Plumville-Murphysville 69 kV line section using 795 MCM ACSR conductor at 212 degrees F (9.9 miles) Project Type : FAC Cost : $8,140,000 Time Estimate : 20.0 Months r0061 (1571) : Replace the 4/0 copper bus and jumpers at the Murphysville substation using 750 MCM copper or equivalent Project Type : FAC Cost : $120,000 Time Estimate : 6.0 Months r0062 (1572) : Replace the 4/0 copper bus and jumpers at the Plumville substation using 750 MCM copper or equivalent Project Type : FAC Cost : $120,000 Time Estimate : 6.0 Months r0063 (1573) : Replace the 600A disconnect switches N34-613 and N34-615 at the Plumville substation with 1200A equipment Project Type : FAC Cost : $100,000 Time Estimate : 9.0 Months r0064 (1574) : Change the Zone 3 relay setting at Murphysville associated with the line protection to at least 108 MVA LTE rating. Project Type : FAC Cost : $0 Time Estimate : 6.0 Months	$8,480,000
43958234	5	138.0 kV - 05EMERSS 138.0 kV Ckt 1	AEPO0039a (1935) : A Sag Study will be required on the 4.5 miles ofACSR ~ 477 ~ 26/7 ~ HAWK- Conductor to mitigate the overload. Depending on the sag study results, the cost for this upgrade is expected to be between $18,000 (no remediations required, just sag study) and $6.75 million (complete line reconductor/rebuild). New rating after sag study: S/N: 185 S/E: 257. 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 : $18,000 Time Estimate : Sag Study : 6 - 12 months Months	$18,000
41050424	8	08LONGBR 138.0 kV - 08MTZION 138.0 kV Ckt 1	n30581 (1690) : Rebuild the line and Substation Bus Conductor on the Longbranch terminal at Mt. Zion Project Type : FAC Cost : $2,660,676 Time Estimate : 30.0 Months	$2,660,676

ID	Index	Facility	Upgrade Description	Cost
41665273,41876128, 41876127,41665274	4	AF1-256 TAP 138.0 kV - 4SPURLOCK 138.0 kV Ckt 1	r0034 (1544) : Increase the maximum operating temperature of the 795 and 954 MCM ACSR conductor in the Spurlock-AF!-256 Tap 138 kV line section to 275 degrees F (19.5 miles) Project Type : FAC Cost : $1,770,000 Time Estimate : 15.0 Months	$1,770,000
41876010,41050367, 41351751,41665068, 41665067	15	7SPURLOCK 345.0 kV - 09STUART 345.0 kV Ckt 1	EKPC: r0040 (1550) : Replace the 1500A interconnection metering CTs with 2000A equipment. Project Type : FAC Cost : $150,000 Time Estimate : 9.0 Months r0041 (1551) : Replace the 3000A wave trap with 3600A equipment. Project Type : FAC Cost : $170,000 Time Estimate : 9.0 Months r0042 (1552) : Construct a new 345 kV circuit (Id 2) between the EKPC Spurlock and DP&L Stuart substations (circuit length approximately 8.5 miles) Project Type : CON Cost : $30,000,000 Time Estimate : 48.0 Months Dayton: DAYr190039 (1627) : Reconductor Stuart-Spurlock line with twin bundle 1033 Curlew ACCR conductor Project Type : FAC Cost : $17,000,000 Time Estimate : 18.0 Months DAYr190040 (1628) : Replace Stuart substation riser conductor with 2500AAC (parallel) Project Type : FAC Cost : $100,000 Time Estimate : 12.0 Months DAYr190041 (1629) : Reconductor Stuart substation conductor with twin bundle 1033 Curlew ACCR conductor Project Type : FAC Cost : $250,000 Time Estimate : 12.0 Months	$47,350,000
41050514	14	4SPURLOCK 138.0 kV - 4SPUR-KENT-R 138.0 kV Ckt 1	n6041 (1512) : Replace the 5% 1200A reactor at Spurlock with a 7.5% 1600A reactor Project Type : FAC Cost : $600,000 Time Estimate : 9.0 Months	$600,000

ID	Index	Facility	Upgrade Description	Cost
43573455	10	4KENTON 138.0 kV - 138.0 kV Ckt 1	AEPO0040a (1936) : A Sag Study will be required on the 24 miles ofACSR ~ 477 ~ 26/7 ~ HAWK- Conductor section 1 to mitigate the overload. Depending on the sag study results, the cost for this upgrade is expected to be between $96,000 (no remediations required, just sag study) and $36 million (complete line reconductor/rebuild). New rating after sag study: S/N: 185 S/E: 257. 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 : $96,000 Time Estimate : Sag Study : 6 - 12 months Months	$96,000
			TOTAL COST	$85,873,701

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
41665396	342571	4CRANSTON	EKPC	342649	4ROWAN CO	EKPC	1	EKPC_P4-6_SPUR N39-92T	breaker	255.0	87.05	105.58	DC	47.24

Bus #	Bus	MW Impact
936381	AD2-048 C	2.2900
936382	AD2-048 E	1.1426
939141	AE1-144 C O1	42.5966
939142	AE1-144 E O1	21.1390
940531	AE2-038 C O1	28.4155
940532	AE2-038 E O1	14.0749
945681	AF1-233 C O1	88.9263
945682	AF1-233 E O1	43.9317
945911	AF1-256 C	28.3430
945912	AF1-256 E	18.8954
LGEE	LGEE	0.0776
WEC	WEC	0.0135
CBM-W2	CBM-W2	0.3522
NY	NY	0.0083
CBM-W1	CBM-W1	0.4754
TVA	TVA	0.0378
O-066	O-066	0.1075
CBM-S1	CBM-S1	0.4004
G-007	G-007	0.0166
MEC	MEC	0.0667
CATAWBA	CATAWBA	0.0053

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
41665395	342589	4GODDARD	EKPC	342571	4CRANSTON	EKPC	1	EKPC_P4-6_SPUR N39-92T	breaker	255.0	87.13	105.65	DC	47.24

Bus #	Bus	MW Impact
936381	AD2-048 C	2.2900
936382	AD2-048 E	1.1426
939141	AE1-144 C O1	42.5966
939142	AE1-144 E O1	21.1390
940531	AE2-038 C O1	28.4155
940532	AE2-038 E O1	14.0749
945681	AF1-233 C O1	88.9263
945682	AF1-233 E O1	43.9317
945911	AF1-256 C	28.3430
945912	AF1-256 E	18.8954
LGEE	LGEE	0.0776
WEC	WEC	0.0135
CBM-W2	CBM-W2	0.3522
NY	NY	0.0083
CBM-W1	CBM-W1	0.4754
TVA	TVA	0.0378
O-066	O-066	0.1075
CBM-S1	CBM-S1	0.4004
G-007	G-007	0.0166
MEC	MEC	0.0667
CATAWBA	CATAWBA	0.0053

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
41665310	342649	4ROWAN CO	EKPC	324302	4RODBURN	LGEE	1	EKPC_P4-6_SPUR N39-92T	breaker	191.0	90.48	112.65	DC	42.33

Bus #	Bus	MW Impact
939141	AE1-144 C O1	38.4006
939142	AE1-144 E O1	19.0566
940531	AE2-038 C O1	25.6163
940532	AE2-038 E O1	12.6885
945681	AF1-233 C O1	79.6930
945682	AF1-233 E O1	39.3702
945911	AF1-256 C	25.4002
945912	AF1-256 E	16.9334
DUCKCREEK	DUCKCREEK	0.1071
NEWTON	NEWTON	0.1160
CPLE	CPLE	0.0509
FARMERCITY	FARMERCITY	0.0042
G-007A	G-007A	0.0863
VFT	VFT	0.2322
PRAIRIE	PRAIRIE	0.2170
COFFEEN	COFFEEN	0.0529
CBM-S2	CBM-S2	0.4335
EDWARDS	EDWARDS	0.0329
TILTON	TILTON	0.0750
MADISON	MADISON	0.3468
GIBSON	GIBSON	0.0923
BLUEG	BLUEG	0.4184
TRIMBLE	TRIMBLE	0.1336

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
41876128	945910	AF1-256 TAP	EKPC	342664	4SPURLOCK	EKPC	1	EKPC_P2-2_GODDARD 138	bus	255.0	84.55	115.92	DC	80.0

Bus #	Bus	MW Impact
945681	AF1-233 C O1	150.6000
945682	AF1-233 E O1	74.4000
945911	AF1-256 C	48.0000
945912	AF1-256 E	32.0000

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
43958234	246800		AEP	247034	05EMERSS	AEP	1	DAY_P734541 34553	tower	185.0	111.06	112.84	DC	7.32

Bus #	Bus	MW Impact
251831	Z1-080 BAT	0.5186
918802	AA1-099 E	-0.2939
918803	AA1-099 BAT	0.3457
925981	AC1-074 C O1	2.6670
925982	AC1-074 E O1	1.1430
932551	AC2-075 C	0.6334
932552	AC2-075 E	0.3191
936381	AD2-048 C	3.0966
936382	AD2-048 E	1.5450
939141	AE1-144 C O1	6.3793
939142	AE1-144 E O1	3.1658
940531	AE2-038 C O1	4.2556
940532	AE2-038 E O1	2.1079
941411	AE2-138 C	8.9377
941412	AE2-138 E	3.3057
941981	AE2-210 C O1	3.0797
941982	AE2-210 E O1	1.1584
943111	AE2-339 C	1.1504
943112	AE2-339 E	0.5666
944621	AF1-127 C O1	1.3160
944622	AF1-127 E O1	0.6482
945681	AF1-233 C O1	6.2207
945682	AF1-233 E O1	3.0732
945861	AF1-251 C	3.2688
945862	AF1-251 E	2.1792
945911	AF1-256 C	1.9773
945912	AF1-256 E	1.3182
LGEE	LGEE	0.9231
CPLE	CPLE	0.1376
WEC	WEC	0.0617
CBM-W2	CBM-W2	4.4472
NY	NY	0.0824
CBM-W1	CBM-W1	1.7264
TVA	TVA	1.0108
O-066	O-066	0.9341
CBM-S2	CBM-S2	1.7860
CBM-S1	CBM-S1	7.5743
G-007	G-007	0.1435
MADISON	MADISON	1.9212
MEC	MEC	0.5244

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
43958138	246946	05WLDCAT	AEP	243019	05HILLSB	AEP	1	DAY_P734541 34553	tower	185.0	163.8	165.58	DC	7.32

Bus #	Bus	MW Impact
251831	Z1-080 BAT	0.5186
918802	AA1-099 E	-0.2939
918803	AA1-099 BAT	0.3457
925981	AC1-074 C O1	2.6670
925982	AC1-074 E O1	1.1430
926101	AC1-089 C O1	40.2705
926102	AC1-089 E O1	65.7045
932551	AC2-075 C	0.6334
932552	AC2-075 E	0.3191
936381	AD2-048 C	3.0966
936382	AD2-048 E	1.5450
939141	AE1-144 C O1	6.3793
939142	AE1-144 E O1	3.1658
940531	AE2-038 C O1	4.2556
940532	AE2-038 E O1	2.1079
941411	AE2-138 C	8.9377
941412	AE2-138 E	3.3057
941981	AE2-210 C O1	3.0797
941982	AE2-210 E O1	1.1584
943111	AE2-339 C	1.1504
943112	AE2-339 E	0.5666
944621	AF1-127 C O1	1.3160
944622	AF1-127 E O1	0.6482
945681	AF1-233 C O1	6.2207
945682	AF1-233 E O1	3.0732
945861	AF1-251 C	3.2688
945862	AF1-251 E	2.1792
945911	AF1-256 C	1.9773
945912	AF1-256 E	1.3182
LGEE	LGEE	0.9231
CPLE	CPLE	0.1376
WEC	WEC	0.0617
CBM-W2	CBM-W2	4.4472
NY	NY	0.0824
CBM-W1	CBM-W1	1.7264
TVA	TVA	1.0108
O-066	O-066	0.9341
CBM-S2	CBM-S2	1.7860
CBM-S1	CBM-S1	7.5743
G-007	G-007	0.1435
MADISON	MADISON	1.9212
MEC	MEC	0.5244

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
43958235	247034	05EMERSS	AEP	246946	05WLDCAT	AEP	1	DAY_P734541 34553	tower	185.0	109.82	111.6	DC	7.32

Bus #	Bus	MW Impact
251831	Z1-080 BAT	0.5186
918802	AA1-099 E	-0.2939
918803	AA1-099 BAT	0.3457
925981	AC1-074 C O1	2.6670
925982	AC1-074 E O1	1.1430
932551	AC2-075 C	0.6334
932552	AC2-075 E	0.3191
936381	AD2-048 C	3.0966
936382	AD2-048 E	1.5450
939141	AE1-144 C O1	6.3793
939142	AE1-144 E O1	3.1658
940531	AE2-038 C O1	4.2556
940532	AE2-038 E O1	2.1079
941411	AE2-138 C	8.9377
941412	AE2-138 E	3.3057
941981	AE2-210 C O1	3.0797
941982	AE2-210 E O1	1.1584
943111	AE2-339 C	1.1504
943112	AE2-339 E	0.5666
944621	AF1-127 C O1	1.3160
944622	AF1-127 E O1	0.6482
945681	AF1-233 C O1	6.2207
945682	AF1-233 E O1	3.0732
945861	AF1-251 C	3.2688
945862	AF1-251 E	2.1792
945911	AF1-256 C	1.9773
945912	AF1-256 E	1.3182
LGEE	LGEE	0.9231
CPLE	CPLE	0.1376
WEC	WEC	0.0617
CBM-W2	CBM-W2	4.4472
NY	NY	0.0824
CBM-W1	CBM-W1	1.7264
TVA	TVA	1.0108
O-066	O-066	0.9341
CBM-S2	CBM-S2	1.7860
CBM-S1	CBM-S1	7.5743
G-007	G-007	0.1435
MADISON	MADISON	1.9212
MEC	MEC	0.5244

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
41050424	250054	08LONGBR	DEO&K	250077	08MTZION	DEO&K	1	DAY_P734541 34553	tower	284.0	116.41	119.55	DC	8.86

Bus #	Bus	MW Impact
342957	1SPURLK1G	5.1535
342960	1SPURLK2G	8.0926
342963	1SPURLK3G	4.2526
342966	1SPURLK4G	4.2526
925981	AC1-074 C O1	9.2562
925982	AC1-074 E O1	3.9670
932551	AC2-075 C	2.1984
932552	AC2-075 E	1.1074
936381	AD2-048 C	6.0729
936382	AD2-048 E	3.0299
936571	AD2-072 C O1	2.9465
936572	AD2-072 E O1	1.4447
939141	AE1-144 C O1	8.7899
939142	AE1-144 E O1	4.3621
940531	AE2-038 C O1	5.8636
940532	AE2-038 E O1	2.9044
941411	AE2-138 C	14.2325
941412	AE2-138 E	5.2641
941981	AE2-210 C O1	4.9041
941982	AE2-210 E O1	1.8447
942411	AE2-254 C O1	1.4096
942412	AE2-254 E O1	0.9398
942591	AE2-275 C O1	4.0264
942592	AE2-275 E O1	1.5145
942891	AE2-308 C O1	6.9274
942892	AE2-308 E O1	2.5191
943111	AE2-339 C	2.0999
943112	AE2-339 E	1.0343
944211	AF1-089 C O1	1.5157
944212	AF1-089 E O1	0.4638
944621	AF1-127 C O1	2.1479
944622	AF1-127 E O1	1.0579
945541	AF1-219 C O1	0.6926
945542	AF1-219 E O1	0.2248
945681	AF1-233 C O1	16.4726
945682	AF1-233 E O1	8.1379
945861	AF1-251 C	5.2663
945862	AF1-251 E	3.5109
945911	AF1-256 C	5.3174
945912	AF1-256 E	3.5450
946021	AF1-267 C O1	1.1808
946022	AF1-267 E O1	0.5425

Bus #	Bus	MW Impact
LGEE	LGEE	1.7069
CPLE	CPLE	0.2792
WEC	WEC	0.0350
CBM-W2	CBM-W2	6.2080
NY	NY	0.0735
CBM-W1	CBM-W1	0.6755
TVA	TVA	1.6156
O-066	O-066	0.7325
CBM-S2	CBM-S2	3.3062
CBM-S1	CBM-S1	12.7459
G-007	G-007	0.1123
MADISON	MADISON	3.7740
MEC	MEC	0.5673

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
41050475	250077	08MTZION	DEO&K	249991	08BUFTN1	DEO&K	1	DAY_P734541 34553	tower	298.0	106.62	109.6	DC	8.86

Bus #	Bus	MW Impact
342957	1SPURLK1G	5.1535
342960	1SPURLK2G	8.0926
342963	1SPURLK3G	4.2526
342966	1SPURLK4G	4.2526
925981	AC1-074 C O1	9.2562
925982	AC1-074 E O1	3.9670
932551	AC2-075 C	2.1984
932552	AC2-075 E	1.1074
936381	AD2-048 C	6.0729
936382	AD2-048 E	3.0299
936571	AD2-072 C O1	2.9465
936572	AD2-072 E O1	1.4447
939141	AE1-144 C O1	8.7899
939142	AE1-144 E O1	4.3621
940531	AE2-038 C O1	5.8636
940532	AE2-038 E O1	2.9044
941411	AE2-138 C	14.2325
941412	AE2-138 E	5.2641
941981	AE2-210 C O1	4.9041
941982	AE2-210 E O1	1.8447
942411	AE2-254 C O1	1.4096
942412	AE2-254 E O1	0.9398
942591	AE2-275 C O1	4.0264
942592	AE2-275 E O1	1.5145
942891	AE2-308 C O1	6.9274
942892	AE2-308 E O1	2.5191
943111	AE2-339 C	2.0999
943112	AE2-339 E	1.0343
944211	AF1-089 C O1	1.5157
944212	AF1-089 E O1	0.4638
944621	AF1-127 C O1	2.1479
944622	AF1-127 E O1	1.0579
945541	AF1-219 C O1	0.6926
945542	AF1-219 E O1	0.2248
945681	AF1-233 C O1	16.4726
945682	AF1-233 E O1	8.1379
945861	AF1-251 C	5.2663
945862	AF1-251 E	3.5109
945911	AF1-256 C	5.3174
945912	AF1-256 E	3.5450
946021	AF1-267 C O1	1.1808
946022	AF1-267 E O1	0.5425

Bus #	Bus	MW Impact
LGEE	LGEE	1.7069
CPLE	CPLE	0.2792
WEC	WEC	0.0350
CBM-W2	CBM-W2	6.2080
NY	NY	0.0735
CBM-W1	CBM-W1	0.6755
TVA	TVA	1.6156
O-066	O-066	0.7325
CBM-S2	CBM-S2	3.3062
CBM-S1	CBM-S1	12.7459
G-007	G-007	0.1123
MADISON	MADISON	3.7740
MEC	MEC	0.5673

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
43573455	324267	4KENTON	LGEE	246800		AEP	1	DAY_P734541 34553	tower	185.0	114.09	115.87	DC	7.32

Bus #	Bus	MW Impact
251831	Z1-080 BAT	0.5186
918802	AA1-099 E	-0.2939
918803	AA1-099 BAT	0.3457
925981	AC1-074 C O1	2.6670
925982	AC1-074 E O1	1.1430
932551	AC2-075 C	0.6334
932552	AC2-075 E	0.3191
936381	AD2-048 C	3.0966
936382	AD2-048 E	1.5450
939141	AE1-144 C O1	6.3793
939142	AE1-144 E O1	3.1658
940531	AE2-038 C O1	4.2556
940532	AE2-038 E O1	2.1079
941411	AE2-138 C	8.9377
941412	AE2-138 E	3.3057
941981	AE2-210 C O1	3.0797
941982	AE2-210 E O1	1.1584
943111	AE2-339 C	1.1504
943112	AE2-339 E	0.5666
944621	AF1-127 C O1	1.3160
944622	AF1-127 E O1	0.6482
945681	AF1-233 C O1	6.2207
945682	AF1-233 E O1	3.0732
945861	AF1-251 C	3.2688
945862	AF1-251 E	2.1792
945911	AF1-256 C	1.9773
945912	AF1-256 E	1.3182
LGEE	LGEE	0.9231
CPLE	CPLE	0.1376
WEC	WEC	0.0617
CBM-W2	CBM-W2	4.4472
NY	NY	0.0824
CBM-W1	CBM-W1	1.7264
TVA	TVA	1.0108
O-066	O-066	0.9341
CBM-S2	CBM-S2	1.7860
CBM-S1	CBM-S1	7.5743
G-007	G-007	0.1435
MADISON	MADISON	1.9212
MEC	MEC	0.5244

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
41664888	342091	2PLUMVILLE	EKPC	341923	2MURPHYSVIL	EKPC	1	EKPC_P4-6_SPUR N39-92T	breaker	63.0	135.86	165.52	DC	18.69

Bus #	Bus	MW Impact
939141	AE1-144 C O1	23.9269
939142	AE1-144 E O1	11.8739
940531	AE2-038 C O1	15.9612
940532	AE2-038 E O1	7.9060
945681	AF1-233 C O1	35.1771
945682	AF1-233 E O1	17.3784
945911	AF1-256 C	11.2118
945912	AF1-256 E	7.4746
DUCKCREEK	DUCKCREEK	0.0507
NEWTON	NEWTON	0.0505
CPLE	CPLE	0.0351
FARMERCITY	FARMERCITY	0.0014
G-007A	G-007A	0.0408
VFT	VFT	0.1096
TVA	TVA	0.0560
PRAIRIE	PRAIRIE	0.0672
COFFEEN	COFFEEN	0.0227
CBM-S2	CBM-S2	0.3295
EDWARDS	EDWARDS	0.0161
CBM-S1	CBM-S1	0.0767
TILTON	TILTON	0.0378
MADISON	MADISON	0.2782
GIBSON	GIBSON	0.0399
BLUEG	BLUEG	0.1910
TRIMBLE	TRIMBLE	0.0646

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
41050400	342559	4BOONE CO	EKPC	250054	08LONGBR	DEO&K	1	DAY_P734541 34553	tower	284.0	123.74	126.87	DC	8.86

Bus #	Bus	MW Impact
342957	1SPURLK1G	5.1535
342960	1SPURLK2G	8.0926
342963	1SPURLK3G	4.2526
342966	1SPURLK4G	4.2526
925981	AC1-074 C O1	9.2562
925982	AC1-074 E O1	3.9670
932551	AC2-075 C	2.1984
932552	AC2-075 E	1.1074
936381	AD2-048 C	6.0729
936382	AD2-048 E	3.0299
936571	AD2-072 C O1	2.9465
936572	AD2-072 E O1	1.4447
939141	AE1-144 C O1	8.7899
939142	AE1-144 E O1	4.3621
940531	AE2-038 C O1	5.8636
940532	AE2-038 E O1	2.9044
941411	AE2-138 C	14.2325
941412	AE2-138 E	5.2641
941981	AE2-210 C O1	4.9041
941982	AE2-210 E O1	1.8447
942411	AE2-254 C O1	1.4096
942412	AE2-254 E O1	0.9398
942591	AE2-275 C O1	4.0264
942592	AE2-275 E O1	1.5145
942891	AE2-308 C O1	6.9274
942892	AE2-308 E O1	2.5191
943111	AE2-339 C	2.0999
943112	AE2-339 E	1.0343
944211	AF1-089 C O1	1.5157
944212	AF1-089 E O1	0.4638
944621	AF1-127 C O1	2.1479
944622	AF1-127 E O1	1.0579
945541	AF1-219 C O1	0.6926
945542	AF1-219 E O1	0.2248
945681	AF1-233 C O1	16.4726
945682	AF1-233 E O1	8.1379
945861	AF1-251 C	5.2663
945862	AF1-251 E	3.5109
945911	AF1-256 C	5.3174
945912	AF1-256 E	3.5450
946021	AF1-267 C O1	1.1808
946022	AF1-267 E O1	0.5425

Bus #	Bus	MW Impact
LGEE	LGEE	1.7069
CPLE	CPLE	0.2792
WEC	WEC	0.0350
CBM-W2	CBM-W2	6.2080
NY	NY	0.0735
CBM-W1	CBM-W1	0.6755
TVA	TVA	1.6156
O-066	O-066	0.7325
CBM-S2	CBM-S2	3.3062
CBM-S1	CBM-S1	12.7459
G-007	G-007	0.1123
MADISON	MADISON	3.7740
MEC	MEC	0.5673

17.13 Index 13

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
41050476	342661	4SPUR-KENT-R	EKPC	324267	4KENTON	LGEE	1	DAY_P734541 34553	tower	281.0	108.4	109.62	DC	7.48

Bus #	Bus	MW Impact
342957	1SPURLK1G	6.4835
342960	1SPURLK2G	9.4323
342963	1SPURLK3G	4.9566
342966	1SPURLK4G	4.9566
925981	AC1-074 C O1	2.4428
925982	AC1-074 E O1	1.0469
932551	AC2-075 C	0.5802
932552	AC2-075 E	0.2923
939141	AE1-144 C O1	5.2600
939142	AE1-144 E O1	2.6103
940531	AE2-038 C O1	3.5089
940532	AE2-038 E O1	1.7380
941411	AE2-138 C	11.1398
941412	AE2-138 E	4.1202
941981	AE2-210 C O1	3.8385
941982	AE2-210 E O1	1.4438
944621	AF1-127 C O1	1.5826
944622	AF1-127 E O1	0.7795
945681	AF1-233 C O1	5.8686
945682	AF1-233 E O1	2.8992
945861	AF1-251 C	4.0068
945862	AF1-251 E	2.6712
945911	AF1-256 C	2.0212
945912	AF1-256 E	1.3475
LGEE	LGEE	0.3206
CPLE	CPLE	0.0582
WEC	WEC	0.0038
CBM-W2	CBM-W2	2.0721
NY	NY	0.0841
TVA	TVA	0.6020
O-066	O-066	0.9744
CBM-S2	CBM-S2	0.9132
CBM-S1	CBM-S1	3.8766
G-007	G-007	0.1498
MADISON	MADISON	1.0786
MEC	MEC	0.1700

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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
41050514	342664	4SPURLOCK	EKPC	342661	4SPUR-KENT-R	EKPC	1	DAY_P734541 34553	tower	291.0	104.78	105.95	DC	7.48

Bus #	Bus	MW Impact
342957	1SPURLK1G	6.4835
342960	1SPURLK2G	9.4323
342963	1SPURLK3G	4.9566
342966	1SPURLK4G	4.9566
925981	AC1-074 C O1	2.4428
925982	AC1-074 E O1	1.0469
932551	AC2-075 C	0.5802
932552	AC2-075 E	0.2923
939141	AE1-144 C O1	5.2600
939142	AE1-144 E O1	2.6103
940531	AE2-038 C O1	3.5089
940532	AE2-038 E O1	1.7380
941411	AE2-138 C	11.1398
941412	AE2-138 E	4.1202
941981	AE2-210 C O1	3.8385
941982	AE2-210 E O1	1.4438
944621	AF1-127 C O1	1.5826
944622	AF1-127 E O1	0.7795
945681	AF1-233 C O1	5.8686
945682	AF1-233 E O1	2.8992
945861	AF1-251 C	4.0068
945862	AF1-251 E	2.6712
945911	AF1-256 C	2.0212
945912	AF1-256 E	1.3475
LGEE	LGEE	0.3206
CPLE	CPLE	0.0582
WEC	WEC	0.0038
CBM-W2	CBM-W2	2.0721
NY	NY	0.0841
TVA	TVA	0.6020
O-066	O-066	0.9744
CBM-S2	CBM-S2	0.9132
CBM-S1	CBM-S1	3.8766
G-007	G-007	0.1498
MADISON	MADISON	1.0786
MEC	MEC	0.1700

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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
41876010	342838	7SPURLOCK	EKPC	253077	09STUART	DAY	1	DEOK_P2-2_C1 SILVER GROVE 345 BUS	bus	1532.0	130.04	132.25	DC	33.69

Bus #	Bus	MW Impact
251968	08ZIMRHP	39.2669
251969	08ZIMRLP	21.5033
251970	08MELDL1	1.9892
251971	08MELDL2	1.9892
251972	08MELDL3	1.9946
342957	1SPURLK1G	20.1913
342960	1SPURLK2G	38.4191
342963	1SPURLK3G	20.1889
342966	1SPURLK4G	20.1889
925921	AC1-068 C	-3.5400
925922	AC1-068 E	-1.6555
925931	AC1-069 C	-3.5400
925932	AC1-069 E	-1.6555
925981	AC1-074 C O1	15.7063
925982	AC1-074 E O1	6.7313
926101	AC1-089 C O1	4.0790
926102	AC1-089 E O1	6.6552
926791	AC1-165 C	-3.4983
926792	AC1-165 E	-1.6971
926801	AC1-166 C	-3.4983
926802	AC1-166 E	-1.6971
926951	AC1-182	6.6980
932461	AC2-066 C	-3.1887
932462	AC2-066 E	-5.2027
932551	AC2-075 C	3.7303
932552	AC2-075 E	1.8791
936381	AD2-048 C	10.7895
936382	AD2-048 E	5.3832
936571	AD2-072 C O1	8.5203
936572	AD2-072 E O1	4.1776
936821	AD2-105 C O1	3.6360
936822	AD2-105 E O1	5.3196
936831	AD2-106 C O1	2.5615
936832	AD2-106 E O1	3.5374
936841	AD2-107 C O1	2.0318
936842	AD2-107 E O1	2.8059
939131	AE1-143 C	6.3754
939132	AE1-143 E	3.1579
939141	AE1-144 C O1	32.8515
939142	AE1-144 E O1	16.3029

Bus #	Bus	MW Impact
940531	AE2-038 C O1	21.9147
940532	AE2-038 E O1	10.8549
941411	AE2-138 C	63.0876
941412	AE2-138 E	23.3338
941961	AE2-208	2.1989
941981	AE2-210 C O1	21.7383
941982	AE2-210 E O1	8.1768
942411	AE2-254 C O1	4.2815
942412	AE2-254 E O1	2.8543
942591	AE2-275 C O1	13.4850
942592	AE2-275 E O1	5.0723
942891	AE2-308 C O1	22.6036
942892	AE2-308 E O1	8.2195
943111	AE2-339 C	7.4394
943112	AE2-339 E	3.6642
943701	AF1-038 C	1.6966
943702	AF1-038 E	1.1310
943772	AF1-045 BAT	4.6964
943821	AF1-050 C	1.5068
943822	AF1-050 E	1.0045
944151	AF1-083 C O1	1.5843
944152	AF1-083 E O1	1.0562
944211	AF1-089 C O1	2.4799
944212	AF1-089 E O1	0.7588
944511	AF1-116 C	3.7895
944512	AF1-116 E	2.5263
944621	AF1-127 C O1	17.2758
944622	AF1-127 E O1	8.5090
945541	AF1-219 C O1	2.0568
945542	AF1-219 E O1	0.6674
945681	AF1-233 C O1	62.3740
945682	AF1-233 E O1	30.8142
945861	AF1-251 C	43.2419
945862	AF1-251 E	28.8279
945911	AF1-256 C	20.2128
945912	AF1-256 E	13.4752
946021	AF1-267 C O1	3.9648
946022	AF1-267 E O1	1.8217
LGEE	LGEE	4.6422
CPLE	CPLE	0.4545
WEC	WEC	0.3597
LGE-0012019	LGE-0012019	6.2986
CBM-W2	CBM-W2	24.2260
NY	NY	0.7897
CBM-W1	CBM-W1	9.0572
TVA	TVA	5.1954
O-066	O-066	9.2400
CBM-S2	CBM-S2	7.3522
CBM-S1	CBM-S1	38.6212
G-007	G-007	1.4248
MADISON	MADISON	3.2780
MEC	MEC	2.9190

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
DEOK_P7-1_C5 CIRCUIT1883&4545REDBANKSILGRVZIMMER	CONTINGENCY 'DEOK_P7-1_C5 CIRCUIT1883&4545REDBANKSILGRVZIMMER' OPEN BRANCH FROM BUS 249989 TO BUS 250080 CKT 1 / 249989 08BKJ246 138 250080 08NWTWN2 138 1 OPEN BRANCH FROM BUS 250079 TO BUS 250080 CKT Z1 / 250079 08NWTWN1 138 250080 08NWTWN2 138 Z1 OPEN BRANCH FROM BUS 250079 TO BUS 250092 CKT 1 / 250079 08NWTWN1 138 250092 08REDBK1 138 1 OPEN BRANCH FROM BUS 249573 TO BUS 249577 CKT 1 / 249573 08SGROVE 345 249577 08ZIMER 345 1 OPEN BRANCH FROM BUS 249573 TO BUS 250097 CKT 1 / 249573 08SGROVE 345 250097 08SGROVE 138 1 OPEN BRANCH FROM BUS 249571 TO BUS 249573 CKT 1 / 249571 08REDBK1 345 249573 08SGROVE 345 1 END
EKPC_P4-6_SPUR N39-92T	CONTINGENCY 'EKPC_P4-6_SPUR N39-92T' /* SPURLOCK OPEN BRANCH FROM BUS 342622 TO BUS 342664 CKT 1 /* 342622 4MAYSVIL I T138.00 342664 4SPURLOCK 138.00 OPEN BRANCH FROM BUS 342622 TO BUS 342625 CKT 1 /* 342622 4MAYSVIL I T138.00 342625 4MAYSVIL IND138.00 OPEN BRANCH FROM BUS 342622 TO BUS 342634 CKT 1 /* 342622 4MAYSVIL I T138.00 342634 4PLUMVILLE 138.00 OPEN BRANCH FROM BUS 945910 TO BUS 342664 CKT 1 /* 945910 AF1-256 TAP 138.00 342664 4SPURLOCK 138.00 END
DEOK_P2-3_C2 816_SILVERGROVE	CONTINGENCY 'DEOK_P2-3_C2 816_SILVERGROVE' OPEN BRANCH FROM BUS 249573 TO BUS 250097 CKT 1 / 249573 08SGROVE 345 250097 08SGROVE 138 1 OPEN BRANCH FROM BUS 249988 TO BUS 250097 CKT 1 / 249988 08BKJ135 138 250097 08SGROVE 138 1 OPEN BRANCH FROM BUS 250042 TO BUS 250097 CKT 1 / 250042 08HANDS1 138 250097 08SGROVE 138 1 OPEN BRANCH FROM BUS 250052 TO BUS 250097 CKT 1 / 250052 08KYUNIV 138 250097 08SGROVE 138 1 OPEN BRANCH FROM BUS 250053 TO BUS 250097 CKT 1 / 250053 08LAFARG 138 250097 08SGROVE 138 1 OPEN BRANCH FROM BUS 249571 TO BUS 249573 CKT 1 / 249571 08REDBK1 345 249573 08SGROVE 345 1 OPEN BRANCH FROM BUS 249573 TO BUS 249577 CKT 1 / 249573 08SGROVE 345 249577 08ZIMER 345 1 END
DAY-P1-STU SPUR	CONTINGENCY 'DAY-P1-STU SPUR' DISCONNECT BRANCH FROM BUS 253077 TO BUS 342838 CKT 1 /* STU SPUR END

Contingency Name	Contingency Definition
DEOK_P2-3_C2 1493_RED BANK	CONTINGENCY 'DEOK_P2-3_C2 1493_RED BANK' OPEN BRANCH FROM BUS 249571 TO BUS 249573 CKT 1 / 249571 08REDBK1 345 249573 08SGROVE 345 1 OPEN BRANCH FROM BUS 249573 TO BUS 250097 CKT 1 / 249573 08SGROVE 345 250097 08SGROVE 138 1 OPEN BRANCH FROM BUS 249573 TO BUS 249577 CKT 1 / 249573 08SGROVE 345 249577 08ZIMER 345 1 OPEN BRANCH FROM BUS 249571 TO BUS 250092 CKT 1 / 249571 08REDBK1 345 250092 08REDBK1 138 1 END
EKPC_P2-3_GODDARD E5-834	CONTINGENCY 'EKPC_P2-3_GODDARD E5-834' /* OPEN BUS 342589 /* 4GODDARD OPEN BRANCH FROM BUS 342571 TO BUS 342649 CKT 1 /* 342571 4CRANSTON 138.00 342649 4ROWAN CO 138.00 END
DEOK_P1-3_B3 SILVER GROVE 345/138 TB23*	CONTINGENCY 'DEOK_P1-3_B3 SILVER GROVE 345/138 TB23*' OPEN BRANCH FROM BUS 249573 TO BUS 250097 CKT 1 / 249573 08SGROVE 345 250097 08SGROVE 138 1 OPEN BRANCH FROM BUS 249571 TO BUS 249573 CKT 1 / 249571 08REDBK1 345 249573 08SGROVE 345 1 OPEN BRANCH FROM BUS 249573 TO BUS 249577 CKT 1 / 249573 08SGROVE 345 249577 08ZIMER 345 1 END
EKPC_P2-2_GODDARD 138	CONTINGENCY 'EKPC_P2-2_GODDARD 138' /* GODDARD 138 BUS OPEN BUS 342589 /* 4GODDARD END
EKPC_P4-2_GODDARD E5-824	CONTINGENCY 'EKPC_P4-2_GODDARD E5-824' /* OPEN BUS 342589 /* 4GODDARD DROPS BUS END
DAY_P734541 34553	CONTINGENCY 'DAY_P734541 34553' OPEN BRANCH FROM BUS 249581 TO BUS 342838 CKT 1 /* 249581 08MELDAL 345.00 342838 7SPURLOCK 345.00 OPEN BRANCH FROM BUS 253077 TO BUS 342838 CKT 1 /* 253077 09STUART 345.00 342838 7SPURLOCK 345.00 END
EKPC_P1-2_SPUR-GODD 138-B	CONTINGENCY 'EKPC_P1-2_SPUR-GODD 138-B' /* SPURLOCK - GODDARD OPEN BRANCH FROM BUS 945910 TO BUS 342664 CKT 1 /* 945910 AF1-256 TAP 138.00 342664 4SPURLOCK 138.00 END
DAY_P4_L34553-1	CONTINGENCY 'DAY_P4_L34553-1' OPEN LINE FROM BUS 253077 TO BUS 342838 CKT 1 /* 09STUART 345 - 7SPURLK 345 OPEN LINE FROM BUS 253077 TO BUS 253076 CKT 1 /* 09STUART 345 - 09STUART 138 END
Base Case	

Contingency Name	Contingency Definition
EKPC_P4-2_GODDARD E5-834	CONTINGENCY 'EKPC_P4-2_GODDARD E5-834' /* OPEN BUS 342589 /* 4GODDARD OPEN BRANCH FROM BUS 342571 TO BUS 342649 CKT 1 /* 342571 4CRANSTON 138.00 342649 4ROWAN CO 138.00 END
DEOK_P2-2_C1 SILVER GROVE 345 BUS	CONTINGENCY 'DEOK_P2-2_C1 SILVER GROVE 345 BUS' OPEN BRANCH FROM BUS 249573 TO BUS 249577 CKT 1 / 249573 08SGROVE 345 249577 08ZIMER 345 1 OPEN BRANCH FROM BUS 249573 TO BUS 250097 CKT 1 / 249573 08SGROVE 345 250097 08SGROVE 138 1 OPEN BRANCH FROM BUS 249571 TO BUS 249573 CKT 1 / 249571 08REDBK1 345 249573 08SGROVE 345 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