Generation Interconnection

Feasibility Study Report

for

Queue Project AG1-405

WALNUT GROVE-ASAHI 69 KV

34.2 MW Capacity / 57 MW Energy

January 2021

Table of Contents

1 Introduction

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

2 Preface

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

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

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

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

3 General

The Interconnection Customer (IC), has proposed a Solar generating facility located in McLean County, Illinois. The installed facilities will have a total capability of 57 MW with 34.2 MW of this output being recognized by PJM as Capacity.

The proposed in-service date for this project is September 25, 2024. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-405
Project Name	WALNUT GROVE-ASAHI 69 KV
State	Illinois
County	McLean
Transmission Owner	EKPC
MFO	57
MWE	57
MWC	34.2
Fuel	Solar
Basecase Study Year	2024

Any new service customers who can feasibly be commercially operable prior to June 1st of the basecase study year are required to request interim deliverability analysis.

4 Point of Interconnection

AG1-405 will interconnect with the EKPC transmission system tapping the Walnut Grove to Asahi Tap 69 kV line.

5 Cost Summary

The AG1-405 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$7,180,000
Total System Network Upgrade Costs	$705,000
Total Costs	**$7,885,000**

This cost excludes a Federal Income Tax Gross Up charges. This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 2016-36, 2016-25 I.R.B. (6/20/2016). If at a future date it is determined that the Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

Cost allocations for any System Upgrades will be provided in the System Impact Study Report.

6 Transmission Owner Scope of Work

The total physical interconnection costs is given in the table below:

6.1 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 69 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 East Pulaski switching station, to accept the IC generator lead line/bus (Estimated time to implement is 21 months)	$1,170,000
Total Attachment Facility Costs	**$1,170,000**

6.2 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 69 kV switching station (East Pulaski) to facilitate connection of the IC solar generation project to the existing Walnut Grove-Asahi Motor Wheel 69 kV line (Estimated time to implement is 21 months)	$3,510,000
Total Direct Connection Facility Costs	**$3,510,000**

6.3 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 Walnut Grove-Asahi Motor Wheel 69 kV line into the new East Pulaski switching station (Estimated time to implement is 21 months)	$240,000
Modify relays and/or settings at Walnut Grove substation for the existing line to the new East Pulaski switching station (Estimated time to implement is 9 months)	$85,000
Modify relays and/or settings at Pulaski County substation for the existing line to the new East Pulaski switching station (Estimated time to implement is 9 months)	$85,000
Modify relays and/or settings at Somerset substation for the existing line to the new East Pulaski switching station (Estimated time to implement is 9 months)	$85,000
Install OPGW on the East Pulaski-Asahi Motor Wheel-Shopville-Norwood Junction-East Somerset-Nelson Valley-Norwood-Pulaski County 69 kV line sections (12.4 miles) (Estimated time to implement is 25 months)	$2,005,000
Total Non-Direct Connection Facility Costs	**$2,500,000**

7 Interconnection Customer Requirements

It is understood that the Interconnection Customer (IC) is responsible for all costs associated with this interconnection. The costs above are reimbursable to the Transmission Owner. The cost of the IC's generating plant and the costs for the line connecting the generating plant to the Point of Interconnection are not included in this report; these are assumed to be the IC's responsibility.

The Generation Interconnection Agreement does not in or by itself establish a requirement for the Transmission Owner 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.

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.

8 Revenue Metering and SCADA Requirements

8.1 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.

8.2 Meteorological Data Reporting Requirements

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

- Back Panel temperature (Fahrenheit) - (Required for plants with Maximum Facility Output of 3 MW or higher)
- Irradiance (Watts/meter2) - (Required for plants with Maximum Facility Output of 3 MW or higher)
- Ambient air temperature (Fahrenheit) - (Accepted, not required)
- Wind speed (meters/second) - (Accepted, not required)
- Wind direction (decimal degrees from true north) - (Accepted, not required)

8.3 Interconnected Transmission Owner Requirements

The IC will be required to comply with all Interconnected Transmission Owner's revenue metering requirements for generation interconnection customers located at the following link:

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

9 Summer Peak - Load Flow Analysis

The Queue Project AG1-405 was evaluated as a 57.0 MW (Capacity 34.2 MW) injection tapping the Walnut Grove to Asahi Tap 69 kV line in the EKPC area. Project AG1-405 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-405 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

9.1 Generation Deliverability

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

None

9.2 Multiple Facility Contingency

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

None

9.3 Contribution to Previously Identified Overloads

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

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
166803679	342286	2SOMERSET	69.0	EKPC	342287	2SOMERSET KU	69.0	EKPC	1	EKPC_P7-1_COOP 161 DBL 2	tower	115.0	102.62	119.77	DC	19.68
165388571	342287	2SOMERSET KU	69.0	EKPC	324531	2FERGUSON SO	69.0	LGEE	1	EKPC_P7-1_COOP 161 DBL 2	tower	105.0	120.17	137.05	DC	17.68
165388320	342718	5COOPER2	161.0	EKPC	324141	5ELIHU	161.0	LGEE	1	EKPC_P2-2_LAUREL CO 161	bus	277.0	125.88	128.25	DC	6.54
165388586	342718	5COOPER2	161.0	EKPC	324141	5ELIHU	161.0	LGEE	1	EKPC_P7-1_LAURL 161 DBL	tower	277.0	126.12	128.48	DC	6.54
169451379	342718	5COOPER2	161.0	EKPC	324141	5ELIHU	161.0	LGEE	1	EKPC_P2-1_5LAUREL CO 161.00 TO 5LAUREL DAM 161.00	single	277.0	106.39	107.81	DC	3.93
169451493	342757	5LAUREL DAM	161.0	EKPC	342754	5LAUREL CO	161.0	EKPC	1	EXT_B-69-25	single	200.0	101.66	103.62	DC	3.92

9.4 Potential Congestion due to Local Energy Deliverability

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

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

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
164624264	324010	7TRIMBL REAC	345.0	LGEE	248000	06CLIFTY	345.0	OVEC	1	Base Case	operation	1134.0	99.91	100.5	DC	6.67
169451376	342718	5COOPER 2	161.0	EKPC	324141	5ELIHU	161.0	LGEE	1	EKPC_P2-1_5LAUREL CO 161.00 TO 5LAUREL DAM 161.00	operation	277.0	125.86	128.22	DC	6.55
169451378	342718	5COOPER 2	161.0	EKPC	324141	5ELIHU	161.0	LGEE	1	Base Case	operation	219.0	104.6	105.64	DC	5.03
169451491	342757	5LAUREL DAM	161.0	EKPC	342754	5LAUREL CO	161.0	EKPC	1	EXT_B-69-25	operation	200.0	104.63	107.92	DC	6.54
169451390	342769	5MARION CO	161.0	EKPC	342770	4MARION CO	138.0	EKPC	1	Base Case	operation	192.0	106.36	107.13	DC	3.28
169451558	342769	5MARION CO	161.0	EKPC	342775	5MARION IP T	161.0	EKPC	1	EXT_B-69-18-B	operation	131.0	103.82	104.99	DC	3.4
169451394	342770	4MARION CO	138.0	EKPC	324271	4LEBANON	138.0	LGEE	1	Base Case	operation	187.0	109.15	109.94	DC	3.28

9.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
166803679	1	2SOMERSET 69.0 kV - 2SOMERSET KU 69.0 kV Ckt 1	EKPC r0080 (84) : 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
169451493	4	5LAUREL DAM 161.0 kV - 5LAUREL CO 161.0 kV Ckt 1	EKPC r0013a (16) : 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
165388320,165388586,169451379	3	5COOPER2 161.0 kV - 5ELIHU 161.0 kV Ckt 1	EKPC r0018 (22) : LGEE violation (non PJM area). EKPC continuous rating is 267 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 r0076 (80) : 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 LGEE NonPJMArea (89) : 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	$660,000
165388571	2	2SOMERSET KU 69.0 kV - 2FERGUSON SO 69.0 kV Ckt 1	EKPC r0077 (81) : 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 LGEE NonPJMArea (89) : 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
			TOTAL COST	$705,000

9.6 Flow Gate Details

The following indices contain additional information about each facility presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. The intent of the indices is to provide more details on which projects/generators have contributions to the flowgate in question. All New Service Queue Requests, through the end of the Queue under study, that are contributors to a flowgate will be listed in the indices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the indices. Although this information is not used "as is" for cost allocation purposes, it can be used to gage the impact of other projects/generators. It should be noted the project/generator MW contributions presented in the body of the report are Full MW Impact contributions which are also noted in the indices column named "Full MW Impact", whereas the loading percentages reported in the body of the report, take into consideration the PJM Generator Deliverability Test rules such as commercial probability of each project as well as the ramping impact of "Adder" contributions. The MW Impact found and used in the analysis is shown in the indices column named "Gendeliv MW Impact".

9.6.1 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
166803679	342286	2SOMERSET	EKPC	342287	2SOMERSET KU	EKPC	1	EKPC_P7-1_COOP 161 DBL 2	tower	115.0	102.62	119.77	DC	19.68

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
342900	1COOPER1 G	5.0281	50/50	5.0281
342903	1COOPER2 G	9.7520	50/50	9.7520
939131	AE1-143 C	5.2595	Adder	6.19
939132	AE1-143 E	2.6052	Adder	3.06
940045	AE1-246 C	4.3059	Adder	5.07
940046	AE1-246 E	2.0732	Adder	2.44
940831	AE2-071 C	1.2797	Adder	1.51
940832	AE2-071 E	0.8531	Adder	1.0
943701	AF1-038 C	6.1070	50/50	6.1070
943702	AF1-038 E	4.0714	50/50	4.0714
943821	AF1-050 C	2.2112	Adder	2.6
943822	AF1-050 E	1.4741	Adder	1.73
944151	AF1-083 C O1	2.3430	Adder	2.76
944152	AF1-083 E O1	1.5620	Adder	1.84
944511	AF1-116 C	5.8985	Adder	6.94
944512	AF1-116 E	3.9323	Adder	4.63
945381	AF1-203 C	0.7312	Adder	0.86
945382	AF1-203 E	0.4875	Adder	0.57
962221	AG1-067 C O1	0.7327	Adder	1.63
962222	AG1-067 E O1	0.3900	Adder	0.87
962241	AG1-070 C O1	0.9836	Adder	2.18
962242	AG1-070 E O1	0.1967	Adder	0.44
962251	AG1-071 C O1	1.1803	Adder	2.62
962252	AG1-071 E O1	0.2623	Adder	0.58
964781	AG1-341 C O1	1.7956	Adder	3.99
964782	AG1-341 E O1	1.1971	Adder	2.66
964891	AG1-353 C	2.1186	Adder	4.7
964892	AG1-353 E	1.4124	Adder	3.14
964901	AG1-354 C	2.7048	Adder	6.0
964902	AG1-354 E	1.8032	Adder	4.0
965401	AG1-405 C	11.8058	50/50	11.8058
965402	AG1-405 E	7.8706	50/50	7.8706
965411	AG1-406	7.5944	50/50	7.5944
966021	AG1-471 C O1	4.5385	50/50	4.5385
966022	AG1-471 E O1	3.0257	50/50	3.0257
966031	AG1-472 C	1.2254	Adder	2.72
966032	AG1-472 E	0.8170	Adder	1.81
966191	AG1-488 C O1	1.7621	Adder	3.91
966192	AG1-488 E O1	1.1747	Adder	2.61
WEC	WEC	0.0507	Confirmed LTF	0.0507
LGEE	LGEE	0.0145	Confirmed LTF	0.0145

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
CPLE	CPLE	0.0293	Confirmed LTF	0.0293
LGE-0012019	LGE-0012019	4.9049	LTF	4.9049
CBM-W2	CBM-W2	4.0051	Confirmed LTF	4.0051
NY	NY	0.0415	Confirmed LTF	0.0415
TVA	TVA	1.0206	Confirmed LTF	1.0206
O-066	O-066	0.5048	Confirmed LTF	0.5048
SIGE	SIGE	0.0423	Confirmed LTF	0.0423
CBM-S2	CBM-S2	1.0753	Confirmed LTF	1.0753
CBM-S1	CBM-S1	0.2284	Confirmed LTF	0.2284
G-007	G-007	0.0788	Confirmed LTF	0.0788
MEC	MEC	0.4529	Confirmed LTF	0.4529
LAGN	LAGN	0.9660	Confirmed LTF	0.9660
CBM-W1	CBM-W1	1.9908	Confirmed LTF	1.9908

9.6.2 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
165388571	342287	2SOMERSET KU	EKPC	324531	2FERGUSON SO	LGEE	1	EKPC_P7-1_COOP 161 DBL 2	tower	105.0	120.17	137.05	DC	17.68

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
342900	1COOPER1 G	4.9218	50/50	4.9218
342903	1COOPER2 G	9.5458	50/50	9.5458
939131	AE1-143 C	5.4221	Adder	6.38
939132	AE1-143 E	2.6857	Adder	3.16
940045	AE1-246 C	5.4632	Adder	6.43
940046	AE1-246 E	2.6305	Adder	3.09
940831	AE2-071 C	1.6233	Adder	1.91
940832	AE2-071 E	1.0822	Adder	1.27
943701	AF1-038 C	8.3977	50/50	8.3977
943702	AF1-038 E	5.5985	50/50	5.5985
943821	AF1-050 C	2.5575	Adder	3.01
943822	AF1-050 E	1.7050	Adder	2.01
944151	AF1-083 C O1	2.5256	Adder	2.97
944152	AF1-083 E O1	1.6837	Adder	1.98
944511	AF1-116 C	6.0808	Adder	7.15
944512	AF1-116 E	4.0539	Adder	4.77
945381	AF1-203 C	0.9276	Adder	1.09
945382	AF1-203 E	0.6184	Adder	0.73
960741	AF2-365 C O1	1.5231	Adder	1.79
960742	AF2-365 E O1	1.0154	Adder	1.19
962221	AG1-067 C O1	0.9274	Adder	2.06
962222	AG1-067 E O1	0.4936	Adder	1.1
962241	AG1-070 C O1	1.2361	Adder	2.74
962242	AG1-070 E O1	0.2472	Adder	0.55
962251	AG1-071 C O1	1.4833	Adder	3.29
962252	AG1-071 E O1	0.3296	Adder	0.73
964781	AG1-341 C O1	2.2790	Adder	5.06
964782	AG1-341 E O1	1.5193	Adder	3.37
964891	AG1-353 C	2.3239	Adder	5.16
964892	AG1-353 E	1.5493	Adder	3.44
964901	AG1-354 C	3.2939	Adder	7.31
964902	AG1-354 E	2.1959	Adder	4.87
965401	AG1-405 C	10.6088	50/50	10.6088
965402	AG1-405 E	7.0726	50/50	7.0726
965411	AG1-406	6.8244	50/50	6.8244
966021	AG1-471 C O1	5.1635	50/50	5.1635
966022	AG1-471 E O1	3.4423	50/50	3.4423
966031	AG1-472 C	1.5310	Adder	3.4
966032	AG1-472 E	1.0207	Adder	2.27
966191	AG1-488 C O1	1.8353	Adder	4.07
966192	AG1-488 E O1	1.2236	Adder	2.72

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
WEC	WEC	0.0652	Confirmed LTF	0.0652
CPLE	CPLE	0.0628	Confirmed LTF	0.0628
LGE-0012019	LGE-0012019	5.0017	LTF	5.0017
CBM-W2	CBM-W2	5.1878	Confirmed LTF	5.1878
NY	NY	0.0426	Confirmed LTF	0.0426
TVA	TVA	1.3454	Confirmed LTF	1.3454
O-066	O-066	0.5048	Confirmed LTF	0.5048
SIGE	SIGE	0.0489	Confirmed LTF	0.0489
CBM-S2	CBM-S2	1.7957	Confirmed LTF	1.7957
CBM-S1	CBM-S1	0.2983	Confirmed LTF	0.2983
G-007	G-007	0.0788	Confirmed LTF	0.0788
MEC	MEC	0.5848	Confirmed LTF	0.5848
LAGN	LAGN	1.2705	Confirmed LTF	1.2705
CBM-W1	CBM-W1	2.5797	Confirmed LTF	2.5797

9.6.3 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
165388586	342718	5COOPER2	EKPC	324141	5ELIHU	LGEE	1	EKPC_P7-1_LAURL 161 DBL	tower	277.0	126.12	128.48	DC	6.54

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
342442	2W GLASGOW	0.0165	50/50	0.0165
342900	1COOPER1 G	10.1486	50/50	10.1486
342903	1COOPER2 G	19.7433	50/50	19.7433
342945	1LAUREL 1G	6.1423	50/50	6.1423
939131	AE1-143 C	9.9773	50/50	9.9773
939132	AE1-143 E	4.9420	50/50	4.9420
940045	AE1-246 C	9.3685	50/50	9.3685
940046	AE1-246 E	4.5107	50/50	4.5107
940831	AE2-071 C	2.5509	50/50	2.5509
940832	AE2-071 E	1.7006	50/50	1.7006
942411	AE2-254 C O1	1.3451	Adder	1.58
942412	AE2-254 E O1	0.8967	Adder	1.05
943701	AF1-038 C	6.6586	50/50	6.6586
943702	AF1-038 E	4.4390	50/50	4.4390
943821	AF1-050 C	4.5025	50/50	4.5025
943822	AF1-050 E	3.0017	50/50	3.0017
944151	AF1-083 C O1	4.5583	50/50	4.5583
944152	AF1-083 E O1	3.0389	50/50	3.0389
944511	AF1-116 C	11.1895	50/50	11.1895
944512	AF1-116 E	7.4597	50/50	7.4597
945381	AF1-203 C	1.4576	50/50	1.4576
945382	AF1-203 E	0.9718	50/50	0.9718
960741	AF2-365 C O1	2.2040	Adder	2.59
960742	AF2-365 E O1	1.4693	Adder	1.73
962221	AG1-067 C O1	2.8138	50/50	2.8138
962222	AG1-067 E O1	1.4977	50/50	1.4977
962241	AG1-070 C O1	3.8850	50/50	3.8850
962242	AG1-070 E O1	0.7770	50/50	0.7770
962251	AG1-071 C O1	4.6620	50/50	4.6620
962252	AG1-071 E O1	1.0360	50/50	1.0360
964781	AG1-341 C O1	7.3763	50/50	7.3763
964782	AG1-341 E O1	4.9176	50/50	4.9176
964891	AG1-353 C	7.8586	50/50	7.8586
964892	AG1-353 E	5.2391	50/50	5.2391
964901	AG1-354 C	10.7820	50/50	10.7820
964902	AG1-354 E	7.1880	50/50	7.1880
965401	AG1-405 C	3.9234	50/50	3.9234
965402	AG1-405 E	2.6156	50/50	2.6156
965411	AG1-406	2.5238	50/50	2.5238
966021	AG1-471 C O1	7.2990	50/50	7.2990
966022	AG1-471 E O1	4.8660	50/50	4.8660

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
966031	AG1-472 C	4.8624	50/50	4.8624
966032	AG1-472 E	3.2416	50/50	3.2416
966191	AG1-488 C O1	6.3433	50/50	6.3433
966192	AG1-488 E O1	4.2288	50/50	4.2288
WEC	WEC	0.0787	Confirmed LTF	0.0787
CPLE	CPLE	0.0874	Confirmed LTF	0.0874
LGE-0012019	LGE-0012019	7.7561	LTF	7.7561
CBM-W2	CBM-W2	7.4368	Confirmed LTF	7.4368
NY	NY	0.0868	Confirmed LTF	0.0868
TVA	TVA	2.0090	Confirmed LTF	2.0090
O-066	O-066	1.0364	Confirmed LTF	1.0364
SIGE	SIGE	0.0700	Confirmed LTF	0.0700
CBM-S2	CBM-S2	2.6726	Confirmed LTF	2.6726
CBM-S1	CBM-S1	0.4378	Confirmed LTF	0.4378
G-007	G-007	0.1617	Confirmed LTF	0.1617
MEC	MEC	0.7945	Confirmed LTF	0.7945
LAGN	LAGN	1.8725	Confirmed LTF	1.8725
CBM-W1	CBM-W1	3.0283	Confirmed LTF	3.0283

9.6.4 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
169451493	342757	5LAUREL DAM	EKPC	342754	5LAUREL CO	EKPC	1	EXT_B-69-25	single	200.0	101.66	103.62	DC	3.92

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
342442	2W GLASGOW	0.0089	80/20	0.0089
342900	1COOPER1 G	4.6906	80/20	4.6906
342903	1COOPER2 G	9.1166	80/20	9.1166
342945	1LAUREL 1G	5.5642	80/20	5.5642
939131	AE1-143 C	5.0204	80/20	5.0204
940045	AE1-246 C	4.9451	80/20	4.9451
940831	AE2-071 C	1.3906	80/20	1.3906
943701	AF1-038 C	4.5860	80/20	4.5860
943821	AF1-050 C	2.3328	80/20	2.3328
944151	AF1-083 C O1	2.3222	80/20	2.3222
944511	AF1-116 C	5.6304	80/20	5.6304
945381	AF1-203 C	0.7946	80/20	0.7946
962221	AG1-067 C O1	1.5225	80/20	1.5225
962241	AG1-070 C O1	2.0779	80/20	2.0779
962251	AG1-071 C O1	2.4935	80/20	2.4935
964781	AG1-341 C O1	3.8923	80/20	3.8923
964891	AG1-353 C	4.0225	80/20	4.0225
964901	AG1-354 C	5.6448	80/20	5.6448
965401	AG1-405 C	3.9224	80/20	3.9224
965411	AG1-406	2.5232	80/20	2.5232
966021	AG1-471 C O1	3.8786	80/20	3.8786
966031	AG1-472 C	2.5915	80/20	2.5915
966191	AG1-488 C O1	3.2012	80/20	3.2012
WEC	WEC	0.0551	Confirmed LTF	0.0551
LGEE	LGEE	0.0603	Confirmed LTF	0.0603
CPLE	CPLE	0.0723	Confirmed LTF	0.0723
LGE-0012019	LGE-0012019	3.6993	LTF	3.6993
CBM-W2	CBM-W2	4.6771	Confirmed LTF	4.6771
NY	NY	0.0465	Confirmed LTF	0.0465
TVA	TVA	1.2012	Confirmed LTF	1.2012
SIGE	SIGE	0.0506	Confirmed LTF	0.0506
CBM-S2	CBM-S2	1.9627	Confirmed LTF	1.9627
CBM-S1	CBM-S1	0.2732	Confirmed LTF	0.2732
MEC	MEC	0.5101	Confirmed LTF	0.5101
LAGN	LAGN	1.1410	Confirmed LTF	1.1410
CBM-W1	CBM-W1	2.1170	Confirmed LTF	2.1170

9.7 Queue Dependencies

The Queue Projects below are listed in one or more indices for the overloads identified in your report. These projects contribute to the loading of the overloaded facilities identified in your report. The percent overload of a facility and cost allocation you may have towards a particular reinforcement could vary depending on the action of these earlier projects. The status of each project at the time of the analysis is presented in the table. This list may change as earlier projects withdraw or modify their requests.

Queue Number	Project Name	Status
AE1-143	Marion County 161 kV	Engineering and Procurement
AE1-246	Barren County-Summer Shade 161 kV	Active
AE2-071	Patton Rd-Summer Shade 69 kV	Active
AE2-254	Garrard County-Tommy-Gooch 69 kV	Active
AF1-038	Sewellton Jct-Webbs Crossroads 69 kV	Active
AF1-050	Summer Shade - Green County 161 kV	Active
AF1-083	Green County-Saloma 161 kV	Active
AF1-116	Marion County 161 kV	Active
AF1-203	Patton Rd-Summer Shade 69 kV	Active
AF2-365	Munfordville KU Tap-Horse Cave Jct. 69 kV	Active
AG1-067	Temple Hill 69 kV	Active
AG1-070	Bon Ayr 69 kV	Active
AG1-071	Bon Ayr 69 kV	Active
AG1-341	Summer Shade 161 kV	Active
AG1-353	Greene County-Marion County 161 kV	Active
AG1-354	Summershade-Green County 161 kV	Active
AG1-405	Walnut Grove-Asahi 69 kV	Active
AG1-406	Walnut Grove-Asahi 69 kV	Active
AG1-471	Up Church-Wayne County 69 kV	Active
AG1-472	Seymour-Cave City 69 kV	Active
AG1-488	Marion IP 161 kV	Active

9.8 Contingency Descriptions

Contingency Name	Contingency Definition
EKPC_P2-2_LAUREL CO 161	CONTINGENCY 'EKPC_P2-2_LAUREL CO 161' /* LAUREL 161 BUS OPEN BUS 342754 /* 5LAUREL CO END
EXT_B-69-25	CONTINGENCY 'EXT_B-69-25' / 2360 OPEN BRANCH FROM BUS 324130 TO BUS 324141 CKT 1 / 324130 5ALCALDE 161 324141 5ELIHU 161 1 OPEN BRANCH FROM BUS 324141 TO BUS 342718 CKT 1 / 324141 5ELIHU 161 342718 5COOPER2 161 1 OPEN BRANCH FROM BUS 324141 TO BUS 324514 CKT 1 / 324141 5ELIHU 161 324514 2ELIHU 69.0 1 OPEN BRANCH FROM BUS 324141 TO BUS 324514 CKT 2 / 324141 5ELIHU 161 324514 2ELIHU 69.0 2 END
EXT_B-69-18-B	CONTINGENCY 'EXT_B-69-18-B' / 2394 OPEN BRANCH FROM BUS 950000 TO BUS 324271 CKT 1 / 950000 LGE-0012019 138 324271 4LEBANON 138 1 OPEN BRANCH FROM BUS 324270 TO BUS 324271 CKT 1 / 324270 4LEBANON WES 138 324271 4LEBANON 138 1 OPEN BRANCH FROM BUS 324271 TO BUS 342770 CKT 1 / 324271 4LEBANON 138 342770 4MARION CO 138 1 OPEN BRANCH FROM BUS 324271 TO BUS 324606 CKT 1 / 324271 4LEBANON 138 324606 2LEBANON 69.0 1 OPEN BRANCH FROM BUS 324271 TO BUS 324606 CKT 2 / 324271 4LEBANON 138 324606 2LEBANON 69.0 2 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_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

Contingency Name	Contingency Definition
Base Case	
EKPC_P2-1_5LAUREL CO 161.00 TO 5LAUREL DAM 161.00	CONTINGENCY 'EKPC_P2-1_5LAUREL CO 161.00 TO 5LAUREL DAM 161.00' OPEN BRANCH FROM BUS 342754 TO BUS 342757 CKT 1 /*5LAUREL CO 161.005LAUREL DAM 161.00 END

10 Short Circuit Analysis

The following Breakers are overdutied:

None.

11 Affected Systems

11.1 TVA

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

11.2 Duke Energy Progress

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

11.3 MISO

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

11.4 LG&E

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