Generation Interconnection

Feasibility Study Report

for

Queue Project AG1-004

MARYSVILLE-SORENSON 765 KV

200 MW Capacity / 200 MW Energy

January 2021

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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 AEP.

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.

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

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

3 General

The Interconnection Customer (IC) has proposed an uprate to a planned Solar/Storage generating facility located in Logan, Ohio. This project is an increase to the Interconnection Customer's AF2-137/AG1-003 project, which will share the same point of interconnection. The AG1-004 queue position is a 200 MW uprate (200 MW Capacity uprate) to the previous project. The total installed facilities will have a capability of 1100 MW with 636 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this uprate project is December 31, 2023. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-004
Project Name	MARYSVILLE-SORENSON 765 KV
State	Ohio
County	Logan
Transmission Owner	AEP
MFO	1100
MWE	200
MWC	200
Fuel	Storage
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

AG1-004 will interconnect with the AEP transmission system as an uprate to AF2-137/AG1-003 tapping the Marysville to Sorenson 765kV line.

Note: It is assumed that the existing 765 kV revenue metering system, generation lead and Protection & Control Equipment that will be installed for AF2-137 will be adequate for the increased generation of AG1-004. Depending on the timing of the completion of the AF2-137 interconnection construction relative to the AG1-004 completion, there may (or many not) be a need to review and revise the relay settings for the increased generation of AG1-004.

5 Cost Summary

The AG1-004 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$45,000
Total System Network Upgrade Costs	$3,000,000
Total Costs	$3,045,000

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.

The estimates provided in this report are preliminary in nature, as they were determined without the benefit of detailed engineering studies. Final estimates will require an on-site review and coordination to determine final construction requirements. In addition, Stability analysis will be completed during the Facilities Study stage. It is possible that a need for additional upgrades could be identified by these studies.

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
Total Attachment Facility Costs	**$0**

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
Total Direct Connection Facility Costs	**$0**

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
Review line protection and control settings at the proposed 765 kV switching station	$45,000
Total Non-Direct Connection Facility Costs	**$45,000**

7 Schedule

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

8 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 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

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 AG1-004 was evaluated as a 200.0 MW (Capacity 200.0 MW) injection tapping the Marysville to Sorenson 765kV line in the AEP area. Project AG1-004 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-004 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
168060135	242928	05MARYSV	765.0	AEP	242939	05MARYSV	345.0	AEP	2	AEP_P1-3_#7222_05MALIS 765_1	single	1868.0	106.44	109.2	DC	52.95
168060136	242928	05MARYSV	765.0	AEP	242939	05MARYSV	345.0	AEP	2	AEP_P1-2_#711_6224	single	1868.0	105.17	107.96	DC	53.3
167018313	958430	AF2-137 TAP	765.0	AEP	242928	05MARYSV	765.0	AEP	1	AEP_P4_#6189_05HANG	breaker	4142.0	105.74	107.25	DC	139.69
167018314	958430	AF2-137 TAP	765.0	AEP	242928	05MARYSV	765.0	AEP	1	AEP_P4_#1760_05JEFRSO	breaker	4142.0	104.38	105.71	DC	140.9

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
168060133	242928	05MARYSV	765.0	AEP	242939	05MARYSV	345.0	AEP	2	AEP_P1-3_#7222_05MALIS 765_1	operation	1868.0	109.7	112.54	DC	52.95
169825412	958430	AF2-137 TAP	765.0	AEP	242928	05MARYSV	765.0	AEP	1	AEP_P1-2_#709_546	operation	4142.0	104.5	106.01	DC	139.79

9.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
168060135,168060136	1	05MARYSV 765.0 kV - 05MARYSV 345.0 kV Ckt 2	AEP AEPO0045a (602) : Replace two 345kV Marysville CBs Project Type : FAC Cost : $1,000,000 Time Estimate : 18-24 Months	$1,000,000
167018314,167018313	2	AF2-137 TAP 765.0 kV - 05MARYSV 765.0 kV Ckt 1	AEP AEPO0047a (605) : Replace one Marysville 765kV CB Project Type : FAC Cost : $2,000,000 Time Estimate : 12-18 Months	$2,000,000
			TOTAL COST	$3,000,000

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
168060135	242928	05MARYSV	AEP	242939	05MARYSV	AEP	2	AEP_P1-3_#7222_05MALIS 765_1	single	1868.0	106.44	109.2	DC	52.95

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
240624	02GALON M2	-3.2947	Adder	-3.88
243186	05GVG1	13.6382	80/20	13.6382
243187	05GVG2	14.6309	80/20	14.6309
243441	05CKG2	11.9013	80/20	11.9013
247216	05FLATG1	2.5291	80/20	2.5291
247217	05FLATG2	2.5306	80/20	2.5306
247218	05FLATG3	2.5291	80/20	2.5291
247219	05FLATG4	2.5291	80/20	2.5291
247220	05FLATG5	2.5336	80/20	2.5336
253325	AC1-069 C	-2.6415	Adder	-3.11
253333	AC1-068 C	-2.6415	Adder	-3.11
253338	AC1-165 C	-2.6104	Adder	-3.07
253343	AC1-166 C	-2.6104	Adder	-3.07
270100	X2-052 CT1	2.0161	80/20	2.0161
270101	X2-052 CT2	2.0161	80/20	2.0161
270102	X2-052 ST	2.1812	80/20	2.1812
274660	LASCO STA;1U	9.7979	80/20	9.7979
274661	LASCO STA;2U	9.8404	80/20	9.8404
274770	LINCOLN ;1U	0.6897	80/20	0.6897
274771	LINCOLN ;2U	0.6897	80/20	0.6897
274772	LINCOLN ;3U	0.6897	80/20	0.6897
274773	LINCOLN ;4U	0.6897	80/20	0.6897
274774	LINCOLN ;5U	0.6897	80/20	0.6897
274775	LINCOLN ;6U	0.6897	80/20	0.6897
274776	LINCOLN ;7U	0.6897	80/20	0.6897
274777	LINCOLN ;8U	0.6897	80/20	0.6897
933281	AC2-140 C	0.3940	80/20	0.3940
938161	AE1-021	0.7307	80/20	0.7307
938321	AE1-050	1.1957	80/20	1.1957
945351	AF1-200 FTIR	113.4106	80/20	113.4106
958431	AF2-137 C	55.5933	80/20	55.5933
960681	AF2-359 C	4.1115	80/20	4.1115
961041	AF2-395	8.6007	80/20	8.6007
961631	AG1-003 C	59.8290	80/20	59.8290
961641	AG1-004	52.9460	80/20	52.9460
962761	AG1-125 C O1	59.8361	80/20	59.8361
962771	AG1-126 C	59.8361	80/20	59.8361
963851	AG1-238 C	5.4675	80/20	5.4675
965681	AG1-436 C	4.1115	80/20	4.1115
965801	AG1-448	3.0151	80/20	3.0151
WEC	WEC	1.6304	Confirmed LTF	1.6304

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
LGEE	LGEE	0.5472	Confirmed LTF	0.5472
CPLE	CPLE	1.0053	Confirmed LTF	1.0053
CBM-W2	CBM-W2	25.9123	Confirmed LTF	25.9123
NY	NY	0.8970	Confirmed LTF	0.8970
TVA	TVA	3.4118	Confirmed LTF	3.4118
SIGE	SIGE	0.3594	Confirmed LTF	0.3594
CBM-S2	CBM-S2	18.8129	Confirmed LTF	18.8129
CBM-S1	CBM-S1	0.8181	Confirmed LTF	0.8181
MEC	MEC	6.9360	Confirmed LTF	6.9360
LAGN	LAGN	4.8650	Confirmed LTF	4.8650
CBM-W1	CBM-W1	39.4803	Confirmed LTF	39.4803

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
167018313	958430	AF2-137 TAP	AEP	242928	05MARYSV	AEP	1	AEP_P4_#6189_05HANG	breaker	4142.0	105.74	107.25	DC	139.69

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
243440	05CKG1	39.7902	50/50	39.7902
243441	05CKG2	49.5470	50/50	49.5470
244415	05OLIV SLR C	0.6183	50/50	0.6183
246397	05ELKHART HY	0.1005	50/50	0.1005
246416	05TWIN BRCH1	0.1520	50/50	0.1520
246422	05MAYFLWER	0.2247	50/50	0.2247
246431	05BUCHANAN	0.1083	50/50	0.1083
247620	Y3-023	0.1725	50/50	0.1725
247643	Z2-116 C	0.0508	50/50	0.0508
247966	05WTRV SLR E	0.4670	Adder	0.55
247967	05OLIV SLR E	0.6183	50/50	0.6183
247969	Z2-116 E	0.3219	50/50	0.3219
270100	X2-052 CT1	9.1481	50/50	9.1481
270101	X2-052 CT2	9.1481	50/50	9.1481
270102	X2-052 ST	9.8972	50/50	9.8972
270142	AA2-116_CT1	14.7259	50/50	14.7259
270143	AA2-116_CT2	14.7259	50/50	14.7259
270144	AA2-116_ST	13.0418	50/50	13.0418
274774	LINCOLN ;5U	2.9492	50/50	2.9492
274775	LINCOLN ;6U	2.9492	50/50	2.9492
274776	LINCOLN ;7U	2.9492	50/50	2.9492
274777	LINCOLN ;8U	2.9492	50/50	2.9492
274788	**SE CHICAG;5U (Deactivation : 01/06/2020)**	**7.7235**	**Adder**	**9.09**
274789	**SE CHICAG;6U (Deactivation : 01/06/2020)**	**7.7439**	**Adder**	**9.11**
274790	**SE CHICAG;7U (Deactivation : 01/06/2020)**	**7.8458**	**Adder**	**9.23**
274791	**SE CHICAG;8U (Deactivation : 01/06/2020)**	**7.8458**	**Adder**	**9.23**
274792	**SE CHICAG;9U (Deactivation : 01/06/2020)**	**7.8494**	**Adder**	**9.23**
274793	**SE CHICAG;0U (Deactivation : 01/06/2020)**	**7.8494**	**Adder**	**9.23**
274794	**SE CHICAG;1U (Deactivation : 01/06/2020)**	**7.8494**	**Adder**	**9.23**

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
274795	SE CHICAG;2U (Deactivation : 01/06/2020)	7.8494	Adder	9.23
275149	KELLYCK ;1E	28.1733	Adder	33.15
276169	Z1-107 E	3.9838	Adder	4.69
293799	PILOT HIL;1E	28.1733	Adder	33.15
294392	P-010 E	15.1842	Adder	17.86
910542	X3-005 E	1.1367	Adder	1.34
927451	AC1-142A 1	6.3847	Adder	7.51
927461	AC1-142A 2	6.3847	Adder	7.51
930501	AB1-091 CT	61.7243	Adder	72.62
930502	AB1-091 ST	49.0732	Adder	57.73
933281	AC2-140 C	1.6403	50/50	1.6403
933282	AC2-140 E	0.5471	50/50	0.5471
933411	AC2-154 C	3.8235	Adder	4.5
933412	AC2-154 E	6.2384	Adder	7.34
934721	AD1-100 C	30.0530	Adder	35.36
934722	AD1-100 E	140.2474	Adder	165.0
936141	AD2-020 C O1	12.7607	Adder	15.01
936142	AD2-020 E O1	7.8543	Adder	9.24
936371	AD2-047 C O1	6.8421	Adder	8.05
936372	AD2-047 E O1	33.4054	Adder	39.3
936461	AD2-060	4.0248	Adder	4.74
936631	AD2-079 C O1	2.9633	50/50	2.9633
936632	AD2-079 E O1	1.9755	50/50	1.9755
939351	AE1-166 C O1	8.2977	Adder	18.42
939352	AE1-166 E O1	7.6594	Adder	17.0
939395	AE1-170 C	15.4659	50/50	15.4659
939396	AE1-170 E	21.3576	50/50	21.3576
939631	AE1-193 C	13.2125	Adder	15.54
939632	AE1-193 E	88.4220	Adder	104.03
939641	AE1-194 C	13.2125	Adder	15.54
939642	AE1-194 E	88.4220	Adder	104.03
939651	AE1-195 C	13.2125	Adder	15.54
939652	AE1-195 E	88.4220	Adder	104.03
939681	AE1-198 C	39.2309	Adder	46.15
939682	AE1-198 E	33.3361	Adder	39.22
940752	AE2-062 E	0.1057	Adder	0.23
941551	AE2-152 C O1	9.5743	Adder	21.25
941552	AE2-152 E O1	6.3829	Adder	14.17
941561	AE2-153 C O1	7.0839	Adder	8.33
941562	AE2-153 E O1	33.1653	Adder	39.02
942241	AE2-236 C O1	9.6970	50/50	9.6970
942242	AE2-236 E O1	4.1559	50/50	4.1559
943001	AE2-323 C	13.7169	Adder	16.14
943002	AE2-323 E	6.7256	Adder	7.91
943021	AE2-325 C	6.4566	Adder	7.6
943022	AE2-325 E	4.3044	Adder	5.06
943781	AF1-046 C	6.4026	Adder	7.53
943782	AF1-046 E	4.2684	Adder	5.02
944161	AF1-084 C	11.0907	Adder	13.05
944162	AF1-084 E	6.3346	Adder	7.45
944241	AF1-092 C O1	28.3015	50/50	28.3015

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
944242	AF1-092 E O1	8.6135	50/50	8.6135
944531	AF1-118 C O1	53.7333	Adder	63.22
944532	AF1-118 E O1	16.2059	Adder	19.07
944911	AF1-156 C	18.1121	Adder	21.31
944912	AF1-156 E	12.0748	Adder	14.21
944931	AF1-158 C O1	22.2777	50/50	22.2777
944932	AF1-158 E O1	14.8518	50/50	14.8518
944961	AF1-161 C	5.1538	Adder	6.06
944962	AF1-161 E	5.1538	Adder	6.06
945111	AF1-176 C O1	37.8468	50/50	37.8468
945112	AF1-176 E O1	35.0832	50/50	35.0832
945351	AF1-200 FTIR	485.1033	Merchant Transmission	485.1033
945501	AF1-215 C O1	36.0300	Adder	42.39
945502	AF1-215 E O1	24.0200	Adder	28.26
957371	AF2-031 C O1	1.6296	Adder	1.92
957372	AF2-031 E O1	2.4444	Adder	2.88
957891	AF2-083 C O1	24.4550	50/50	24.4550
957892	AF2-083 E O1	12.2275	50/50	12.2275
958001	AF2-094 C	6.4970	50/50	6.4970
958002	AF2-094 E	3.3470	50/50	3.3470
958011	AF2-095 C O1	27.3683	Adder	32.2
958012	AF2-095 E O1	12.8792	Adder	15.15
958021	AF2-096 C	51.3004	Adder	60.35
958022	AF2-096 E	24.1414	Adder	28.4
958401	AF2-134 C O1	12.0100	Adder	14.13
958402	AF2-134 E O1	8.0067	Adder	9.42
958431	AF2-137 C	146.6766	50/50	146.6766
958432	AF2-137 E	202.5534	50/50	202.5534
959001	AF2-191 C O1	16.3000	50/50	16.3000
959002	AF2-191 E O1	10.8667	50/50	10.8667
960591	AF2-350 C O1	12.0743	Adder	14.21
960592	AF2-350 E O1	8.0495	Adder	9.47
960601	AF2-351 C O1	1.6099	Adder	1.89
960602	AF2-351 E O1	2.4149	Adder	2.84
960681	AF2-359 C	18.6203	50/50	18.6203
960682	AF2-359 E	12.4135	50/50	12.4135
960981	AF2-389 C	7.3392	50/50	7.3392
960982	AF2-389 E	4.8928	50/50	4.8928
961051	AF2-396 O1	41.2607	Adder	48.54
961501	AF2-441 C O1	16.2513	Adder	19.12
961502	AF2-441 E O1	24.3770	Adder	28.68
961631	AG1-003 C	157.8520	50/50	157.8520
961632	AG1-003 E	121.5320	50/50	121.5320
961641	AG1-004	139.6920	50/50	139.6920
962601	AG1-109	2.7315	Adder	6.06
963701	AG1-222 C	8.9818	Adder	19.94
963702	AG1-222 E	7.2700	Adder	16.14
963851	AG1-238 C	23.7357	50/50	23.7357
963852	AG1-238 E	15.8238	50/50	15.8238
964361	AG1-298 O1	53.7829	Adder	119.38
965501	AG1-418 C O1	7.5726	50/50	7.5726
965502	AG1-418 E O1	5.0484	50/50	5.0484

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
965681	AG1-436 C	18.6203	50/50	18.6203
965682	AG1-436 E	12.4135	50/50	12.4135
965791	AG1-447	13.6549	50/50	13.6549
965801	AG1-448	13.6549	50/50	13.6549
965841	AG1-453 C O1	9.0484	Adder	20.09
965842	AG1-453 E O1	6.0323	Adder	13.39
965851	AG1-454 O1	5.3860	Adder	11.96
966431	AG1-512 C	1.7164	Adder	3.81
966432	AG1-512 E	2.5747	Adder	5.72
966651	AG1-535 O1	9.1783	Adder	20.37
WEC	WEC	7.0128	Confirmed LTF	7.0128
LGEE	LGEE	6.0782	Confirmed LTF	6.0782
CBM-W2	CBM-W2	102.3949	Confirmed LTF	102.3949
NY	NY	3.3904	Confirmed LTF	3.3904
TVA	TVA	8.9768	Confirmed LTF	8.9768
O-066	O-066	41.7260	Confirmed LTF	41.7260
SIGE	SIGE	1.9802	Confirmed LTF	1.9802
CBM-S1	CBM-S1	2.6619	Confirmed LTF	2.6619
G-007	G-007	6.5090	Confirmed LTF	6.5090
HAMLET	HAMLET	1.1446	Confirmed LTF	1.1446
MEC	MEC	29.2011	Confirmed LTF	29.2011
LAGN	LAGN	14.9397	Confirmed LTF	14.9397
CATAWBA	CATAWBA	0.4785	Confirmed LTF	0.4785
CBM-W1	CBM-W1	249.8785	Confirmed LTF	249.8785

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
AA2-116	Cook-East Elkhart 345kV	Under Construction
AB1-091	Davis Creek 345kV	Active
AC1-068	Atlanta 69kV I	Engineering and Procurement
AC1-069	Atlanta 69kV II	Engineering and Procurement
AC1-142A	Joliet	In Service
AC1-165	Atlanta 69kV III	Engineering and Procurement
AC1-166	Atlanta 69kV IV	Engineering and Procurement
AC2-140	DC Cook Unit 2	In Service
AC2-154	Davis Creek 138kV	Active
AD1-100	Loretto-Wilton & Braidwood-Davis Creek	Active
AD2-020	Valley 138 kV	Active
AD2-047	Davis Creek 138 kV	Active
AD2-060	Davis Creek 138kV	Active
AD2-079	Capitol Ave 34.5kV	Active
AE1-021	Gavin #2 765 kV	Engineering and Procurement
AE1-050	Gavin Unit 1 765 kV	Engineering and Procurement
AE1-166	Loretto-Wilton & Braidwood-Davis Creek	Active
AE1-170	Kenzie Creek-Colby 138 kV	Active
AE1-193	Crete 345 kV	Active
AE1-194	Crete 345 kV	Active
AE1-195	Crete 345 kV	Active
AE1-198	Crete 345 kV	Active
AE2-062	Romeoville 12 kV	Engineering and Procurement
AE2-152	Loretto-Wilton & Braidwood-Davis Creek	Active
AE2-153	Braidwood-Davis Creek	Active
AE2-236	Columbia-Northeast 138 kV	Active
AE2-323	Twin Branch-Guardian 138 kV	Active
AE2-325	Valley 138 kV	Active
AF1-046	Twin Branch-Guardian 138 kV	Active
AF1-084	East Hartford-Murch 69 kV	Active
AF1-092	Huntington Jct. 138 kV	Active
AF1-118	Sorenson-Desoto 345 kV	Active
AF1-156	Braidwood-Davis Creek	Active
AF1-158	Edison-Gravel Pit 138 kV	Active
AF1-161	Valley 138 kV	Active
AF1-176	Corey 138 kV	Active
AF1-200	Plano 345 kV	Active
AF1-215	Reynolds-Olive 345 kV	Active
AF2-031	River E.C.	Active

Queue Number	Project Name	Status
AF2-083	Ed Lowe-Kenzie Creek 138 kV	Active
AF2-094	Huntington Jct. 138 kV	Active
AF2-095	Wilmington-Davis Creek	Active
AF2-096	Braidwood-East Frankfort 345 kV	Active
AF2-134	Reynolds-Olive #2 345 kV	Active
AF2-137	Marysville-Sorenson 765 kV	Active
AF2-191	New Carlisle 138 kV	Active
AF2-350	Kensington 138 kV	Active
AF2-351	Kensington 138 kV	Active
AF2-359	Olive-University Park 345 kV	Active
AF2-389	Pokagon-Corey 69 kV	Active
AF2-395	Flatlick 765 kV	Active
AF2-396	Stinger 138 kV	Active
AF2-441	Burnham 138kV	Active
AG1-003	Marysville-Sorenson 765 kV	Active
AG1-004	Marysville-Sorenson 765 kV	Active
AG1-109	Valley 138 kV	Active
AG1-125	Marysville-Flatlick 765 kV	Active
AG1-126	Marysville-Flatlick 765 kV	Active
AG1-222	Guardian-Twin Branch 138 kV	Active
AG1-238	Dumont 345 kV	Active
AG1-298	Calumet-Burnham 345 kV	Active
AG1-418	Columbia City 138 kV	Active
AG1-436	Olive-University Park 345 kV	Active
AG1-447	Olive-University Park 345 kV	Active
AG1-448	Olive-University Park 345 kV	Active
AG1-453	Guardian 138 kV	Active
AG1-454	Guardian 138 kV	Active
AG1-512	University Park North 345 kV	Active
AG1-535	Franklin Park 138 kV	Active
X2-052	Dumont-Olive 345kV	In Service
X3-005	Wildwood 12kV	In Service
Y3-023	Country Side 12kV	In Service
Z1-107	Joliet 34kV	In Service
Z2-116	Twin Branch 12.47kV	In Service

9.8 Contingency Descriptions

Contingency Name	Contingency Definition
AEP_P1-2_#709_546	CONTINGENCY 'AEP_P1-2_#709_546' OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1 / 242924 05HANG R 765 243208 05JEFRSO 765 1 END
AEP_P1-3_#7222_05MALIS 765_1	CONTINGENCY 'AEP_P1-3_#7222_05MALIS 765_1' OPEN BRANCH FROM BUS 242926 TO BUS 242928 CKT 1 / 242926 05MALIS 765 242928 05MARYSV 765 1 OPEN BRANCH FROM BUS 242926 TO BUS 246751 CKT 1 / 242926 05MALIS 765 246751 05VASSEL 765 1 OPEN BRANCH FROM BUS 242926 TO BUS 243538 CKT 1 / 242926 05MALIS 765 243538 05MALISX 138 1 OPEN BRANCH FROM BUS 243537 TO BUS 243538 CKT SR / 243537 05MALIS 138 243538 05MALISX 138 SR OPEN BRANCH FROM BUS 243537 TO BUS 243538 CKT ZB / 243537 05MALIS 138 243538 05MALISX 138 ZB END
AEP_P4_#6189_05HANG	CONTINGENCY '"AEP_P4_#6189_05HANG' R 765_D1" / 1717 OPEN BRANCH FROM BUS 242921 TO BUS 242924 CKT 1 / 242921 05CORNU 765 242924 05HANG R 765 1 OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1 / 242924 05HANG R 765 243208 05JEFRSO 765 1 OPEN BRANCH FROM BUS 242921 TO BUS 242934 CKT 1 / 242921 05CORNU 765 242934 05CORNU 345 1 REMOVE MACHINE 1A FROM BUS 247245 /* 247245 05HRKG1A 18.0 DEFAULT DISPATCH REMOVE MACHINE 1B FROM BUS 247246 /* 247246 05HRKG1B 18.0 DEFAULT DISPATCH REMOVE MACHINE 1S FROM BUS 247247 /* 247247 05HRKG1S 18.0 DEFAULT DISPATCH REMOVE MACHINE 2A FROM BUS 247248 /* 247248 05HRKG2A 18.0 DEFAULT DISPATCH REMOVE MACHINE 2B FROM BUS 247249 /* 247249 05HRKG2B 18.0 DEFAULT DISPATCH REMOVE MACHINE 2S FROM BUS 247250 /* 247250 05HRKG2S 18.0 DEFAULT DISPATCH END
AEP_P4_#1760_05JEFRSO	CONTINGENCY '"AEP_P4_#1760_05JEFRSO' 765_A" / 1455 OPEN BRANCH FROM BUS 243207 TO BUS 243208 CKT 1 / 243207 05GRNTWN 765 243208 05JEFRSO 765 1 OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1 / 242924 05HANG R 765 243208 05JEFRSO 765 1 END

Contingency Name	Contingency Definition
AEP_P1-2_#711_6224	CONTINGENCY 'AEP_P1-2_#711_6224' OPEN BRANCH FROM BUS 242926 TO BUS 242928 CKT 1 / 242926 05MALIS 765 242928 05MARYSV 765 1 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).