Generation Interconnection

System Impact Study Report

for

Queue Project AF2-173

DESOTO 345 KV

84 MW Capacity / 200 MW Energy

February 2021

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1 Introduction

This System Impact Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 205, as well as the System Impact 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 System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

In some instances an Interconnection Customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, may also contribute to the need for the same network reinforcement. 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 System Impact Study is performed.

The System Impact 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.

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

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

3 General

The Interconnection Customer (IC), has proposed a Solar generating facility located in Delaware County, Indiana. The installed facilities will have a total capability of 200 MW with 84 MW of this output being recognized by PJM as Capacity.

The proposed in-service date for this project is October 31, 2023. This study does not imply a TO commitment to this in-service date.

Queue Number	AF2-173
Project Name	DESOTO 345 KV
State	Indiana
County	Delaware
Transmission Owner	AEP
MFO	200
MWE	200
MWC	84
Fuel	Solar
Basecase Study Year	2023

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

AF2-173 will interconnect with the AEP transmission system via a direct connection to the Desoto 345 kV station as an uprate to the PJM projects AE1-209/AE1-210.

Note: It is assumed that the existing 345 kV revenue metering system, generation lead and Protection & Control Equipment that will be installed for AE2-209/AE2-210 will be adequate for the increased generation of AF2-173.Depending on the timing of the completion of the AE2-209/AE2-210 interconnection construction relative to the AF2-173 completion, there may (or may not) be a need to review and revise the relay settings for the increased generation of AF2-173.

5 Cost Summary

The AF2-173 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$45,000
Allocation towards System Network Upgrade Costs*	$9,000,000
Total Costs	**$9,045,000**

*As your project progresses through the study process and other projects modify their request or withdraw, then your cost allocation could change.

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.

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.

Note 1: PJM Open Access Transmission Tariff (OATT) section 217.3A outline cost allocation rules. The rules are further clarified in PJM Manual 14A Attachment B. The allocation of costs for a network upgrade will start with the first Queue project to cause the need for the upgrade. Later queue projects will receive cost allocation contingent on their contribution to the violation and are allocated to the queues that have not closed less than 5 years following the execution of the first Interconnection Service Agreement which identifies the need for this upgrade.

Note 2: For customers with System Reinforcements listed: If your present cost allocation to a System Reinforcement indicates $0, then please be aware that as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, the cost responsibilities can change and a cost allocation may be assigned to your project. In addition, although your present cost allocation to a System Reinforcement is presently $0, your project may need this system reinforcement completed to be deliverable to the PJM system. If your project comes into service prior to completion of the system reinforcement, an interim deliverability study for your project will be required.

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
None	$0
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
None	$0
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 Desoto 345 kV 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 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 Section 8 of Attachment O.

9.2 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)

9.3 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/

10 Summer Peak Analysis

The Queue Project AF2-173 was evaluated as a 200.0 MW (Capacity 84.0 MW) injection at the Desoto 345 kV substation in the AEP area. Project AF2-173 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-173 was studied with a commercial probability of 100.0 %. Potential network impacts were as follows:

10.1 Generation Deliverability

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

None

10.2 Multiple Facility Contingency

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

None

10.3 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
95750184	243278	05DESOTO	138.0	AEP	946030	AF1-268 TAP	138.0	AEP	1	AEP_P7-1_#11019	tower	393.0	113.69	117.05	AC	15.51
156903256	243278	05DESOTO	138.0	AEP	946030	AF1-268 TAP	138.0	AEP	1	AEP_P7-1_#11087-C-A	tower	393.0	109.26	112.62	AC	15.54
98746524	248001	06DEARB1	345.0	OVEC	248013	06PIERCE	345.0	OVEC	1	DEOK_P7-1_C5 4504MFTANNERS4512EBTANNERS	tower	972.0	123.56	126.18	AC	24.81
95750143	946030	AF1-268 TAP	138.0	AEP	243319	05JAY	138.0	AEP	1	AEP_P7-1_#11019	tower	393.0	118.21	121.56	AC	15.51
156903145	946030	AF1-268 TAP	138.0	AEP	243319	05JAY	138.0	AEP	1	AEP_P7-1_#11087-C-A	tower	393.0	113.76	117.12	AC	15.54

10.4 Steady-State Voltage Requirements

To be determined.

10.5 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
95323192	243218	05DESOTO	345.0	AEP	945370	AF1-202 TAP	345.0	AEP	1	AEP_P1-2_#8702-C	operation	897.0	105.37	110.67	AC	48.51
95323200	243218	05DESOTO	345.0	AEP	958860	AF2-177 TAP	345.0	AEP	2	AEP_P1-2_#4817	operation	971.0	113.06	118.02	AC	48.85
95323204	243225	05KEYSTN	345.0	AEP	243232	05SORENS	345.0	AEP	1	AEP_P1-2_#8702-C	operation	1301.0	106.47	110.16	AC	48.26
95323205	243225	05KEYSTN	345.0	AEP	243232	05SORENS	345.0	AEP	1	Base Case	operation	897.0	109.36	113.28	AC	35.34
95323078	944530	AF1-118 TAP	345.0	AEP	243232	05SORENS	345.0	AEP	2	AEP_P1-2_#4817	operation	971.0	143.77	148.75	AC	48.85
95323083	944530	AF1-118 TAP	345.0	AEP	243232	05SORENS	345.0	AEP	2	Base Case	operation	971.0	104.03	107.73	AC	36.04
144143599	944540	AF1-119 TAP	345.0	AEP	960970	AF2-388 TAP	345.0	AEP	1	AEP_P1-2_#8702-C	operation	897.0	132.34	137.67	AC	48.51
95323120	944830	AF1-148 TAP	345.0	AEP	944530	AF1-118 TAP	345.0	AEP	2	AEP_P1-2_#4817	operation	971.0	122.16	127.13	AC	48.85
95323138	945370	AF1-202 TAP	345.0	AEP	944540	AF1-119 TAP	345.0	AEP	1	AEP_P1-2_#8702-C	operation	897.0	120.53	125.87	AC	48.51
156562141	958860	AF2-177 TAP	345.0	AEP	944830	AF1-148 TAP	345.0	AEP	2	AEP_P1-2_#4817	operation	971.0	113.06	118.02	AC	48.85
144143592	960970	AF2-388 TAP	345.0	AEP	243225	05KEYSTN	345.0	AEP	1	AEP_P1-2_#8702-C	operation	897.0	132.34	137.68	AC	48.51

10.6 System Reinforcements

ID	Idx	Facility	Upgrade Description	Cost	Cost Allocated to AF2-173	Upgrade Number
156903256,95750184	5,6	**05DESOTO 138.0 kV - AF1-268 TAP 138.0 kV Ckt 1 & AF1-268 TAP 138.0 kV - 05JAY 138.0 kV Ckt 1**	Replace 2 risers at Jay 138 kV substation. This work is covered under PJM 2022 baseline upgrade B3103.5. There is also work on this line covered under PJM supplemental project S2015.3. Work presently expected to be complete by summer 2022. New expected ratings 383/409 MVA SN/SE. A Sag Study will be required on the (Desoto-Jay) 12.53 miles of ACSR ~ 556.5 ~ 26/7 ~ DOVE - Conductor section 1 to mitigate the overload. The new ratings after sag study will be: S/N: 409 MVA, S/E: 620 MVA, Depending on the sag study results, the cost for this upgrade is expected to be between $50,120(no remediation required, just sag study) and $18.8 million (complete line Reconductor/rebuild). 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. PJM Network Upgrade N6279.2. This upgrade is required in a prior queue cycle.	$50.12 K	$0	B3103.5 S2015.3 N6279.2
98745941,98745942,98746524	3	**06DEARB1 345.0 kV - 06PIERCE 345.0 kV Ckt 1**	Perform a sag study. Cost estmate: $125 K Time estmate is 6-12 months. New expected SE rating to be 1204 MVA. PJM Network Upgrade N6759.1 This upgrade is required in a prior queue cycle. Replace 2, 1600 A switches at Dearborn and 4 switches at Pierce. Cost $9.0M. Time estmate is 12-18 months. New SE rating to be 1319 MVA. PJM Network Upgrade N6759.2 AF2-173 is responsible for this upgrade.	$125 K $9 M	$0 $9 M	N6759.1 N6759.2
			Total Cost	**$9,175,120**	**$9,000,000**	

Note : For customers with System Reinforcements listed: If your present cost allocation to a System Reinforcement indicates $0, then please be aware that as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, the cost responsibilities can change and a cost allocation may be assigned to your project. In addition, although your present cost allocation to a System Reinforcement is presently $0, your project may need this system reinforcement

completed to be deliverable to the PJM system. If your project comes into service prior to completion of the system reinforcement, an interim deliverability study for your project will be required.

10.7 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".

10.7.1 Index 1

None.

10.7.2 Index 2

None.

10.7.3 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
9874652 4	248001	06DEARB 1	OVEC	248013	06PIERCE	OVEC	1	DEOK_P7-1_C5 4504MFTANNERS4512EBTANNERS	tower	972.0	123.56	126.18	AC	24.81

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
243795	05HDWTR1G C	0.6797	50/50	0.6797
247264	05LAWG1A	8.3663	50/50	8.3663
247265	05LAWG1B	8.3663	50/50	8.3663
247266	05LAWG1S	13.3597	50/50	13.3597
247267	05LAWG2A	8.3663	50/50	8.3663
247268	05LAWG2B	8.3663	50/50	8.3663
247269	05LAWG2S	13.3597	50/50	13.3597
247543	V3-007 C	0.6797	50/50	0.6797
247929	S-071 E	7.3799	Adder	8.68
247935	V3-007 E	27.0709	50/50	27.0709
247958	05WLD G2 E	14.0446	Adder	16.52
247963	05HDWTR1G E	27.0709	50/50	27.0709
247968	Z2-115 E	0.0799	Adder	0.09
250163	Y3-099 BAT	0.1987	Merchant Transmission	0.1987
250167	Y3-100 BAT	0.1987	Merchant Transmission	0.1987
251823	Z1-065 BAT	0.3758	Merchant Transmission	0.3758
913222	Y1-054 E	-1.2657	Adder	-1.49
920501	AA2-148 C OP	3.5479	50/50	3.5479
920502	AA2-148 E OP	23.7434	50/50	23.7434
923881	AB2-028 C	2.9149	50/50	2.9149
923882	AB2-028 E	19.5071	50/50	19.5071
926691	AC1-152	2.6392	50/50	2.6392
926851	AC1-172	2.6392	50/50	2.6392
926881	AC1-175 C	11.8241	50/50	11.8241
926882	AC1-175 E	19.2919	50/50	19.2919
932681	AC2-090 C	5.9120	50/50	5.9120
932682	AC2-090 E	9.6460	50/50	9.6460
932841	AC2-111 C O1	2.4321	Adder	2.86
932842	AC2-111 E O1	3.9681	Adder	4.67
933592	AC2-176 E O1	8.6570	Adder	10.18
933601	AC2-177 C O1	4.0451	50/50	4.0451
933602	AC2-177 E O1	27.0709	50/50	27.0709
934161	AD1-043 C O1	3.8217	Adder	4.5
934162	AD1-043 E O1	6.2355	Adder	7.34
934961	AD1-128 C	6.1110	50/50	6.1110
934962	AD1-128 E	9.9705	50/50	9.9705
936561	AD2-071 C	5.0799	Adder	5.98
936562	AD2-071 E	2.5021	Adder	2.94
939761	AE1-207 C	5.0466	Adder	5.94
939762	AE1-207 E	6.9690	Adder	8.2
939771	AE1-208 C	4.5268	Adder	5.33

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
939772	AE1-208 E	6.1729	Adder	7.26
939781	AE1-209 C O1	1.6124	50/50	1.6124
939782	AE1-209 E O1	10.7906	50/50	10.7906
939791	AE1-210 C O1	1.6124	50/50	1.6124
939792	AE1-210 E O1	10.7906	50/50	10.7906
940981	AE2-089 C O1	6.1888	Adder	7.28
940982	AE2-089 E O1	4.1259	Adder	4.85
941691	AE2-169	2.7161	Adder	3.2
941711	AE2-171	2.5143	Adder	2.96
941721	AE2-172	3.0039	Adder	3.53
942071	AE2-219 C	3.2680	Adder	3.84
942072	AE2-219 E	4.5129	Adder	5.31
942081	AE2-220 C	8.1679	50/50	8.1679
942082	AE2-220 E	11.2795	50/50	11.2795
942221	AE2-234 C O1	1.5386	Adder	1.81
942222	AE2-234 E O1	0.6959	Adder	0.82
942791	AE2-297 C O1	13.9419	50/50	13.9419
942792	AE2-297 E O1	9.2946	50/50	9.2946
943772	AF1-045 BAT	3.2990	Merchant Transmission	3.2990
944031	AF1-071 C	0.6080	Adder	0.72
944032	AF1-071 E	0.9920	Adder	1.17
944531	AF1-118 C O1	18.9732	Adder	22.32
944532	AF1-118 E O1	5.7223	Adder	6.73
944541	AF1-119 C O1	14.2632	50/50	14.2632
944542	AF1-119 E O1	6.1128	50/50	6.1128
944831	AF1-148 C O1	6.9818	Adder	8.21
944832	AF1-148 E O1	4.6546	Adder	5.48
945371	AF1-202 C O1	3.6009	50/50	3.6009
945372	AF1-202 E O1	17.5811	50/50	17.5811
945561	AF1-221 C O1	18.3491	50/50	18.3491
945562	AF1-221 E O1	5.5153	50/50	5.5153
945581	AF1-223 C O1	9.5319	50/50	9.5319
945582	AF1-223 E O1	6.3546	50/50	6.3546
946031	AF1-268 C O1	5.9801	50/50	5.9801
946032	AF1-268 E O1	2.7125	50/50	2.7125
956561	J1152	12.1380	PJM External (MISO)	12.1380
957741	AF2-068 C O1	6.8888	Adder	8.1
957742	AF2-068 E O1	4.5926	Adder	5.4
958711	AF2-162 C	3.0564	50/50	3.0564
958712	AF2-162 E	1.5282	50/50	1.5282
958821	AF2-173 C	10.4185	50/50	10.4185
958822	AF2-173 E	14.3875	50/50	14.3875
958861	AF2-177 C O1	2.6213	50/50	2.6213
958862	AF2-177 E O1	17.5427	50/50	17.5427
959131	AF2-204 C	4.6928	Adder	5.52
959132	AF2-204 E	2.4768	Adder	2.91
959201	AF2-211 C	4.8001	Adder	5.65
959202	AF2-211 E	3.2001	Adder	3.76
960441	AF2-335 C	6.4524	50/50	6.4524
960442	AF2-335 E	4.3016	50/50	4.3016
960791	AF2-370	2.1508	50/50	2.1508
960971	AF2-388 C	2.9265	Adder	3.44

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
960972	AF2-388 E	13.7012	Adder	16.12
961161	AF2-407	32.2410	50/50	32.2410
961171	AF2-408	8.6536	50/50	8.6536
LGEE	LGEE	0.9208	Confirmed LTF	0.9208
CBM-W2	CBM-W2	25.1269	Confirmed LTF	25.1269
NY	NY	0.4806	Confirmed LTF	0.4806
TVA	TVA	1.8648	Confirmed LTF	1.8648
WEC	WEC	1.1557	Confirmed LTF	1.1557
O-066	O-066	5.8666	Confirmed LTF	5.8666
CBM-S1	CBM-S1	11.7917	Confirmed LTF	11.7917
G-007	G-007	0.9079	Confirmed LTF	0.9079
MADISON	MADISON	20.2346	Confirmed LTF	20.2346
MEC	MEC	5.3311	Confirmed LTF	5.3311
CATAWBA	CATAWBA	0.0732	Confirmed LTF	0.0732
CBM-W1	CBM-W1	36.9670	Confirmed LTF	36.9670

10.7.4 Index 4

None.

10.7.5 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
95750184	243278	05DESOTO	AEP	946030	AF1-268 TAP	AEP	1	AEP_P7-1_#11019	tower	393.0	113.69	117.05	AC	15.51

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
247935	V3-007 E	10.0143	Adder	11.78
247963	05HDWTR1G E	10.0143	Adder	11.78
923881	AB2-028 C	1.2803	Adder	1.51
923882	AB2-028 E	8.5678	Adder	10.08
926881	AC1-175 C	4.3741	Adder	5.15
926882	AC1-175 E	7.1366	Adder	8.4
927181	AC1-212 C	-0.1224	Adder	-0.14
927183	AC1-212 BAT	1.5086	Merchant Transmission	1.5086
932681	AC2-090 C	2.1870	Adder	2.57
932682	AC2-090 E	3.5683	Adder	4.2
933601	AC2-177 C O1	1.4964	Adder	1.76
933602	AC2-177 E O1	10.0143	Adder	11.78
934961	AD1-128 C	3.3896	Adder	3.99
934962	AD1-128 E	5.5303	Adder	6.51
939761	AE1-207 C	3.0194	Adder	3.55
939762	AE1-207 E	4.1696	Adder	4.91
939771	AE1-208 C	2.4703	Adder	2.91
939772	AE1-208 E	3.3685	Adder	3.96
939781	AE1-209 C O1	0.8571	Adder	1.01
939782	AE1-209 E O1	5.7363	Adder	6.75
939791	AE1-210 C O1	0.8571	Adder	1.01
939792	AE1-210 E O1	5.7363	Adder	6.75
941691	AE2-169	1.4822	Adder	1.74
941721	AE2-172	1.7972	Adder	2.11
942081	AE2-220 C	3.0216	Adder	3.55
942082	AE2-220 E	4.1726	Adder	4.91
944531	AF1-118 C O1	17.7252	Adder	20.85
944532	AF1-118 E O1	5.3459	Adder	6.29
944541	AF1-119 C O1	9.2296	Adder	10.86
944542	AF1-119 E O1	3.9556	Adder	4.65
944831	AF1-148 C O1	6.2885	Adder	7.4
944832	AF1-148 E O1	4.1924	Adder	4.93
945371	AF1-202 C O1	2.2415	Adder	2.64
945372	AF1-202 E O1	10.9437	Adder	12.87
945581	AF1-223 C O1	5.9333	Adder	6.98
945582	AF1-223 E O1	3.9556	Adder	4.65
958711	AF2-162 C	1.9778	Adder	2.33
958712	AF2-162 E	0.9889	Adder	1.16
958821	AF2-173 C	5.5385	Adder	6.52
958822	AF2-173 E	7.6484	Adder	9.0
958861	AF2-177 C O1	1.7141	Adder	2.02

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
958862	AF2-177 E O1	11.4711	Adder	13.5
960441	AF2-335 C	4.3615	Adder	5.13
960442	AF2-335 E	2.9077	Adder	3.42
960791	AF2-370	1.4538	Adder	1.71
960971	AF2-388 C	2.3206	Adder	2.73
960972	AF2-388 E	10.8646	Adder	12.78
LGEE	LGEE	0.6572	Confirmed LTF	0.6572
CPLE	CPLE	0.1442	Confirmed LTF	0.1442
CBM-W2	CBM-W2	6.5602	Confirmed LTF	6.5602
NY	NY	0.0459	Confirmed LTF	0.0459
TVA	TVA	0.8148	Confirmed LTF	0.8148
WEC	WEC	0.0154	Confirmed LTF	0.0154
O-066	O-066	0.4838	Confirmed LTF	0.4838
CBM-S2	CBM-S2	1.6300	Confirmed LTF	1.6300
CBM-S1	CBM-S1	5.8618	Confirmed LTF	5.8618
G-007	G-007	0.0738	Confirmed LTF	0.0738
MEC	MEC	0.4942	Confirmed LTF	0.4942

10.7.6 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
95750143	946030	AF1-268 TAP	AEP	243319	05JAY	AEP	1	AEP_P7-1_#11019	tower	393.0	118.21	121.56	AC	15.51

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
247935	V3-007 E	10.0143	Adder	11.78
247963	05HDWTR1G E	10.0143	Adder	11.78
923881	AB2-028 C	1.2803	Adder	1.51
923882	AB2-028 E	8.5678	Adder	10.08
926881	AC1-175 C	4.3741	Adder	5.15
926882	AC1-175 E	7.1366	Adder	8.4
927181	AC1-212 C	-0.1224	Adder	-0.14
927183	AC1-212 BAT	1.5086	Merchant Transmission	1.5086
932681	AC2-090 C	2.1870	Adder	2.57
932682	AC2-090 E	3.5683	Adder	4.2
933601	AC2-177 C O1	1.4964	Adder	1.76
933602	AC2-177 E O1	10.0143	Adder	11.78
934961	AD1-128 C	3.3896	Adder	3.99
934962	AD1-128 E	5.5303	Adder	6.51
939761	AE1-207 C	3.0194	Adder	3.55
939762	AE1-207 E	4.1696	Adder	4.91
939771	AE1-208 C	2.4703	Adder	2.91
939772	AE1-208 E	3.3685	Adder	3.96
939781	AE1-209 C O1	0.8571	Adder	1.01
939782	AE1-209 E O1	5.7363	Adder	6.75
939791	AE1-210 C O1	0.8571	Adder	1.01
939792	AE1-210 E O1	5.7363	Adder	6.75
941691	AE2-169	1.4822	Adder	1.74
941721	AE2-172	1.7972	Adder	2.11
942081	AE2-220 C	3.0216	Adder	3.55
942082	AE2-220 E	4.1726	Adder	4.91
944531	AF1-118 C O1	17.7252	Adder	20.85
944532	AF1-118 E O1	5.3459	Adder	6.29
944541	AF1-119 C O1	9.2296	Adder	10.86
944542	AF1-119 E O1	3.9556	Adder	4.65
944831	AF1-148 C O1	6.2885	Adder	7.4
944832	AF1-148 E O1	4.1924	Adder	4.93
945371	AF1-202 C O1	2.2415	Adder	2.64
945372	AF1-202 E O1	10.9437	Adder	12.87
945581	AF1-223 C O1	5.9333	Adder	6.98
945582	AF1-223 E O1	3.9556	Adder	4.65
946031	AF1-268 C O1	12.9406	50/50	12.9406
946032	AF1-268 E O1	5.8697	50/50	5.8697
958711	AF2-162 C	1.9778	Adder	2.33
958712	AF2-162 E	0.9889	Adder	1.16
958821	AF2-173 C	5.5385	Adder	6.52
958822	AF2-173 E	7.6484	Adder	9.0

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
958861	AF2-177 C O1	1.7141	Adder	2.02
958862	AF2-177 E O1	11.4711	Adder	13.5
960441	AF2-335 C	4.3615	Adder	5.13
960442	AF2-335 E	2.9077	Adder	3.42
960791	AF2-370	1.4538	Adder	1.71
960971	AF2-388 C	2.3206	Adder	2.73
960972	AF2-388 E	10.8646	Adder	12.78
961161	AF2-407	12.8265	Adder	15.09
961171	AF2-408	3.4537	Adder	4.06
LGEE	LGEE	0.6572	Confirmed LTF	0.6572
CPLE	CPLE	0.1442	Confirmed LTF	0.1442
CBM-W2	CBM-W2	6.5602	Confirmed LTF	6.5602
NY	NY	0.0459	Confirmed LTF	0.0459
TVA	TVA	0.8148	Confirmed LTF	0.8148
WEC	WEC	0.0154	Confirmed LTF	0.0154
O-066	O-066	0.4838	Confirmed LTF	0.4838
CBM-S2	CBM-S2	1.6300	Confirmed LTF	1.6300
CBM-S1	CBM-S1	5.8618	Confirmed LTF	5.8618
G-007	G-007	0.0738	Confirmed LTF	0.0738
MEC	MEC	0.4942	Confirmed LTF	0.4942

10.8 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
AA2-148	Madison-Tanners Creek 138kV	Active
AB2-028	Fall Creek-Desoto 345kV	Active
AC1-152	Lawrenceburg 345kV PB I	In Service
AC1-172	Lawrenceburg 345kV PB II	Partially in Service - Under Construction
AC1-175	Losantville 345kV	Active
AC1-212	Minster 69kV	Engineering and Procurement
AC2-090	Losantville 345kV	Active
AC2-111	College Corner 138kV	Active
AC2-176	Jay 138 kV	In Service
AC2-177	Desoto-Tanners Creek 345kV	Active
AD1-043	Makahoy 138 kV	Active
AD1-128	Modoc-Delaware 138 kV	Active
AD2-071	Strawton-Pipe Creek 138 kV	Active
AE1-207	Mississinewa-Gaston 138 kV	Active
AE1-208	Delaware-Van Buren 138 kV	Active
AE1-209	Desoto 345 kV	Active
AE1-210	Desoto 345 kV	Active
AE2-089	Pennville-Adams 138 kV	Active
AE2-169	Delaware-Van Buren 138 kV	Active
AE2-171	Makahoy 138 kV	Active
AE2-172	Mississinewa-Gaston 138 kV	Active
AE2-219	Bluff Point-Randolph 138 kV	Active
AE2-220	Losantville 345 kV	Active
AE2-234	Liberty Center-Buckeye Tap 69 kV	Active
AE2-297	Madison-Tanners Creek 138 kV	Active
AF1-045	Cedarville-Ford 138 kV	Active
AF1-071	College Corner 138 kV	Active
AF1-118	Sorenson-Desoto 345 kV	Active
AF1-119	Keystone-Desoto 345 kV	Active
AF1-148	Sorenson-Desoto 345 kV	Active
AF1-202	Keystone-Desoto 345 kV	Active
AF1-221	College Corner-Drewersburg 138 kV	Active
AF1-223	Jay-Desoto 138 kV	Active
AF1-268	Desoto-Jay 138 kV	Active
AF2-068	Jay 138 kV	Active
AF2-162	Keystone-Desoto 345 kV	Active
AF2-173	Desoto 345 kV	Active
AF2-177	Sorenson-DeSoto #2 345 kV	Active
AF2-204	Van Buren 138 kV	Active

Queue Number	Project Name	Status
AF2-211	College Corner 138 kV	Active
AF2-335	West Del-Royerton 138 kV	Active
AF2-370	West Del-Royerton 138 kV	Active
AF2-388	Desoto-Sorenson 345 kV	Active
AF2-407	Fall Creek 345 kV	Active
AF2-408	Fall Creek 138 kV	Active
V3-007	Desoto-Tanners Creek #1 345kV	Under Construction
Y1-054	Rochelle 138kV	In Service
Y3-024	Bluff Point 12kV	In Service
Y3-099	Beckjord 2 MW-1	In Service
Y3-100	Beckjord 2 MW-2	In Service
Z1-065	Wiley 34.5kV	In Service
Z2-115	Deer Creek 12.47kV	In Service
J1152	MISO	MISO
J805	MISO	MISO
J903	MISO	MISO
J993	MISO	MISO

10.9 Contingency Descriptions

Contingency Name	Contingency Definition
AEP_P7-1_#11087-C-A	CONTINGENCY 'AEP_P7-1_#11087-C-A' OPEN BRANCH FROM BUS 960970 TO BUS 243225 CKT 1 / 960970 AF2-388 TAP 345 243225 05KEYSTN 345 1 OPEN BRANCH FROM BUS 944530 TO BUS 243232 CKT 2 / 944530 AF1-118 TAP 345 243232 05SORENS 345 2 END
DEOK_P2-3_C2 1401_MIAMIFORT	CONTINGENCY 'DEOK_P2-3_C2 1401_MIAMIFORT' OPEN BRANCH FROM BUS 249567 TO BUS 250057 CKT 9 / 249567 08M.FORT 345 250057 08M.FORT 138 9 OPEN BRANCH FROM BUS 243233 TO BUS 249567 CKT 1 / 243233 05TANNER 345 249567 08M.FORT 345 1 END
AEP_P1-2_#4817	CONTINGENCY 'AEP_P1-2_#4817' OPEN BRANCH FROM BUS 243225 TO BUS 243232 CKT 1 / 243225 05KEYSTN 345 243232 05SORENS 345 1 END
AEP_P1-2_#8702-C	CONTINGENCY 'AEP_P1-2_#8702-C' OPEN BRANCH FROM BUS 944530 TO BUS 243232 CKT 2 / 944530 AF1-118 TAP 345 243232 05SORENS 345 2 END
AEP_P1-2_#144	CONTINGENCY 'AEP_P1-2_#144' OPEN BRANCH FROM BUS 243233 TO BUS 249567 CKT 1 / 243233 05TANNER 345 249567 08M.FORT 345 1 END
DEOK_P2-3_C2 1403_MIAMIFORT	CONTINGENCY 'DEOK_P2-3_C2 1403_MIAMIFORT' OPEN BRANCH FROM BUS 243233 TO BUS 249567 CKT 1 / 243233 05TANNER 345 249567 08M.FORT 345 1 OPEN BRANCH FROM BUS 249567 TO BUS 251950 CKT 7 / 249567 08M.FORT 345 251950 08M.FRT7 22.0 7 END
Base Case	
AEP_P7-1_#11019	CONTINGENCY 'AEP_P7-1_#11019' OPEN BRANCH FROM BUS 944530 TO BUS 243232 CKT 2 / 243218 05DESOTO 345 243232 05SORENS 345 2 OPEN BRANCH FROM BUS 243225 TO BUS 243232 CKT 1 / 243225 05KEYSTN 345 243232 05SORENS 345 1 END

Contingency Name	Contingency Definition
DEOK_P7-1_C5 4504MFTANNERS4512EBTANNERS	CONTINGENCY 'DEOK_P7-1_C5 4504MFTANNERS4512EBTANNERS' OPEN BRANCH FROM BUS 243233 TO BUS 249567 CKT 1 / 243233 05TANNER 345 249567 08M.FORT 345 1 OPEN BRANCH FROM BUS 243233 TO BUS 249565 CKT 1 / 243233 05TANNER 345 249565 08EBEND

11 Light Load Analysis

Not applicable.

12 Short Circuit Analysis

The following Breakers are overdutied:

None.

13 Stability and Reactive Power

(Summary of the VAR requirements based upon the results of the dynamic studies)

To be determined in the Facilities Study Phase.

14 Affected Systems

14.1 TVA

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

14.2 Duke Energy Progress

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

14.3 MISO

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

14.4 LG&E

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

15 Attachment 1: One Line Diagram and Project Site Location