Generation Interconnection

Feasibility Study Report

for

Queue Project AF2-173

DESOTO 345 KV

84 MW Capacity / 200 MW Energy

July 2020

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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.

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.

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 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 at the Desoto 345 kV substation utilizing the same generation lead as previous queue position AE2-209/AE2-210.

Note: It is assumed that the 345 kV revenue metering system, gen lead and Protection & Control Equipment that will be installed for AE2-209/AE2-210 will be adequate for the additional storage facility connection requested in AF2-173. Depending on the timing of the completion of the AF2-173 interconnection construction relative to the AE2-209/AE2-210 completion, there may (or may not) be a need to review and revise 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	$50,000
Total System Network Upgrade Costs	$9,423,200
Total Costs	**$9,473,200**

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 88-129. 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.

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 tables below:

7 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
	$0
Total Attachment Facility Costs	$0

8 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
	$0
Total Direct Connection Facility Costs	$0

9 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 and revise relay settings for the increased generation of AF2-173	$50,000
Total Non-Direct Connection Facility Costs	**$50,000**

10 Incremental Capacity Transfer Rights (ICTRs)

Will be determined at a later study phase

11 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 signing Agreement execution.

12 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.

13 Revenue Metering and SCADA Requirements

13.1 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.

13.2 Meteorological Data Reporting Requirements

Solar generation facilities shall provide the Transmission Provider with site-specific meteorological data including:

- Back Panel temperature (Fahrenheit)
- Irradiance (Watts/meter^2)
- Ambient air temperature (Fahrenheit) – (Accepted, not required)
- Wind speed (meters/second) – (Accepted, not required)

13.3 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/

14 Summer Peak - Load Flow 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 53.0 %. Potential network impacts were as follows:

14.1 Generation Deliverability

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

None

14.2 Multiple Facility Contingency

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

None

14.3 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
98745941	248001	06DEARB1	345.0	OVEC	248013	06PIERCE	345.0	OVEC	1	DEOK_P2-3_C21403_MIAMIFORT	breaker	972.0	101.15	102.06	DC	18.97
98745942	248001	06DEARB1	345.0	OVEC	248013	06PIERCE	345.0	OVEC	1	DEOK_P2-3_C21401_MIAMIFORT	breaker	972.0	100.59	101.5	DC	18.98
98746524	248001	06DEARB1	345.0	OVEC	248013	06PIERCE	345.0	OVEC	1	DEOK_P7-1_C54504MFTANNERS4512EBTANNERS	tower	972.0	131.25	133.8	DC	24.73
95750143	946030	AF1-268 TAP	138.0	AEP	243319	05JAY	138.0	AEP	1	AEP_P7-1_#11019	tower	393.0	106.31	108.09	DC	15.51
95750144	946030	AF1-268 TAP	138.0	AEP	243319	05JAY	138.0	AEP	1	AEP_P7-1_#11087-F	tower	393.0	101.91	103.69	DC	15.53

14.4 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
95323192	243218	05DESOTO	345.0	AEP	945370	AF1-202 TAP	345.0	AEP	1	AEP_P1-2_#8702-C	operation	897.0	105.01	110.39	DC	48.54
95323200	243218	05DESOTO	345.0	AEP	958860	AF2-177 TAP	345.0	AEP	2	AEP_P1-2_#4817	operation	971.0	113.04	118.05	DC	48.88

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
95323204	243225	05KEYSTN	345.0	AEP	243232	05SORENS	345.0	AEP	1	AEP_P1-2_#8702-C	operation	1301.0	106.46	110.17	DC	48.29
95323205	243225	05KEYSTN	345.0	AEP	243232	05SORENS	345.0	AEP	1	Base Case	operation	897.0	108.22	112.17	DC	35.36
98746210	248001	06DEARB1	345.0	OVEC	248013	06PIERCE	345.0	OVEC	1	AEP_P1-2_#144	operation	972.0	100.56	101.47	DC	18.98
95323078	944530	AF1-118 TAP	345.0	AEP	243232	05SORENS	345.0	AEP	2	AEP_P1-2_#4817	operation	971.0	144.19	149.21	DC	48.88
95323083	944530	AF1-118 TAP	345.0	AEP	243232	05SORENS	345.0	AEP	2	Base Case	operation	971.0	103.25	106.97	DC	36.07
95323114	944540	AF1-119 TAP	345.0	AEP	243225	05KEYSTN	345.0	AEP	1	AEP_P1-2_#8702-C	operation	897.0	132.65	138.03	DC	48.54
95323120	944830	AF1-148 TAP	345.0	AEP	944530	AF1-118 TAP	345.0	AEP	2	AEP_P1-2_#4817	operation	971.0	122.47	127.49	DC	48.88
95323138	945370	AF1-202 TAP	345.0	AEP	944540	AF1-119 TAP	345.0	AEP	1	AEP_P1-2_#8702-C	operation	897.0	120.71	126.09	DC	48.54
95323168	958860	AF2-177 TAP	345.0	AEP	960970	AF2-388 TAP	345.0	AEP	2	AEP_P1-2_#4817	operation	971.0	113.03	118.05	DC	48.88
95323132	960970	AF2-388 TAP	345.0	AEP	944830	AF1-148 TAP	345.0	AEP	2	AEP_P1-2_#4817	operation	971.0	113.04	118.06	DC	48.88

14.5 System Reinforcements

ID	Idx	Facility	Upgrade Description	Cost
98745941,98745942,98746524	1	06DEARB1 345.0 kV - 06PIERCE 345.0 kV Ckt 1	**OVEC** **OVEC0001a (1669) : Perform a sag study. OVECs cost estimate for performing the sag study is $125K.** **Project Type : FAC** **Cost : $125,000** **Time Estimate : 6-12 Months** **OVEC0001b (1670) : Replace 2156 KCM ACSR risers at Dearborn 345 kV** **Project Type : FAC** **Cost : $175,000** **Time Estimate : 12 -18 Months** **OVEC0001c (1671) : Replace 2 1600 A switches at Dearborn 345 kV and 4 1600 A switches at Pierce 345kV** **Project Type : FAC** **Cost : $9,000,000** **Time Estimate : 12 -18 Months**	$9,300,000

ID	Idx	Facility	Upgrade Description	Cost
95750144,95750143	2	**AF1-268 TAP 138.0 kV - 05JAY 138.0 kV Ckt 1**	**AEP** **AEPI0019a (304) : Current AEP End Ratings are S/N :335MVA S/E: 392 MVA** **1) Replace 2 risers(Sub cond 1590 AAC 61 Str) at Jay Station** **Project Type : FAC** **Cost : $70,000** **Time Estimate : 24- 36 Months** **AEPI0027a (328) : A Sag Study will be required on the 8.3 mile section of ACSR ~ 556.5 26/7 ~ DOVE line to mitigate the overload . New Rating after the Sag Study : S/N: 410 MVA S/E: 568 MVA. Depending on the sag study results, cost for this upgrade is expected to be between $33,200 (No remediations required just sag study) and 9.96 million (complete line reconductor/rebuild required). 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 : $33,200** **Time Estimate : 6-12 Months** **AEPI0027b (329) : A Sag Study will be required on the 0.06 mile section of ACSR ~ 1781~ 84/19 ~ CHUKAR line to mitigate the overload . New Rating after the Sag Study : S/N: 418 MVA S/E: 569 MVA. Depending on the sag study results, cost for this upgrade is expected to be between $20,000 (No remediations required just sag study) and 90,000 million (complete line reconductor/rebuild required). 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 : $20,000** **Time Estimate : 6-12 Months**	$123,200
			TOTAL COST	**$9,423,200**

14.6 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".

14.6.1 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
98746524	248001	06DEARB1	OVEC	248013	06PIERCE	OVEC	1	DEOK_P7-1_C5 4504MFTANNERS4512EBTANNERS	tower	972.0	131.25	133.8	DC	24.73

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
243795	05HDWTR1G C	0.6960	50/50	0.6960
247264	05LAWG1A	8.5772	50/50	8.5772
247265	05LAWG1B	8.5772	50/50	8.5772
247266	05LAWG1S	13.6964	50/50	13.6964
247267	05LAWG2A	8.5772	50/50	8.5772
247268	05LAWG2B	8.5772	50/50	8.5772
247269	05LAWG2S	13.6964	50/50	13.6964
247543	V3-007 C	0.6960	50/50	0.6960
247929	S-071 E	7.3481	Adder	8.64
247935	V3-007 E	27.0013	50/50	27.0013
247958	05WLD G2 E	13.9869	Adder	16.46
247963	05HDWTR1G E	27.0013	50/50	27.0013
247968	Z2-115 E	0.0795	Adder	0.09
250163	Y3-099 BAT	0.1995	Merchant Transmission	0.1995
250167	Y3-100 BAT	0.1995	Merchant Transmission	0.1995
251823	Z1-065 BAT	0.3781	Merchant Transmission	0.3781
913222	Y1-054 E	-1.2723	Adder	-1.5
920501	AA2-148 C OP	3.5390	50/50	3.5390
920502	AA2-148 E OP	23.6840	50/50	23.6840
923881	AB2-028 C	2.9047	50/50	2.9047
923882	AB2-028 E	19.4393	50/50	19.4393
926691	AC1-152	2.7057	50/50	2.7057
926851	AC1-172	2.7057	50/50	2.7057
926881	AC1-175 C	11.7937	50/50	11.7937
926882	AC1-175 E	19.2423	50/50	19.2423
932681	AC2-090 C	5.8968	50/50	5.8968
932682	AC2-090 E	9.6212	50/50	9.6212
932841	AC2-111 C O1	2.4220	Adder	2.85
932842	AC2-111 E O1	3.9517	Adder	4.65
933592	AC2-176 E O1	8.6195	Adder	10.14
933601	AC2-177 C O1	4.0347	50/50	4.0347
933602	AC2-177 E O1	27.0013	50/50	27.0013
934161	AD1-043 C O1	3.8066	Adder	4.48
934162	AD1-043 E O1	6.2108	Adder	7.31
934961	AD1-128 C	6.0887	50/50	6.0887
934962	AD1-128 E	9.9343	50/50	9.9343
936561	AD2-071 C	5.0577	Adder	5.95
936562	AD2-071 E	2.4911	Adder	2.93
939761	AE1-207 C	5.0243	Adder	5.91
939762	AE1-207 E	6.9383	Adder	8.16
939771	AE1-208 C	4.5086	Adder	5.3
939772	AE1-208 E	6.1481	Adder	7.23

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
939781	AE1-209 C O1	1.6073	50/50	1.6073
939782	AE1-209 E O1	10.7567	50/50	10.7567
939791	AE1-210 C O1	1.6073	50/50	1.6073
939792	AE1-210 E O1	10.7567	50/50	10.7567
940981	AE2-089 C O1	6.1580	Adder	7.24
940982	AE2-089 E O1	4.1053	Adder	4.83
940991	AE2-090 C	6.7653	Adder	7.96
940992	AE2-090 E	4.5102	Adder	5.31
941691	AE2-169	2.7051	Adder	3.18
941711	AE2-171	2.5044	Adder	2.95
941721	AE2-172	2.9906	Adder	3.52
942071	AE2-219 C	3.2541	Adder	3.83
942072	AE2-219 E	4.4937	Adder	5.29
942081	AE2-220 C	8.1469	50/50	8.1469
942082	AE2-220 E	11.2506	50/50	11.2506
942221	AE2-234 C O1	1.5306	Adder	1.8
942222	AE2-234 E O1	0.6923	Adder	0.81
942791	AE2-297 C O1	13.9062	50/50	13.9062
942792	AE2-297 E O1	9.2708	50/50	9.2708
943772	AF1-045 BAT	3.3194	Merchant Transmission	3.3194
944031	AF1-071 C	0.6055	Adder	0.71
944032	AF1-071 E	0.9879	Adder	1.16
944121	AF1-080	1.6077	Adder	1.89
944531	AF1-118 C O1	18.8840	Adder	22.22
944532	AF1-118 E O1	5.6954	Adder	6.7
944541	AF1-119 C O1	14.2086	50/50	14.2086
944542	AF1-119 E O1	6.0894	50/50	6.0894
944831	AF1-148 C O1	6.9502	Adder	8.18
944832	AF1-148 E O1	4.6335	Adder	5.45
945371	AF1-202 C O1	3.5877	50/50	3.5877
945372	AF1-202 E O1	17.5163	50/50	17.5163
945561	AF1-221 C O1	18.2951	50/50	18.2951
945562	AF1-221 E O1	5.4991	50/50	5.4991
945581	AF1-223 C O1	9.4968	50/50	9.4968
945582	AF1-223 E O1	6.3312	50/50	6.3312
946031	AF1-268 C O1	5.9578	50/50	5.9578
946032	AF1-268 E O1	2.7024	50/50	2.7024
946491	AF1-313 C O1	2.5716	50/50	2.5716
946492	AF1-313 E O1	1.7144	50/50	1.7144
956561	J1152	12.1360	PJM External (MISO)	12.1360
957741	AF2-068 C O1	3.6353	Adder	8.07
957742	AF2-068 E O1	2.4235	Adder	5.38
958711	AF2-162 C	3.0447	50/50	3.0447
958712	AF2-162 E	1.5224	50/50	1.5224
958821	AF2-173 C	10.3858	50/50	10.3858
958822	AF2-173 E	14.3422	50/50	14.3422
958861	AF2-177 C	2.6112	50/50	2.6112
958862	AF2-177 E	17.4748	50/50	17.4748
959131	AF2-204 C O1	2.4486	Adder	5.44
959132	AF2-204 E O1	1.2923	Adder	2.87
959201	AF2-211 C	2.5335	Adder	5.62
959202	AF2-211 E	1.6890	Adder	3.75

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
960441	AF2-335 C	6.4290	50/50	6.4290
960442	AF2-335 E	4.2860	50/50	4.2860
960791	AF2-370	2.1430	50/50	2.1430
960971	AF2-388 C O1	1.4283	Adder	3.17
960972	AF2-388 E O1	6.6870	Adder	14.84
961161	AF2-407	32.1240	50/50	32.1240
961171	AF2-408	8.6224	50/50	8.6224
WEC	WEC	1.1434	Confirmed LTF	1.1434
LGEE	LGEE	0.8985	Confirmed LTF	0.8985
CBM-W2	CBM-W2	24.8075	Confirmed LTF	24.8075
NY	NY	0.5027	Confirmed LTF	0.5027
CBM-W1	CBM-W1	36.4917	Confirmed LTF	36.4917
TVA	TVA	1.8102	Confirmed LTF	1.8102
O-066	O-066	6.1488	Confirmed LTF	6.1488
CBM-S1	CBM-S1	11.4594	Confirmed LTF	11.4594
G-007	G-007	0.9516	Confirmed LTF	0.9516
MADISON	MADISON	20.2326	Confirmed LTF	20.2326
MEC	MEC	5.2691	Confirmed LTF	5.2691
CATAWBA	CATAWBA	0.0868	Confirmed LTF	0.0868

14.6.2 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
95750143	946030	AF1-268 TAP	AEP	243319	05JAY	AEP	1	AEP_P7-1_#11019	tower	393.0	106.31	108.09	DC	15.51

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
247935	V3-007 E	10.0128	Adder	11.78
247963	05HDWTR1G E	10.0128	Adder	11.78
923881	AB2-028 C	1.2800	Adder	1.51
923882	AB2-028 E	8.5664	Adder	10.08
926881	AC1-175 C	4.3734	Adder	5.15
926882	AC1-175 E	7.1356	Adder	8.39
927181	AC1-212 C	-0.1225	Adder	-0.14
927183	AC1-212 BAT	1.5090	Merchant Transmission	1.5090
932681	AC2-090 C	2.1867	Adder	2.57
932682	AC2-090 E	3.5678	Adder	4.2
933592	AC2-176 E O1	-53.8491	Adder	-63.35
933601	AC2-177 C O1	1.4962	Adder	1.76
933602	AC2-177 E O1	10.0128	Adder	11.78
934961	AD1-128 C	3.3886	Adder	3.99
934962	AD1-128 E	5.5288	Adder	6.5
939761	AE1-207 C	3.0188	Adder	3.55
939762	AE1-207 E	4.1688	Adder	4.9
939771	AE1-208 C	2.4698	Adder	2.91
939772	AE1-208 E	3.3679	Adder	3.96
939781	AE1-209 C O1	0.8570	Adder	1.01
939782	AE1-209 E O1	5.7356	Adder	6.75
939791	AE1-210 C O1	0.8570	Adder	1.01
939792	AE1-210 E O1	5.7356	Adder	6.75
941691	AE2-169	1.4819	Adder	1.74
941721	AE2-172	1.7969	Adder	2.11
942081	AE2-220 C	3.0211	Adder	3.55
942082	AE2-220 E	4.1720	Adder	4.91
944531	AF1-118 C O1	17.7206	Adder	20.85
944532	AF1-118 E O1	5.3445	Adder	6.29
944541	AF1-119 C O1	9.2285	Adder	10.86
944542	AF1-119 E O1	3.9551	Adder	4.65
944831	AF1-148 C O1	6.2877	Adder	7.4
944832	AF1-148 E O1	4.1918	Adder	4.93
945371	AF1-202 C O1	2.2412	Adder	2.64
945372	AF1-202 E O1	10.9423	Adder	12.87
945581	AF1-223 C O1	5.9326	Adder	6.98
945582	AF1-223 E O1	3.9551	Adder	4.65
946031	AF1-268 C O1	12.9400	50/50	12.9400
946032	AF1-268 E O1	5.8695	50/50	5.8695
946491	AF1-313 C O1	1.7444	Adder	2.05
946492	AF1-313 E O1	1.1629	Adder	1.37
958711	AF2-162 C	1.0481	Adder	2.33

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
958712	AF2-162 E	0.5240	Adder	1.16
958821	AF2-173 C	2.9350	Adder	6.51
958822	AF2-173 E	4.0531	Adder	9.0
958861	AF2-177 C	0.9082	Adder	2.02
958862	AF2-177 E	6.0781	Adder	13.49
960441	AF2-335 C	2.3113	Adder	5.13
960442	AF2-335 E	1.5409	Adder	3.42
960791	AF2-370	0.7704	Adder	1.71
960971	AF2-388 C O1	1.2296	Adder	2.73
960972	AF2-388 E O1	5.7568	Adder	12.78
961161	AF2-407	6.7953	Adder	15.08
961171	AF2-408	1.8298	Adder	4.06
WEC	WEC	0.0148	Confirmed LTF	0.0148
LGEE	LGEE	0.6561	Confirmed LTF	0.6561
CPLE	CPLE	0.1429	Confirmed LTF	0.1429
CBM-W2	CBM-W2	6.5438	Confirmed LTF	6.5438
NY	NY	0.0453	Confirmed LTF	0.0453
TVA	TVA	0.8120	Confirmed LTF	0.8120
O-066	O-066	0.4771	Confirmed LTF	0.4771
CBM-S2	CBM-S2	1.6184	Confirmed LTF	1.6184
CBM-S1	CBM-S1	5.8447	Confirmed LTF	5.8447
G-007	G-007	0.0728	Confirmed LTF	0.0728
MEC	MEC	0.4910	Confirmed LTF	0.4910

14.7 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
AA2-148	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	Under Construction
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
AE2-090	Randolph-Hodgin 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
AF1-080	Deer Creek-Fisher Body-Mullin 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
AF1-313	Wes Del-Royerton 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
AF2-211	College Corner 138 kV	Active

Queue Number	Project Name	Status
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
Y3-099	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

14.8 Contingency Descriptions

Contingency Name	Contingency Definition
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_P7-1_#11087-F	CONTINGENCY 'AEP_P7-1_#11087-F' OPEN BRANCH FROM BUS 944540 TO BUS 243225 CKT 1 / 944540 AF1-119 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
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

15 Light Load Analysis

Light Load Studies (As applicable).

Not applicable

16 Short Circuit Analysis

The following Breakers are overdutied

To be determined during later study phases.

17 Stability and Reactive Power Assessment

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

To be determined during later study phases.

18 Affected Systems

18.1 TVA

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

18.2 Duke Energy Progress

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

18.3 MISO

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

18.4 LG&E

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