Generation Interconnection

Feasibility Study Report

for

Queue Project AF1-268

DESOTO-JAY 138 KV

57.1 MW Capacity / 83 MW Energy

January, 2020

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1 Preface

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

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

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

PJM utilizes manufacturer models to ensure the performance of turbines is properly captured during the simulations performed for stability verification and, where applicable, for compliance with low voltage ride through requirements. Turbine manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is contained in Attachment B of Manual 14G. Manufacturer models may be updated from time to time, for various reasons such as to reflect changes to the control systems or to more accurately represent the capabilities turbines and controls which are currently available in the field. Additionally, as new turbine models are developed, turbine manufacturers provide such new models which must be used in the conduct of these studies. PJM needs adequate time to evaluate the new models in order to reduce delays to the System Impact Study process timeline for the Interconnection Customer as well as other Interconnection Customers in the study group. Therefore, PJM will require that any Interconnection Customer with a new manufacturer model must supply that model to PJM, along with a $10,000 fully refundable deposit, no later than three (3) months prior to the starting date of the System Impact Study (See Section 4.3 for starting dates) for the Interconnection Request which shall specify the use of the new model. The Interconnection Customer will be required to submit a completed dynamic model study request form (Attachment B-1 of Manual 14G) in order to document the request for the study.

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

2 General

The Interconnection Customer (IC), has proposed a Solar generating facility located in Delaware County, IN. The installed facilities will have a total capability of 83 MW with 57.1 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is 1/31/2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AF1-268
Project Name	DESOTO-JAY 138 KV
State	Indiana
County	Delaware
Transmission Owner	AEP
MFO	83
MWE	83
MWC	57.1
Fuel	Solar
Basecase Study Year	2023

2.1 Point of Interconnection

AF1-268 will interconnect with the AEP transmission system tapping the Desoto to Jay 138 kV line.

To accommodate the interconnection on the Desoto to Jay 138kV Circuit, a new three (3) circuit breaker 138kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus will be constructed (see Figure 1). Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 kV revenue metering will also be required. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.

2.2 Cost Summary

This project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$ 250,000
Direct Connection Network Upgrade	$ 6,000,000
Non Direct Connection Network Upgrades	$ 1,500,000
Total Costs	$ 7,750,000

In addition, this project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	$31,715,000

Cost allocations for these upgrades will be provided in the System Impact Study Report.

3 Transmission Owner Scope of Work

4 Attachment Facilities

The total preliminary cost estimate for the Attachment work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
138kV Revenue Metering	$ 250,000
Total Attachment Facility Costs	$250,000

5 Direct Connection Cost Estimate

The total preliminary cost estimate for the Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Construct a new three (3) circuit breaker 138 kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus (See Figure 1). Installation of associated protection and control equipment, 138 kV line risers and SCADA will also be required.	$6,000,000
Total Direct Connection Facility Costs	$6,000,000

6 Non-Direct Connection Cost Estimate

The total preliminary cost estimate for the Non-Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
138kV Transmission Line Cut In	$ 1,000,000
Upgrade line protections & Controls at the 138kV remote end Substation #1	$ 250,000
Upgrade line protections & Controls at the 138kV remote end Substation #2	$ 250,000
Total Non-Direct Connection Facility Costs	$1,500,000

7 Incremental Capacity Transfer Rights (ICTRs)

Will be determined at a later study phase

8 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.

9 Interconnection Customer Requirements

It is understood that the Interconnection Customer is responsible for all costs associated with this interconnection. The costs above are reimbursable to AEP. The cost of the Interconnection Customer's generating plant and the costs for the line connecting the generating plant to AEP's 138kV Facilities are not included in this report; these are assumed to be the Interconnection Customer's responsibility.

The Generation Interconnection Agreement does not in or by itself establish a requirement for American Electric Power 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.

Requirement from the PJM Open Access Transmission Tariff:

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.

10 Revenue Metering and SCADA Requirements

10.1 PJM Requirements

The Interconnection Customer will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Section 8 of Attachment O.

10.2 AEP Requirements

The Interconnection Customer will be required to comply with all AEP Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "Requirements for Connection of New Facilities or Changes to Existing Facilities Connected to the AEP Transmission System" document located at the following link:

http://www.pjm.com/~/media/planning/plan-standards/private-aep/aep-interconnection-requirements.ashx

11 Network Impacts

The Queue Project AF1-268 was evaluated as a 83.0 MW (Capacity 57.1 MW) injection tapping the Desoto to Jay 138 kV line in the AEP area. Project AF1-268 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-268 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

Summer Peak Load Flow

12 Generation Deliverability

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

None

13 Multiple Facility Contingency

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

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
43974271	243343	05MISSIS	138.0	AEP	243274	05DEERCR	138.0	AEP	1	AEP_P7-1_#11087-A	tower	233.0	99.77	100.72	DC	4.93
43974273	243343	05MISSIS	138.0	AEP	243274	05DEERCR	138.0	AEP	1	AEP_P7-1_#11087-C	tower	233.0	99.77	100.72	DC	4.93
43974274	946030	AF1-268 TAP	138.0	AEP	945580	AF1-223 TAP	138.0	AEP	1	AEP_P7-1_#11019	tower	393.0	96.86	101.65	DC	18.8

14 Contribution to Previously Identified Overloads

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

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
43974270	243343	05MISSIS	138.0	AEP	243274	05DEERCR	138.0	AEP	1	AEP_P7-1_#11019	tower	233.0	104.27	105.23	DC	4.93
43974189	939760	AE1-207 TAP	138.0	AEP	243343	05MISSIS	138.0	AEP	1	AEP_P7-1_#11019	tower	233.0	118.44	119.39	DC	4.93
43974191	939760	AE1-207 TAP	138.0	AEP	243343	05MISSIS	138.0	AEP	1	AEP_P7-1_#11087-A	tower	233.0	113.93	114.89	DC	4.93
43974192	939760	AE1-207 TAP	138.0	AEP	243343	05MISSIS	138.0	AEP	1	AEP_P7-1_#11087-C	tower	233.0	113.93	114.89	DC	4.93
43974185	945580	AF1-223 TAP	138.0	AEP	243319	05JAY	138.0	AEP	1	AEP_P7-1_#11019	tower	393.0	113.09	117.87	DC	18.8
43974186	945580	AF1-223 TAP	138.0	AEP	243319	05JAY	138.0	AEP	1	AEP_P7-1_#11087-C	tower	393.0	108.56	113.35	DC	18.81

15 Potential Congestion due to Local Energy Deliverability

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

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

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
4358479 7	243218	05DESOTO	345.0	AEP	944830	AF1-148 TAP	345.0	AEP	2	AEP_P1-2_#4817	operation	971.0	120.25	121.73	DC	14.41
4358482 3	243218	05DESOTO	345.0	AEP	945370	AF1-202 TAP	345.0	AEP	1	AEP_P1-2_#8702-C	operation	897.0	117.92	119.51	DC	14.33
4358487 7	243225	05KEYSTN	345.0	AEP	243232	05SORENS	345.0	AEP	1	AEP_P1-2_#8702-C	operation	1301.0	109.08	110.17	DC	14.22
4358487 8	243225	05KEYSTN	345.0	AEP	243232	05SORENS	345.0	AEP	1	Base Case	operation	897.0	107.5	108.66	DC	10.41
4397392 4	243237	05ADAM	138.0	AEP	243334	05MAGLEY	138.0	AEP	1	AEP_P1-2_#5598-A	operation	180.0	103.0	115.71	DC	22.89
4397398 4	243319	05JAY	138.0	AEP	243358	05PENNVI	138.0	AEP	1	AEP_P1-2_#5598-A	operation	205.0	94.93	108.46	DC	27.72
4397399 4	243358	05PENNVI	138.0	AEP	940980	AE2-089 TAP	138.0	AEP	1	AEP_P1-2_#5598-A	operation	205.0	92.54	106.07	DC	27.72
4397393 1	940980	AE2-089 TAP	138.0	AEP	243237	05ADAM	138.0	AEP	1	Base Case	operation	187.0	109.55	111.03	DC	6.14
4527522 4	940980	AE2-089 TAP	138.0	AEP	243237	05ADAM	138.0	AEP	1	AEP_P1-2_#5598-A	operation	205.0	133.27	146.8	DC	27.72
4358467 4	944530	AF1-118 TAP	345.0	AEP	243232	05SORENS	345.0	AEP	2	AEP_P1-2_#4817	operation	971.0	151.04	152.53	DC	14.41
4358467 9	944530	AF1-118 TAP	345.0	AEP	243232	05SORENS	345.0	AEP	2	Base Case	operation	971.0	106.93	108.02	DC	10.63
4358471 0	944540	AF1-119 TAP	345.0	AEP	243225	05KEYSTN	345.0	AEP	1	AEP_P1-2_#8702-C	operation	897.0	136.63	138.23	DC	14.33
4358474 8	944830	AF1-148 TAP	345.0	AEP	944530	AF1-118 TAP	345.0	AEP	2	AEP_P1-2_#4817	operation	971.0	129.37	130.85	DC	14.41
4358476 9	945370	AF1-202 TAP	345.0	AEP	944540	AF1-119 TAP	345.0	AEP	1	AEP_P1-2_#8702-C	operation	897.0	126.89	128.48	DC	14.33

16 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
43974274	2	AF1-268 TAP 138.0 kV - AF1-223 TAP 138.0 kV Ckt 1	AEP AEPI0019a : 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	$70,000
43974191,43974192, 43974189	3	AE1-207 TAP 138.0 kV - 05MISSIS 138.0 kV Ckt 1	AEP AEPI0016a : Reconductor/rebuild 5.6 miles of ACSR ~ 397.5 ~ 30/7 ~ LARK , conductor sec 1 Project Type : FAC Cost : $ 8,400,000 Time Estimate : 24-36 Months	$ 8,400,000
43974270,43974271, 43974273	1	05MISSIS 138.0 kV - 05DEERCR 138.0 kV Ckt 1	AEP AEPI0022a : Replace 3 Deer Creek Sub cond 500 MCM CU 37 Str Project Type : FAC Cost : $300,000 Time Estimate : 12-18 Months s1855 : Rebuild the ~19.8 miles from structure 16 to structure 127 on the Deer Creek – Delaware double circuit 138kV line. Install a breaker facing Desoto in the bus tie position. Reterminate into the P breaker. Projected in-service 10/8/2021 Project Type : FAC Cost : $57,300,000 Time Estimate : Projected in-service 10/8/2021	$300,000
43974186,43974185	4	AF1-223 TAP 138.0 kV - 05JAY 138.0 kV Ckt 1	AEP AEPI0019a : 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 AEPI0019b : Rebuild / reconductor 8.4 miles of ACSR ~ 556.5 ~ 26/7 ~ DOVE - Conductor section 1 Project Type : FAC Cost : $18,800,000 Time Estimate : 24-36 Months AEPI0019c : Rebuild / reconductor 0.05 miles of ACSR ~ 1781 ~ 84/19 ~ CHUKAR @ 284 F Conductor section 2 Project Type : FAC Cost : $75,000 Time Estimate : 24-36 Months AEPI0019d : Replace four Jay Sub cond 2000 AAC 91 Str. Project Type : FAC Cost : $4,000,000 Time Estimate : 24-36 Months	$22,945,000
			TOTAL COST	$31,715,000

17 Flow Gate Details

The following indices contain additional information about each flowgate presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact.It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

17.1 Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
43974270	243343	05MISSIS	AEP	243274	05DEERCR	AEP	1	AEP_P7-1_#11019	tower	233.0	104.27	105.23	DC	4.93

Bus #	Bus	MW Impact
934961	AD1-128 C	2.8077
934962	AD1-128 E	4.5809
939761	AE1-207 C	36.0736
939762	AE1-207 E	49.8160
939811	AE1-217 C O1	36.5333
939812	AE1-217 E O1	50.4507
941701	AE2-170 O1	21.1050
941721	AE2-172	21.4724
944122	AF1-080 BAT	1.0558
946031	AF1-268 C O1	1.5245
946032	AF1-268 E O1	0.6954
DUCKCREEK	DUCKCREEK	0.4710
LGEE	LGEE	0.2881
NEWTON	NEWTON	0.0333
CPLE	CPLE	0.0622
FARMERCITY	FARMERCITY	0.0139
G-007A	G-007A	0.1079
VFT	VFT	0.2902
CBM-W2	CBM-W2	0.6306
TVA	TVA	0.1652
PRAIRIE	PRAIRIE	0.1679
COFFEEN	COFFEEN	0.0740
CBM-S2	CBM-S2	0.5896
EDWARDS	EDWARDS	0.1586
CBM-S1	CBM-S1	1.6188
TILTON	TILTON	0.0920

17.2 Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
43974274	946030	AF1-268 TAP	AEP	945580	AF1-223 TAP	AEP	1	AEP_P7-1_#11019	tower	393.0	96.86	101.65	DC	18.8

Bus #	Bus	MW Impact
247935	V3-007 E	9.9966
247963	05HDWTR1G E	9.9966
923881	AB2-028 C	1.2778
923882	AB2-028 E	8.5516
926881	AC1-175 C	4.3663
926882	AC1-175 E	7.1240
927181	AC1-212 C	-0.1226
927182	AC1-212 E	-1.1617
927183	AC1-212 BAT	1.5110
932681	AC2-090 C	2.1832
932682	AC2-090 E	3.5620
933591	AC2-176 C O1	-8.0478
933592	AC2-176 E O1	-53.8587
933601	AC2-177 C O1	1.4937
933602	AC2-177 E O1	9.9966
934961	AD1-128 C	3.3837
934962	AD1-128 E	5.5209
939761	AE1-207 C	3.0125
939762	AE1-207 E	4.1601
939771	AE1-208 C	2.4647
939772	AE1-208 E	3.3609
939781	AE1-209 C O1	0.8559
939782	AE1-209 E O1	5.7282
939791	AE1-210 C O1	0.8559
939792	AE1-210 E O1	5.7282
939811	AE1-217 C O1	4.6846
939812	AE1-217 E O1	6.4691
941691	AE2-169	0.7838
941701	AE2-170 O1	1.5144
941721	AE2-172	0.9504
942081	AE2-220 C	3.0162
942082	AE2-220 E	4.1652
944531	AF1-118 C O1	9.3798
944532	AF1-118 E O1	2.8289
944541	AF1-119 C O1	5.3726
944542	AF1-119 E O1	1.6048
944831	AF1-148 C O1	3.3278
944832	AF1-148 E O1	2.2185
945371	AF1-202 C O1	1.1863
945372	AF1-202 E O1	5.7919
946031	AF1-268 C O1	12.9111
946032	AF1-268 E O1	5.8893

Bus #	Bus	MW Impact
946341	AF1-298 C	2.9312
946342	AF1-298 E	4.0479
946491	AF1-313 C O1	0.9235
946492	AF1-313 E O1	0.6156
LGEE	LGEE	0.6498
CPLE	CPLE	0.1349
WEC	WEC	0.0117
CBM-W2	CBM-W2	6.4128
NY	NY	0.0553
TVA	TVA	0.7966
O-066	O-066	0.6115
CBM-S2	CBM-S2	1.5490
CBM-S1	CBM-S1	5.7510
G-007	G-007	0.0936
MEC	MEC	0.4751

17.3 Index 3

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
43974189	939760	AE1-207 TAP	AEP	243343	05MISSIS	AEP	1	AEP_P7-1_#11019	tower	233.0	118.44	119.39	DC	4.93

Bus #	Bus	MW Impact
934961	AD1-128 C	2.8077
934962	AD1-128 E	4.5809
939761	AE1-207 C	36.0736
939762	AE1-207 E	49.8160
939811	AE1-217 C O1	36.5333
939812	AE1-217 E O1	50.4507
941701	AE2-170 O1	21.1050
941721	AE2-172	21.4724
944122	AF1-080 BAT	1.0558
946031	AF1-268 C O1	1.5245
946032	AF1-268 E O1	0.6954
DUCKCREEK	DUCKCREEK	0.4710
LGEE	LGEE	0.2881
NEWTON	NEWTON	0.0333
CPLE	CPLE	0.0622
FARMERCITY	FARMERCITY	0.0139
G-007A	G-007A	0.1079
VFT	VFT	0.2902
CBM-W2	CBM-W2	0.6306
TVA	TVA	0.1652
PRAIRIE	PRAIRIE	0.1679
COFFEEN	COFFEEN	0.0740
CBM-S2	CBM-S2	0.5896
EDWARDS	EDWARDS	0.1586
CBM-S1	CBM-S1	1.6188
TILTON	TILTON	0.0920

17.4 Index 4

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
43974185	945580	AF1-223 TAP	AEP	243319	05JAY	AEP	1	AEP_P7-1_#11019	tower	393.0	113.09	117.87	DC	18.8

Bus #	Bus	MW Impact
247935	V3-007 E	9.9966
247963	05HDWTR1G E	9.9966
923881	AB2-028 C	1.2778
923882	AB2-028 E	8.5516
926881	AC1-175 C	4.3663
926882	AC1-175 E	7.1240
927181	AC1-212 C	-0.1226
927182	AC1-212 E	-1.1617
927183	AC1-212 BAT	1.5110
932681	AC2-090 C	2.1832
932682	AC2-090 E	3.5620
933591	AC2-176 C O1	-8.0478
933592	AC2-176 E O1	-53.8587
933601	AC2-177 C O1	1.4937
933602	AC2-177 E O1	9.9966
934961	AD1-128 C	3.3837
934962	AD1-128 E	5.5209
939761	AE1-207 C	3.0125
939762	AE1-207 E	4.1601
939771	AE1-208 C	2.4647
939772	AE1-208 E	3.3609
939781	AE1-209 C O1	0.8559
939782	AE1-209 E O1	5.7282
939791	AE1-210 C O1	0.8559
939792	AE1-210 E O1	5.7282
939811	AE1-217 C O1	4.6846
939812	AE1-217 E O1	6.4691
941691	AE2-169	0.7838
941701	AE2-170 O1	1.5144
941721	AE2-172	0.9504
942081	AE2-220 C	3.0162
942082	AE2-220 E	4.1652
944531	AF1-118 C O1	9.3798
944532	AF1-118 E O1	2.8289
944541	AF1-119 C O1	5.3726
944542	AF1-119 E O1	1.6048
944831	AF1-148 C O1	3.3278
944832	AF1-148 E O1	2.2185
945371	AF1-202 C O1	1.1863
945372	AF1-202 E O1	5.7919
945581	AF1-223 C O1	39.3426
945582	AF1-223 E O1	26.2284

Bus #	Bus	MW Impact
946031	AF1-268 C O1	12.9111
946032	AF1-268 E O1	5.8893
946341	AF1-298 C	2.9312
946342	AF1-298 E	4.0479
946491	AF1-313 C O1	0.9235
946492	AF1-313 E O1	0.6156
LGEE	LGEE	0.6498
CPLE	CPLE	0.1349
WEC	WEC	0.0117
CBM-W2	CBM-W2	6.4128
NY	NY	0.0553
TVA	TVA	0.7966
O-066	O-066	0.6115
CBM-S2	CBM-S2	1.5490
CBM-S1	CBM-S1	5.7510
G-007	G-007	0.0936
MEC	MEC	0.4751

Affected Systems

18 Affected Systems

18.1 LG&E

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

18.2 MISO

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

18.3 TVA

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

18.4 Duke Energy Progress

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

18.5 NYISO

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

19 Contingnecy Descriptions

Contingency Name	Contingency Definition
AEP_P7-1_#11087-A	CONTINGENCY 'AEP_P7-1_#11087-A' OPEN BRANCH FROM BUS 243218 TO BUS 945370 CKT 1 / 243218 05DESOTO 345 945370 AF1-202 TAP 345 1 OPEN BRANCH FROM BUS 243218 TO BUS 944830 CKT 2 / 243218 05DESOTO 345 944830 AF1-148 TAP 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_P7-1_#11087-C	CONTINGENCY 'AEP_P7-1_#11087-C' 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
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
AEP_P1-2_#5598-A	CONTINGENCY 'AEP_P1-2_#5598-A' OPEN BRANCH FROM BUS 243278 TO BUS 946030 CKT 1 / 243278 05DESOTO 138 946030 AF1-268 TAP 138 1 END

Short Circuit

20 Short Circuit

The following Breakers are overduty

Bus Number	Bus Name	BREAKER	Type	Capacity (Amps)	Duty Percentage Post Queue	Duty Percentage Pre Queue

21 Network Impacts – Option 2

The Queue Project AF1-268 was evaluated as a 83.0 MW (Capacity 57.1 MW) injection tapping the Desoto to Sorenson 345 kV line in the AEP area. Project AF1-268 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-268 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

Summer Peak Load Flow

22 Generation Deliverability

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

None

23 Multiple Facility Contingency

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

None

24 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)

None

25 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
51991314	243218	05DESOTO	345.0	AEP	945580	AF1-223 TAP	345.0	AEP	1	AEP_P1-2_#8702-D	operation	897.0	114.49	116.73	DC	20.12
51991361	243225	05KEYSTN	345.0	AEP	944530	AF1-118 TAP	345.0	AEP	1	Base Case	operation	897.0	109.07	110.47	DC	12.57
51991362	243225	05KEYSTN	345.0	AEP	944530	AF1-118 TAP	345.0	AEP	1	AEP_P1-2_#8702-D	operation	1301.0	105.32	106.86	DC	20.01
51991225	944530	AF1-118 TAP	345.0	AEP	243232	05SORENS	345.0	AEP	1	Base Case	operation	897.0	131.7	133.11	DC	12.57
51991226	944530	AF1-118 TAP	345.0	AEP	243232	05SORENS	345.0	AEP	1	AEP_P1-2_#8702-D	operation	1301.0	121.25	122.79	DC	20.01
51991178	944540	AF1-119 TAP	345.0	AEP	243232	05SORENS	345.0	AEP	2	AEP_P1-2_#4817-B	operation	971.0	143.48	146.09	DC	25.3

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
5199120 3	945370	AF1-202 TAP	345.0	AEP	944540	AF1-119 TAP	345.0	AEP	2	AEP_P1-2_#4817-B	operation	971.0	134.26	136.86	DC	25.3
5199127 1	945580	AF1-223 TAP	345.0	AEP	243225	05KEYSTN	345.0	AEP	1	AEP_P1-2_#8702-D	operation	897.0	121.03	123.27	DC	20.12
5199123 1	946030	AF1-268 TAP	345.0	AEP	945370	AF1-202 TAP	345.0	AEP	2	AEP_P1-2_#4817-B	operation	971.0	125.99	128.6	DC	25.3

26 Flow Gate Details

The following indices contain additional information about each flowgate presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact.It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

Affected Systems

27 Affected Systems

27.1 LG&E

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

27.2 MISO

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

27.3 TVA

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

27.4 Duke Energy Progress

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

27.5 NYISO

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

28 Contincency Descriptions

Contingency Name	Contingency Definition
Base Case	
AEP_P1-2_#8702-D	CONTINGENCY 'AEP_P1-2_#8702-D' OPEN BRANCH FROM BUS 944540 TO BUS 243232 CKT 2 / 944540 AF1-119 TAP 345 243232 05SORENS 345 2 END
AEP_P1-2_#4817-B	CONTINGENCY 'AEP_P1-2_#4817-B' OPEN BRANCH FROM BUS 944530 TO BUS 243232 CKT 1 / 944530 AF1-118 TAP 345 243232 05SORENS 345 1 END

Short Circuit

29 Short Circuit

The following Breakers are overduty

Bus Number	Bus Name	BREAKER	Type	Capacity (Amps)	Duty Percentage Post Queue	Duty Percentage Pre Queue