



**Generation Interconnection
Feasibility Study Report
for
Queue Project AG1-414
MISSISSINEWA 138 KV
45 MW Capacity / 75 MW Energy**

January 2021

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1 Introduction

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

2 Preface

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

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

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

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

3 General

The Interconnection Customer (IC), has proposed a Solar; Storage generating facility located in Grant County, Indiana. The installed facilities will have a total capability of 75 MW with 45 MW of this output being recognized by PJM as Capacity.

The proposed in-service date for this project is June 30, 2023. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-414
Project Name	MISSISSINEWA 138 KV
State	Indiana
County	Grant
Transmission Owner	AEP
MFO	75
MWE	75
MWC	45
Fuel	Solar; Storage
Basecase Study Year	2024

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

4 Point of Interconnection

AG1-414 will interconnect with the AEP transmission system along one of the following Points of Interconnection.

Primary POI: Mississinewa 138 kV substation.

AG1-414 will interconnect with the AEP transmission system via a direct connection to the Mississinewa 138 kV substation.

To accommodate the interconnection to the Mississinewa 138 kV substation, the station will be rebuilt and six (6) new 138 kV circuit breaker(s) will be installed (Attachment 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.

Installation of the generator lead first span exiting the POI station, including the first structure outside the AEP fence, will also be included in AEP's scope. In the case where the generator lead is a single span, the structure in the customer station will be the customer's responsibility.

Secondary POI: Deer Creek to Upland 69 kV line.

AG1-414 will interconnect with the AEP transmission system via a new station cut into the Deer Creek - Upland 69 kV circuit.

To accommodate the interconnection on the Deer Creek - Upland 69 kV circuit, a new three (3) circuit breaker 69 kV switching station physically configured and operated as a ring-bus will be constructed (see Figure 3). Installation of associated protection and control equipment, 69 kV line risers, SCADA, and 69 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.

Installation of the generator lead first span exiting the POI station, including the first structure outside the AEP fence, will also be included in AEP's scope. In the case where the generator lead is a single span, the structure in the customer station will be the customer's responsibility.

5 Cost Summary

The AG1-414 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	\$10,293,000
Total System Network Upgrade Costs	\$20,000
Total Costs	\$10,313,000

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

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

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

6 Transmission Owner Scope of Work

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

6.1 Attachment Facilities

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

Description	Total Cost
138 kV Revenue Metering	\$388,000
Generator lead first span exiting the POI station, including the first structure outside the fence	\$400,000
Total Attachment Facility Costs	\$788,000

6.2 Direct Connection Cost Estimate

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

Description	Total Cost
The Mississinewa 138 kV substation will be rebuilt and six (6) new 138 kV circuit breaker(s) will be installed at the Mississinewa 138 kV substation (Attachment 1). Installation of associated protection and control equipment, 138 kV line risers, and SCADA will also be required.	\$9,370,000
Total Direct Connection Facility Costs	\$9,370,000

6.3 Non-Direct Connection Cost Estimate

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

Description	Total Cost
Review line protection and control settings at the Desoto 138 kV substation	\$45,000
Review line protection and control settings at the Deer Creek 138 kV substation	\$45,000
Review line protection and control settings at the Mississinewa 138 kV substation	\$45,000
Total Non-Direct Connection Facility Costs	\$135,000

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 signing 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 - Load Flow Analysis - Primary POI

The Queue Project AG1-414 was evaluated as a 75.0 MW (Capacity 45.0 MW) injection at the Mississinewa 138 kV substation in the AEP area. Project AG1-414 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-414 was studied with a commercial probability of 53.0 %. 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	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPAC T
161808475	960440	AF2-335 TAP	138.0	AEP	243369	05ROYERTON	138.0	AEP	1	AEP_P7-1_#11030-B	tower	223.0	103.99	104.77	DC	3.85
161808476	960440	AF2-335 TAP	138.0	AEP	243369	05ROYERTON	138.0	AEP	1	AEP_P7-1_#14998-A	tower	223.0	103.85	104.63	DC	3.85

10.4 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	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPAC T
168228702	243343	05MISSIS	138.0	AEP	243274	05DEER CRK1	138.0	AEP	1	AEP_P1-2_#14994-A	operation	240.0	75.04	106.29	DC	75.0
168228703	243343	05MISSIS	138.0	AEP	243274	05DEER CRK1	138.0	AEP	1	AEP_P2-1_243296 05GASTON 138 939760 AE1-207 TAP 138 1-A	operation	240.0	75.04	106.29	DC	75.0

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 LOADIN G %	POST PROJECT LOADIN G %	AC DC	MW IMPACT
168228726	243368	05ROSEHI	138.0	AEP	246656	05PENDLETON2	138.0	AEP	1	AEP_P1-2_#14974	operation	220.0	98.94	103.51	DC	10.04
168228740	243920	05MAKAHOY	138.0	AEP	243331	05LINWOO	138.0	AEP	1	AEP_P1-2_#14974	operation	240.0	95.99	100.17	DC	10.04

10.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
161808476,161 808475	1	AF2-335 TAP 138.0 kV - 05ROYERT 138.0 kV Ckt 1	<p><u>AEP</u> AEPI0059a (567) : 1) A sag study will be required on the 3.83 miles of ACSR ~ 636 ~ 26/7 ~ GROSBEAK - Conductor Section 1 to mitigate the overload. Depending on the sag study results, the cost for this upgrade is expected to be between \$20,000 (no remediation required, just sag study) and \$4.6 million (complete line reconductor/rebuild). New rating after sag study: S/N:167 S/E: 245. 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.</p> <p>Project Type : FAC Cost : \$20,000 Time Estimate : 6-12 Months</p>	\$20,000
			TOTAL COST	\$20,000

10.6 Flow Gate Details - Primary POI

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".

10.6.1 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
161808476	960440	AF2-335 TAP	AEP	243369	05ROYERTON	AEP	1	AEP_P7-1_#14998-A	tower	223.0	103.85	104.63	DC	3.85

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
246991	05WLD G1 C	0.2776	50/50	0.2776
247255	05WLD G2 C	0.2692	50/50	0.2692
247958	05WLD G2 E	23.1959	50/50	23.1959
247968	Z2-115 E	0.0546	Adder	0.06
920501	AA2-148 C O1	1.3708	Adder	1.61
920502	AA2-148 E O1	9.1741	Adder	10.79
934161	AD1-043 C O1	5.6097	50/50	5.6097
934162	AD1-043 E O1	9.1527	50/50	9.1527
936561	AD2-071 C	7.6943	50/50	7.6943
936562	AD2-071 E	3.7897	50/50	3.7897
939761	AE1-207 C	2.9343	Adder	3.45
939762	AE1-207 E	4.0521	Adder	4.77
939771	AE1-208 C	25.9198	50/50	25.9198
939772	AE1-208 E	35.3452	50/50	35.3452
941691	AE2-169	15.5519	50/50	15.5519
941711	AE2-171	3.6906	50/50	3.6906
941721	AE2-172	1.7466	Adder	2.05
942791	AE2-297 C O1	5.6519	Adder	6.65
942792	AE2-297 E O1	3.7679	Adder	4.43
959131	AF2-204 C	33.9307	50/50	33.9307
959132	AF2-204 E	17.9079	50/50	17.9079
960441	AF2-335 C	37.8996	50/50	37.8996
960442	AF2-335 E	12.6332	50/50	12.6332
960791	AF2-370	12.6332	50/50	12.6332
961171	AF2-408	3.8230	Adder	4.5
965461	AG1-414 C O1	1.0414	Adder	2.31
965462	AG1-414 E O1	0.6943	Adder	1.54
WEC	WEC	0.0444	Confirmed LTF	0.0444
LGEE	LGEE	0.1552	Confirmed LTF	0.1552
CPL	CPL	0.0314	Confirmed LTF	0.0314
CBM-W2	CBM-W2	2.4909	Confirmed LTF	2.4909
NY	NY	0.0171	Confirmed LTF	0.0171
TVA	TVA	0.2422	Confirmed LTF	0.2422
O-066	O-066	0.1817	Confirmed LTF	0.1817
SIGE	SIGE	0.0486	Confirmed LTF	0.0486
CBM-S2	CBM-S2	0.6890	Confirmed LTF	0.6890
CBM-S1	CBM-S1	0.0711	Confirmed LTF	0.0711
G-007	G-007	0.0283	Confirmed LTF	0.0283
MEC	MEC	0.2908	Confirmed LTF	0.2908
LAGN	LAGN	0.3115	Confirmed LTF	0.3115
CBM-W1	CBM-W1	1.2057	Confirmed LTF	1.2057

10.7 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
AD1-043	Makahoy 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
AE2-169	Delaware-Van Buren 138 kV	Active
AE2-171	Makahoy 138 kV	Active
AE2-172	Mississinewa-Gaston 138 kV	Active
AE2-297	Madison-Tanners Creek 138 kV	Active
AF2-204	Van Buren 138 kV	Active
AF2-335	West Del-Royerton 138 kV	Active
AF2-370	West Del-Royerton 138 kV	Active
AF2-408	Fall Creek 138 kV	Active
AG1-414	Mississinewa 138 kV	Active
Z2-115	Deer Creek 12.47kV	In Service

10.8 Contingency Descriptions - Primary POI

Contingency Name	Contingency Definition
AEP_P2-1_243296 05GASTON 138 939760 AE1-207 TAP 138 1-A	CONTINGENCY 'AEP_P2-1_243296 05GASTON 138 939760 AE1-207 TAP 138 1-A' OPEN BRANCH FROM BUS 243296 TO BUS 939760 CKT 1 END
AEP_P1-2_#14974	CONTINGENCY 'AEP_P1-2_#14974' OPEN BRANCH FROM BUS 246988 TO BUS 247116 CKT 1 / 246988 05STRWTN 138 247116 05ALADDIN 138 1 END
AEP_P7-1_#11030-B	CONTINGENCY 'AEP_P7-1_#11030-B' OPEN BRANCH FROM BUS 246000 TO BUS 243387 CKT 1 / 246000 05VANBUREQ 999 243387 05VANBUR 138 1 OPEN BRANCH FROM BUS 246000 TO BUS 245999 CKT Z1 / 246000 05VANBUREQ 999 245999 05VAN BURE 69.0 Z1 OPEN BRANCH FROM BUS 246000 TO BUS 245998 CKT Z1 / 246000 05VANBUREQ 999 245998 05VAN BURE 12.0 Z1 OPEN BRANCH FROM BUS 959130 TO BUS 243387 CKT 1 / 959130 AF2-204 TAP 138 243387 05VANBUR 138 1 OPEN BRANCH FROM BUS 243278 TO BUS 243296 CKT 1 / 243278 05DESOTO 138 243296 05GASTON 138 1 OPEN BRANCH FROM BUS 243296 TO BUS 939760 CKT 1 / 243296 05GASTON 138 939760 AE1-207 TAP 138 1 OPEN BRANCH FROM BUS 243377 TO BUS 246982 CKT 1 / 243377 05SORENS 138 246982 05HUNT JT_BP 138 1 OPEN BRANCH FROM BUS 243387 TO BUS 246982 CKT 1 / 243387 05VANBUR 138 246982 05HUNT JT_BP 138 1 OPEN BRANCH FROM BUS 245987 TO BUS 245999 CKT 1 / 245987 05MTETNA T 69.0 245999 05VAN BURE 69.0 1 END
AEP_P7-1_#14998-A	CONTINGENCY 'AEP_P7-1_#14998-A' OPEN BRANCH FROM BUS 243387 TO BUS 246000 CKT 1 / 243387 05VANBUR 138 246000 05VANBUREQ 999 1 OPEN BRANCH FROM BUS 245999 TO BUS 246000 CKT Z1 / 245999 05VAN BURE 69.0 246000 05VANBUREQ 999 Z1 OPEN BRANCH FROM BUS 245998 TO BUS 246000 CKT Z1 / 245998 05VAN BURE 12.0 246000 05VANBUREQ 999 Z1 OPEN BRANCH FROM BUS 959130 TO BUS 243387 CKT 1 / 959130 AF2-204 TAP 138 243387 05VANBUR 138 1 OPEN BRANCH FROM BUS 243377 TO BUS 246982 CKT 1 / 243377 05SORENS 138 246982 05HUNT JT_BP 138 1 OPEN BRANCH FROM BUS 243387 TO BUS 246982 CKT 1 / 243387 05VANBUR 138 246982 05HUNT JT_BP 138 1 OPEN BRANCH FROM BUS 245987 TO BUS 245999 CKT 1 / 245987 05MTETNA T 69.0 245999 05VAN BURE 69.0 1 OPEN BRANCH FROM BUS 243278 TO BUS 243296 CKT 1 / 243278 05DESOTO 138 243296 05GASTON 138 1 END

Contingency Name	Contingency Definition
AEP_P1-2_#14994-A	CONTINGENCY 'AEP_P1-2_#14994-A' OPEN BRANCH FROM BUS 243278 TO BUS 243296 CKT 1 / 243278 05DESOTO 138 243296 05GASTON 138 1 OPEN BRANCH FROM BUS 243296 TO BUS 939760 CKT 1 / 243296 05GASTON 138 939760 AE1-207 TAP 138 1 END

11 Short Circuit Analysis - Primary POI

The following Breakers are overdutied:

None.

12 Summer Peak - Load Flow Analysis - Secondary POI

The Queue Project AG1-414 was evaluated as a 75.0 MW (Capacity 45.0 MW) injection tapping the Deer Creek to Upland 69 kV line in the AEP area. Project AG1-414 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-414 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

12.1 Generation Deliverability

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

None

12.2 Multiple Facility Contingency

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

None

12.3 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	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
174086819	243237	05ADAM	138.0	AEP	243334	05MAGLEY	138.0	AEP	1	AEP_P5_#11291_05DESO_05DESO	breaker	359.0	101.71	102.55	DC	6.69
174086745	243334	05MAGLEY	138.0	AEP	243242	05ALLEN	138.0	AEP	1	AEP_P5_#11291_05DESO_05DESO	breaker	341.0	109.7	111.99	DC	7.81

12.4 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	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
168228658	243334	05MAGLEY	138.0	AEP	243242	05ALLEN	138.0	AEP	1	Base Case	operation	257.0	111.3	112.07	DC	4.41
168228726	243368	05ROSEHILL	138.0	AEP	246656	05PENDLETON2	138.0	AEP	1	AEP_P1-2_#14974	operation	220.0	98.94	103.27	DC	9.51
170022423	946030	AF1-268 TAP	138.0	AEP	243278	05DESOTO	138.0	AEP	1	AEP_P1-2_#10526-B	operation	409.0	106.72	107.43	DC	6.38

12.5 Flow Gate Details - Secondary POI

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".

12.5.1 Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJE CT LOADIN G %	POST PROJE CT LOADIN G %	AC D C	MW IMPAC T
174086819	243237	05ADAM	AEP	243334	05MAGLEY	AEP	1	AEP_P5_#11291_05DESO_05DESO	breaker	359.0	101.71	102.55	DC	6.69

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
247536	05BLUFF P WF	0.9052	50/50	0.9052
247621	Y3-024	0.0849	50/50	0.0849
247929	S-071 E	22.9488	50/50	22.9488
933594	AC2-176 C	0.7741	50/50	0.7741
933596	AC2-176 E	32.8352	50/50	32.8352
940981	AE2-089 C O1	39.2404	50/50	39.2404
940982	AE2-089 E O1	26.1603	50/50	26.1603
942071	AE2-219 C	8.6247	50/50	8.6247
942072	AE2-219 E	11.9103	50/50	11.9103
942221	AE2-234 C O1	3.0735	50/50	3.0735
942222	AE2-234 E O1	1.3901	50/50	1.3901
946031	AF1-268 C O1	16.5773	50/50	16.5773
946032	AF1-268 E O1	7.5193	50/50	7.5193
957741	AF2-068 C O1	26.1288	50/50	26.1288
957742	AF2-068 E O1	17.4192	50/50	17.4192
961761	AG1-017 C	0.8506	50/50	0.8506
961762	AG1-017 E	3.9803	50/50	3.9803
962031	AG1-047 C	17.4192	50/50	17.4192
962032	AG1-047 E	11.6128	50/50	11.6128
963731	AG1-225 C	104.9428	50/50	104.9428
963732	AG1-225 E	70.4688	50/50	70.4688
964611	AG1-324 C O2	7.8386	50/50	7.8386
964612	AG1-324 E O2	5.2258	50/50	5.2258
965461	AG1-414 C O2	1.8077	Adder	4.01
965462	AG1-414 E O2	1.2051	Adder	2.68
LGEE	LGEE	0.2620	Confirmed LTF	0.2620
CPL	CPL	0.0614	Confirmed LTF	0.0614
G-007A	G-007A	0.0384	Confirmed LTF	0.0384
VFT	VFT	0.1032	Confirmed LTF	0.1032
CBM-W2	CBM-W2	0.8960	Confirmed LTF	0.8960
TVA	TVA	0.1680	Confirmed LTF	0.1680
SIGE	SIGE	0.0331	Confirmed LTF	0.0331
CBM-S2	CBM-S2	1.0544	Confirmed LTF	1.0544
CBM-S1	CBM-S1	0.0661	Confirmed LTF	0.0661
CBM-N	CBM-N	0.0192	Confirmed LTF	0.0192
LAGN	LAGN	0.1120	Confirmed LTF	0.1120

12.5.2 Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJE CT LOADIN G %	POST PROJE CT LOADIN G %	AC D C	MW IMPAC T
174086745	243334	05MAGLEY	AEP	243242	05ALLEN	AEP	1	AEP_P5_#11291_05DESO_05DESO	breaker	341.0	109.7	111.99	DC	7.81

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
247536	05BLUFF P WF	0.8850	50/50	0.8850
247621	Y3-024	0.0863	50/50	0.0863
247929	S-071 E	22.4390	50/50	22.4390
933594	AC2-176 C	0.7405	50/50	0.7405
933596	AC2-176 E	31.4101	50/50	31.4101
940981	AE2-089 C O1	35.6878	50/50	35.6878
940982	AE2-089 E O1	23.7919	50/50	23.7919
942071	AE2-219 C	8.4395	50/50	8.4395
942072	AE2-219 E	11.6545	50/50	11.6545
942221	AE2-234 C O1	4.9015	50/50	4.9015
942222	AE2-234 E O1	2.2168	50/50	2.2168
946031	AF1-268 C O1	15.8584	50/50	15.8584
946032	AF1-268 E O1	7.1932	50/50	7.1932
957741	AF2-068 C O1	24.9948	50/50	24.9948
957742	AF2-068 E O1	16.6632	50/50	16.6632
961761	AG1-017 C	0.8137	50/50	0.8137
961762	AG1-017 E	3.8075	50/50	3.8075
962031	AG1-047 C	16.6632	50/50	16.6632
962032	AG1-047 E	11.1088	50/50	11.1088
963731	AG1-225 C	93.6116	50/50	93.6116
963732	AG1-225 E	62.8600	50/50	62.8600
963791	AG1-232 C	48.5741	50/50	48.5741
963792	AG1-232 E	32.3827	50/50	32.3827
964611	AG1-324 C O2	7.4984	50/50	7.4984
964612	AG1-324 E O2	4.9990	50/50	4.9990
965461	AG1-414 C O2	4.6858	50/50	4.6858
965462	AG1-414 E O2	3.1239	50/50	3.1239
LGEE	LGEE	0.2783	Confirmed LTF	0.2783
CPL	CPL	0.0648	Confirmed LTF	0.0648
G-007A	G-007A	0.0216	Confirmed LTF	0.0216
VFT	VFT	0.0581	Confirmed LTF	0.0581
CBM-W2	CBM-W2	1.1827	Confirmed LTF	1.1827
TVA	TVA	0.1974	Confirmed LTF	0.1974
SIGE	SIGE	0.0381	Confirmed LTF	0.0381
CBM-S2	CBM-S2	1.1275	Confirmed LTF	1.1275
CBM-S1	CBM-S1	0.0745	Confirmed LTF	0.0745
CBM-N	CBM-N	0.0108	Confirmed LTF	0.0108
LAGN	LAGN	0.1522	Confirmed LTF	0.1522

12.6 Contingency Descriptions - Secondary POI

Contingency Name	Contingency Definition
Base Case	
AEP_P1-2_#10526-B	CONTINGENCY 'AEP_P1-2_#10526-B' / 1098 OPEN BRANCH FROM BUS 243362 TO BUS 942070 CKT 1 / 243362 05RANDOL 138 942070 AE2-219 TAP 138 1 END
AEP_P1-2_#14974	CONTINGENCY 'AEP_P1-2_#14974' / 574 OPEN BRANCH FROM BUS 246988 TO BUS 247116 CKT 1 / 246988 05STRWTN 138 247116 05ALADDIN 138 1 END
AEP_P5_#11291_05DESO_05DESO	CONTINGENCY 'AEP_P5_#11291_05DESO_05DESO' / 647 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 243792 CKT 2 / 243218 05DESOTO 345 243792 05LOSANTVILL 345 2 OPEN BRANCH FROM BUS 243218 TO BUS 958860 CKT 2 / 243218 05DESOTO 345 958860 AF2-177 TAP 345 2 OPEN BRANCH FROM BUS 243218 TO BUS 243233 CKT 1 / 243218 05DESOTO 345 243233 05TANNER 345 1 OPEN BRANCH FROM BUS 243218 TO BUS 923880 CKT 1 / 243218 05DESOTO 345 923880 AB2-028 TAP 345 1 OPEN BRANCH FROM BUS 243218 TO BUS 243278 CKT 1 / 243218 05DESOTO 345 243278 05DESOTO 138 1 OPEN BRANCH FROM BUS 243218 TO BUS 243278 CKT 2 / 243218 05DESOTO 345 243278 05DESOTO 138 2 OPEN BRANCH FROM BUS 243235 TO BUS 246625 CKT 1 / 243235 0523RD 138 246625 05MEDFORD_BP 138 1 OPEN BRANCH FROM BUS 243278 TO BUS 243296 CKT 1 / 243278 05DESOTO 138 243296 05GASTON 138 1 OPEN BRANCH FROM BUS 243278 TO BUS 946030 CKT 1 / 243278 05DESOTO 138 946030 AF1-268 TAP 138 1 OPEN BRANCH FROM BUS 243278 TO BUS 243337 CKT 1 / 243278 05DESOTO 138 243337 05MAYFIE 138 1 OPEN BRANCH FROM BUS 243278 TO BUS 243369 CKT 1 / 243278 05DESOTO 138 243369 05ROYERTON 138 1 OPEN BRANCH FROM BUS 243296 TO BUS 939760 CKT 1 / 243296 05GASTON 138 939760 AE1-207 TAP 138 1 OPEN BRANCH FROM BUS 243337 TO BUS 246625 CKT 1 / 243337 05MAYFIE 138 246625 05MEDFORD_BP 138 1 OPEN BRANCH FROM BUS 243369 TO BUS 960440 CKT 1 / 243369 05ROYERTON 138 960440 AF2-335 TAP 138 1 REMOVE LOAD D2 FROM BUS 243296 /* 243296 05GASTON 138 DEFAULT DISPATCH REMOVE LOAD D1 FROM BUS 243369 /* 243369 05ROYERTON 138 DEFAULT DISPATCH END

13 Affected Systems

13.1 TVA

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

13.2 Duke Energy Progress

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

13.3 MISO

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

13.4 LG&E

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