Generation Interconnection

Feasibility Study Report

for

Queue Project AG1-562

MARYSVILLE-GUNN ROAD 345 KV

150 MW Capacity / 250 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.

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 Hardin County, Ohio. The installed facilities will have a total capability of 250 MW with 150 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is December 04, 2023. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-562
Project Name	MARYSVILLE-GUNN ROAD 345 KV
State	Ohio
County	Hardin
Transmission Owner	AEP
MFO	250
MWE	250
MWC	150
Fuel	Solar
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 – Primary POI

AG1-562 will interconnect with the AEP transmission system via a new station cut into the Gunn Road - Marysville 345 kV circuit (North side of the Marysville-Gunn Road/Southwest Lima Double Circuit line).

To accommodate the interconnection on the Gunn Road - Marysville 345 kV circuit, a new three (3) circuit breaker 345 kV switching station physically configured and operated as a ring-bus will be constructed (see Attachment 1). Installation of associated protection and control equipment, 345 kV line risers, SCADA, and 345 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 Point of Interconnection – Secondary POI

AG1-562 will interconnect with the AEP transmission system via a new station cut into the Marysville - Southwest Lima 345 kV circuit (South side of the Marysville-Gunn Road/Southwest Lima Double Circuit line).

To accommodate the interconnection on the Marysville - Southwest Lima 345 kV circuit, a new three (3) circuit breaker 345 kV switching station physically configured and operated as a ring-bus will be constructed (see Attachment 2). Installation of associated protection and control equipment, 345 kV line risers, SCADA, and 345 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.

6 Cost Summary

The AG1-562 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$19,822,000
Total System Network Upgrade Costs	$400,000
Total Costs	**$20,222,000**

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.

7 Transmission Owner Scope of Work

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

7.1 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
345 kV Revenue Metering	$431,000
Generator lead first span exiting the POI station, including the first structure outside the fence	$651,000
Total Attachment Facility Costs	**$1,082,000**

7.2 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
A new three (3) circuit breaker 345 kV switching station physically configured and operated as a ring-bus will be constructed. Installation of associated protection and control equipment, 345 kV line risers, and SCADA will also be required.	$17,440,000
Total Direct Connection Facility Costs	**$17,440,000**

7.3 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
Gunn Road - Marysville 345 kV T-Line Cut In	$1,210,000
Review Protection and Control Settings at the Gunn Road 345 kV substation	$45,000
Review Protection and Control Settings at the Marysville 345 kV substation	$45,000
Total Non-Direct Connection Facility Costs	**$1,300,000**

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 (IC) is responsible for all costs associated with this interconnection. The costs above are reimbursable to the Transmission Owner. The cost of the IC's generating plant and the costs for the line connecting the generating plant to the Point of Interconnection are not included in this report; these are assumed to be the IC's responsibility.

The Generation Interconnection Agreement does not in or by itself establish a requirement for the Transmission Owner to provide power for consumption at the developer's facilities. A separate agreement may be reached with the local utility that provides service in the area to ensure that infrastructure is in place to meet this demand and proper metering equipment is installed. It is the responsibility of the developer to contact the local service provider to determine if a local service agreement is required.

1. An Interconnection Customer entering the New Services Queue on or after October 1, 2012 with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

2. The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Revenue Metering and SCADA Requirements

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 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)

10.3 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/

11 Summer Peak - Load Flow Analysis - Primary POI

The Queue Project AG1-562 was evaluated as a 250.0 MW (Capacity 150.0 MW) injection tapping the Marysville to Gunn Road 345 kV line in the AEP area. Project AG1-562 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-562 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

11.1 Generation Deliverability

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

None

11.2 Multiple Facility Contingency

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

None

11.3 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
16749742	242935	05E LIMA	345.0	AEP	242989	05E LIMA	138.0	AEP	2	AEP_P4_#463_05E	breaker	368.0	122.11	124.46	DC	19.2
16829171	242935	05E LIMA	345.0	AEP	242989	05E LIMA	138.0	AEP	2	AEP_P1-3_#57_05E LIMA 345_1	single	368.0	103.19	105.35	DC	7.92

11.4 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
16829162	242935	05E LIMA	345.0	AEP	242945	05SW LIM	345.0	AEP	1	AEP_P2-1_242939 05MARYSV 345 945620 AF1-227 TAP 345 1-A	operation	971.0	125.34	132.82	DC	72.56
16829171	242935	05E LIMA	345.0	AEP	242989	05E LIMA	138.0	AEP	2	AEP_P1-3_#57_05E LIMA 345_1	operation	368.0	117.38	119.0	DC	13.19
16829180	242939	05MARYSV	345.0	AEP	243458	05HYATT	345.0	AEP	1	AEP_P1-3_#7222_05MALIS 765_1	operation	1335.0	103.44	106.57	DC	41.8

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
16829157 8	243902	05HARDIN SS	345.0	AEP	242935	05E LIMA	345.0	AEP	1	AEP_P2-1_242939 05MARYSV 345 945620 AF1-227 TAP 345 1-A	operation	1123.0	130.23	152.48	DC	249.87
16829158 0	243902	05HARDIN SS	345.0	AEP	242935	05E LIMA	345.0	AEP	1	Base Case	operation	897.0	107.04	117.33	DC	92.24
17009607 0	945620	AF1-227 TAP	345.0	AEP	242939	05MARYSV	345.0	AEP	1	AEP_P1-2_#6496_3100583	operation	1151.0	127.07	148.78	DC	249.87
17009607 1	945620	AF1-227 TAP	345.0	AEP	242939	05MARYSV	345.0	AEP	1	Base Case	operation	897.0	115.72	133.3	DC	157.64
17009617 0	966910	AG1-562 TAP	345.0	AEP	945620	AF1-227 TAP	345.0	AEP	1	AEP_P1-2_#6496_3100583	operation	1151.0	98.85	120.56	DC	249.87
17009617 2	966910	AG1-562 TAP	345.0	AEP	945620	AF1-227 TAP	345.0	AEP	1	Base Case	operation	897.0	92.79	110.37	DC	157.64

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
168291719,167497428	1	05E LIMA 345.0 kV - 05E LIMA 138.0 kV Ckt 2	AEP AEPO0051a (592) : Replace E Lima Riser Sub Cond 1000 MCM CU Project Type : FAC Cost : $100,000 Time Estimate : 12-18 Months AEPO0051b (593) : Replace three E Lima 138kV Riser Sub Cond 1590 AAC Str Project Type : FAC Cost : $300,000 Time Estimate : 12-18 Months	$400,000
			TOTAL COST	$400,000

11.6 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".

11.6.1 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
167497428	242935	05E LIMA	AEP	242989	05E LIMA	AEP	2	AEP_P4_#463_05E	breaker	368.0	122.11	124.46	DC	19.2

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
244357	05GRANGER EL	-0.2763	Adder	-0.33
246936	05BLCK-1 C	0.2675	50/50	0.2675
246937	05BLCK-2 C	0.2675	50/50	0.2675
246938	05BLCK-3 C	0.2691	50/50	0.2691
247540	U2-072 C	0.6165	50/50	0.6165
247549	V3-028 C	0.1377	50/50	0.1377
247908	05BLCK-1 E	9.5946	50/50	9.5946
247909	05BLCK-2 E	9.5946	50/50	9.5946
247910	05BLCK-3 E	9.7600	50/50	9.7600
247932	U2-072 E	26.1522	50/50	26.1522
247948	V3-028 E	1.4241	50/50	1.4241
925133	AB2-170 C	0.8952	50/50	0.8952
925135	AB2-170 E	9.2569	50/50	9.2569
932301	AC2-044 C	0.7858	50/50	0.7858
932302	AC2-044 E	1.2820	50/50	1.2820
934980	AD1-130 C	13.2077	50/50	13.2077
934984	AD1-130 E	6.6383	50/50	6.6383
936671	AD2-086 C	15.8493	50/50	15.8493
936672	AD2-086 E	10.5662	50/50	10.5662
936721	AD2-091	5.7425	50/50	5.7425
938681	AE1-090 C	2.4762	50/50	2.4762
938682	AE1-090 E	3.2663	50/50	3.2663
938761	AE1-102 C	1.6129	50/50	1.6129
938762	AE1-102 E	1.0753	50/50	1.0753
942041	AE2-216	6.3167	50/50	6.3167
942871	AE2-306 C O1	1.8036	50/50	1.8036
942872	AE2-306 E O1	1.2024	50/50	1.2024
946201	AF1-285 C	5.6112	50/50	5.6112
946202	AF1-285 E	4.4088	50/50	4.4088
957201	AF2-014 C	9.3051	50/50	9.3051
957202	AF2-014 E	6.2034	50/50	6.2034
965421	AG1-410 C O1	7.6808	Adder	17.05
965422	AG1-410 E O1	5.1206	Adder	11.37
965431	AG1-411 O1	4.2671	Adder	9.47
966911	AG1-562 C O1	5.1904	Adder	11.52
966912	AG1-562 E O1	3.4603	Adder	7.68
WEC	WEC	0.1732	Confirmed LTF	0.1732
LGEE	LGEE	0.0829	Confirmed LTF	0.0829
CPLE	CPLE	0.0778	Confirmed LTF	0.0778
CBM-W2	CBM-W2	2.8224	Confirmed LTF	2.8224
NY	NY	0.0924	Confirmed LTF	0.0924
TVA	TVA	0.3360	Confirmed LTF	0.3360

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
O-066	O-066	0.8345	Confirmed LTF	0.8345
SIGE	SIGE	0.0407	Confirmed LTF	0.0407
CBM-S2	CBM-S2	1.4825	Confirmed LTF	1.4825
CBM-S1	CBM-S1	0.0836	Confirmed LTF	0.0836
G-007	G-007	0.1292	Confirmed LTF	0.1292
MEC	MEC	0.7389	Confirmed LTF	0.7389
LAGN	LAGN	0.4917	Confirmed LTF	0.4917
CBM-W1	CBM-W1	0.3785	Confirmed LTF	0.3785

11.7 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
AB2-170	East Lima-Marysville 345kV	Partially in Service - Under Construction
AC2-044	Maddox Creek 345kV	Active
AD1-130	Hardin Switch 345 kV	Active
AD2-086	Marysville-East Lima Hardin Switch 345kV	Active
AD2-091	Hardin Tap 345kV	Active
AE1-090	Hardin Switch 345 kV	Active
AE1-102	Maddox Creek 345 kV	Active
AE2-216	Hardin Switch 345 kV	Active
AE2-306	Gunn Road 345 kV	Active
AF1-285	Gunn Road 345 kV	Active
AF2-014	Maddox Creek 345 kV	Active
AG1-410	Maddox Creek-RP Mone 345 kV	Active
AG1-411	Maddox Creek-RP Mone 345 kV	Active
AG1-562	Marysville-Gunn Road 345 kV	Active
U2-072	East Lima-Marysville 345kV	Partially in Service - Under Construction
V3-028	East Lima-Marysville 345kV	Partially in Service - Under Construction

11.8 Contingency Descriptions - Primary POI

Contingency Name	Contingency Definition
AEP_P1-3_#7222_05MALIS 765_1	CONTINGENCY 'AEP_P1-3_#7222_05MALIS 765_1' OPEN BRANCH FROM BUS 242926 TO BUS 242928 CKT 1 / 242926 05MALIS 765 242928 05MARYSV 765 1 OPEN BRANCH FROM BUS 242926 TO BUS 246751 CKT 1 / 242926 05MALIS 765 246751 05VASSEL 765 1 OPEN BRANCH FROM BUS 242926 TO BUS 243538 CKT 1 / 242926 05MALIS 765 243538 05MALISX 138 1 OPEN BRANCH FROM BUS 243537 TO BUS 243538 CKT SR / 243537 05MALIS 138 243538 05MALISX 138 SR OPEN BRANCH FROM BUS 243537 TO BUS 243538 CKT ZB / 243537 05MALIS 138 243538 05MALISX 138 ZB END
AEP_P1-2_#6496_3100583	CONTINGENCY 'AEP_P1-2_#6496_3100583' OPEN BRANCH FROM BUS 242935 TO BUS 243902 CKT 1 / 242935 05E LIMA 345 243902 05HARDIN SS 345 1 END
AEP_P1-3_#57_05E LIMA 345_1	CONTINGENCY 'AEP_P1-3_#57_05E LIMA 345_1' OPEN BRANCH FROM BUS 242935 TO BUS 242989 CKT 1 / 242935 05E LIMA 345 242989 05E LIMA 138 1 END
AEP_P2-1_242939 05MARYSV 345 945620 AF1-227 TAP 345 1-A	CONTINGENCY 'AEP_P2-1_242939 05MARYSV 345 945620 AF1-227 TAP 345 1-A' OPEN BRANCH FROM BUS 242939 TO BUS 945620 CKT 1 END
Base Case	
AEP_P4_#463_05E	CONTINGENCY '"AEP_P4_#463_05E' LIMA 345_P" / 1409 OPEN BRANCH FROM BUS 242935 TO BUS 242936 CKT 1 / 242935 05E LIMA 345 242936 05FOSTOR 345 1 OPEN BRANCH FROM BUS 242935 TO BUS 242945 CKT 1 / 242935 05E LIMA 345 242945 05SW LIM 345 1 END

12 Short Circuit Analysis - Primary POI

The following Breakers are overdutied

None

13 Summer Peak - Load Flow Analysis - Secondary POI

The Queue Project AG1-562 was evaluated as a 250.0 MW (Capacity 150.0 MW) injection tapping the Marysville to Southwest Lima 345 kV line in the AEP area. Project AG1-562 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-562 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

13.1 Generation Deliverability

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

None

13.2 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
16481078 8	24597 7	05GRISTMIL L	345. 0	AEP	25306 9	09SHELB Y	345. 0	DAY	1	PEORIA_A A 345KV	breake r	1374. 0	96.28	103.17	DC	94.79

13.3 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)

None

13.4 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
17576542 6	24293 9	05MARYS V	345. 0	AEP	96366 0	AG1-218 TAP	345. 0	AEP	1	AEP_P1-3_#7222_05MA LIS 765_1	operatio n	1335. 0	100.13	103.4	DC	43.6
17576539 3	96366 0	AG1-218 TAP	345. 0	AEP	24345 8	05HYAT T	345. 0	AEP	1	AEP_P1-3_#7222_05MA LIS 765_1	operatio n	1335. 0	108.41	111.67	DC	43.6

13.5 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".

13.5.1 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
164810788	245977	05GRISTMILL	AEP	253069	09SHELBY	DAY	1	PEORIA_AA 345KV	breaker	1374.0	96.28	103.17	DC	94.79

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
238979	02NAPMUN	2.7308	Adder	3.21
240968	02BG2 GEN	0.5200	Adder	0.61
240969	02BG4 G1	0.1293	Adder	0.15
240973	02BG6 AMPO	2.0140	Adder	2.37
240975	02PGE GEN	2.6635	Adder	3.13
240997	02BG10	1.4368	Adder	1.69
241946	**AB1-107 CT1 (Suspended)**	**18.9383**	**Adder**	**22.28**
241947	**AB1-107 CT2 (Suspended)**	**19.1113**	**Adder**	**22.48**
241948	**AB1-107 ST1 (Suspended)**	**21.5220**	**Adder**	**25.32**
244357	05GRANGER EL	0.4777	50/50	0.4777
246936	05BLCK-1 C	0.3939	50/50	0.3939
246937	05BLCK-2 C	0.3939	50/50	0.3939
246938	05BLCK-3 C	0.3963	50/50	0.3963
246953	05TIMB G C	0.3706	50/50	0.3706
247270	05RPMNG1	2.8805	50/50	2.8805
247271	05RPMNG2	2.8786	50/50	2.8786
247272	05RPMNG3	2.8805	50/50	2.8805
247521	T131	0.5127	50/50	0.5127
247522	U1-059 C	0.2392	50/50	0.2392
247540	U2-072 C	1.4052	50/50	1.4052
247548	V4-010 C	1.8904	Adder	2.22
247549	V3-028 C	0.2740	50/50	0.2740
247551	**U4-028 C (Suspended)**	**0.9654**	**Adder**	**1.14**
247552	**U4-029 C (Suspended)**	**0.9654**	**Adder**	**1.14**
247555	W1-056 C	0.0598	50/50	0.0598
247607	V1-011 C	0.2609	50/50	0.2609
247908	05BLCK-1 E	14.1269	50/50	14.1269
247909	05BLCK-2 E	14.1269	50/50	14.1269
247910	05BLCK-3 E	14.3705	50/50	14.3705
247911	05TIMB G E	12.3905	50/50	12.3905
247932	U2-072 E	59.6046	50/50	59.6046
247940	**U4-028 E (Suspended)**	**6.4610**	**Adder**	**7.6**
247941	**U4-029 E (Suspended)**	**6.4610**	**Adder**	**7.6**
247942	W1-056 E	2.5266	50/50	2.5266
247947	V4-010 E	12.6514	Adder	14.88
247948	V3-028 E	2.8332	50/50	2.8332
247959	V1-011 E	11.0681	50/50	11.0681
253349	AC2-067 C	-2.8291	Adder	-3.33
270164	T-131 E	12.9996	50/50	12.9996
270165	U1-059 E	6.8691	50/50	6.8691
925133	AB2-170 C	1.7809	50/50	1.7809
925135	AB2-170 E	18.4155	50/50	18.4155

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
926811	AC1-167 C O1	3.5586	50/50	3.5586
926812	AC1-167 E O1	1.7263	50/50	1.7263
926865	AC1-173 C	0.1692	50/50	0.1692
926866	AC1-173 E	7.1498	50/50	7.1498
927185	**AC1-212 BAT (Withdrawn : 12/16/2020)**	**2.0967**	**50/50**	**2.0967**
932301	AC2-044 C	1.1569	50/50	1.1569
932302	AC2-044 E	1.8877	50/50	1.8877
934461	AD1-070 C O1	4.2858	50/50	4.2858
934462	AD1-070 E O1	20.1195	50/50	20.1195
934741	AD1-101 C O1	3.0893	50/50	3.0893
934742	AD1-101 E O1	5.0414	50/50	5.0414
934791	AD1-106 C O1	2.3026	50/50	2.3026
934792	AD1-106 E O1	3.7568	50/50	3.7568
934891	AD1-118	5.0712	Adder	5.97
934901	AD1-119 C O1	2.0974	50/50	2.0974
934902	AD1-119 E O1	3.4226	50/50	3.4226
934980	AD1-130 C	26.2752	50/50	26.2752
934984	AD1-130 E	13.2061	50/50	13.2061
936671	AD2-086 C	31.5302	50/50	31.5302
936672	AD2-086 E	21.0202	50/50	21.0202
936721	AD2-091	11.4240	50/50	11.4240
937021	AD2-136 C O1	3.4756	Adder	4.09
937022	AD2-136 E O1	23.2596	Adder	27.36
938681	AE1-090 C	4.9260	50/50	4.9260
938682	AE1-090 E	6.4980	50/50	6.4980
938691	AE1-091 C	8.6478	50/50	8.6478
938692	AE1-091 E	11.6219	50/50	11.6219
938761	AE1-102 C	2.3748	50/50	2.3748
938762	AE1-102 E	1.5832	50/50	1.5832
938911	AE1-119	39.8450	Adder	46.88
939161	AE1-146 C O1	11.3473	50/50	11.3473
939162	AE1-146 E O1	5.2991	50/50	5.2991
940031	AE1-245 C	2.4823	50/50	2.4823
940032	AE1-245 E	16.6126	50/50	16.6126
940841	AE2-072 C	13.3794	50/50	13.3794
940842	AE2-072 E	8.9196	50/50	8.9196
941741	AE2-174 C	2.5339	Adder	2.98
941742	AE2-174 E	11.8625	Adder	13.96
941781	AE2-181 C	2.2216	Adder	2.61
941782	AE2-181 E	1.4811	Adder	1.74
942041	AE2-216	12.5664	50/50	12.5664
942661	AE2-282 C	3.2438	Adder	3.82
942662	AE2-282 E	1.7069	Adder	2.01
942801	AE2-298 C	3.8205	50/50	3.8205
942802	AE2-298 E	2.5470	50/50	2.5470
942871	AE2-306 C O1	4.1107	50/50	4.1107
942872	AE2-306 E O1	2.7404	50/50	2.7404
943181	AE2-322 C	4.2682	50/50	4.2682
943182	AE2-322 E	2.0864	50/50	2.0864
943581	AF1-029 C O1	1.9103	50/50	1.9103
943582	AF1-029 E O1	1.2735	50/50	1.2735

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
943791	AF1-047 C	2.2114	50/50	2.2114
943792	AF1-047 E	1.4743	50/50	1.4743
943853	AF1-053 BAT	3.2120	Merchant Transmission	3.2120
943951	AF1-063 C O1	1.4038	Adder	1.65
943952	AF1-063 E O1	0.7783	Adder	0.92
943961	AF1-064 C O1	2.4762	Adder	2.91
943962	AF1-064 E O1	1.2307	Adder	1.45
944081	AF1-076 C O1	20.0385	50/50	20.0385
944082	AF1-076 E O1	12.4915	50/50	12.4915
944091	AF1-077 C O1	20.0385	50/50	20.0385
944092	AF1-077 E O1	12.4915	50/50	12.4915
944171	AF1-085 C O1	10.3786	50/50	10.3786
944172	AF1-085 E O1	14.3323	50/50	14.3323
944481	AF1-113 C O1	63.5397	50/50	63.5397
944482	AF1-113 E O1	19.7607	50/50	19.7607
944551	AF1-120 C	1.9655	Adder	2.31
944552	AF1-120 E	0.9901	Adder	1.16
944991	AF1-164 C O1	74.0298	50/50	74.0298
944992	AF1-164 E O1	39.8622	50/50	39.8622
945401	AF1-205 C	1.7713	Adder	2.08
945402	AF1-205 E	1.1809	Adder	1.39
945411	AF1-206 C O1	8.8225	Adder	10.38
945412	AF1-206 E O1	5.8817	Adder	6.92
945621	AF1-227 C O1	44.4561	50/50	44.4561
945622	AF1-227 E O1	29.6374	50/50	29.6374
945641	AF1-229 C	5.2969	Adder	6.23
945642	AF1-229 E	3.5312	Adder	4.15
946201	AF1-285 C	12.7887	50/50	12.7887
946202	AF1-285 E	10.0483	50/50	10.0483
957201	AF2-014 C	13.7007	50/50	13.7007
957202	AF2-014 E	9.1338	50/50	9.1338
957651	AF2-059 C	2.6957	50/50	2.6957
957652	AF2-059 E	3.7227	50/50	3.7227
958091	AF2-103 C	0.1679	50/50	0.1679
958092	AF2-103 E	0.2328	50/50	0.2328
958321	AF2-126 C	2.5207	Adder	2.97
958322	AF2-126 E	1.2603	Adder	1.48
958331	AF2-127 C	1.8111	Adder	2.13
958332	AF2-127 E	0.9528	Adder	1.12
958951	AF2-186 C O1	2.1208	50/50	2.1208
958952	AF2-186 E O1	2.9287	50/50	2.9287
960301	AF2-321 C	6.9019	Adder	8.12
960302	AF2-321 E	4.6013	Adder	5.41
960841	AF2-375 C	9.9027	50/50	9.9027
960842	AF2-375 E	6.6018	50/50	6.6018
960851	AF2-376 C	2.0514	50/50	2.0514
960852	AF2-376 E	3.0771	50/50	3.0771
960861	AF2-377 C	2.1666	50/50	2.1666
960862	AF2-377 E	3.2499	50/50	3.2499
961831	AG1-025 C	2.6957	50/50	2.6957
961832	AG1-025 E	3.7227	50/50	3.7227
962121	AG1-056 C	1.3347	Adder	2.96

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
962122	AG1-056 E	0.8898	Adder	1.98
962281	AG1-076 C O1	9.7621	50/50	9.7621
962282	AG1-076 E O1	14.6432	50/50	14.6432
963501	AG1-199	10.6823	Adder	23.71
963582	AG1-207 BAT	13.3331	50/50	13.3331
964561	AG1-319 C	3.8960	Adder	8.65
964562	AG1-319 E	2.5974	Adder	5.77
964602	AG1-323 BAT	4.5088	50/50	4.5088
965041	AG1-368 C	2.3119	Adder	5.13
965042	AG1-368 E	1.5413	Adder	3.42
965051	AG1-369 C	3.2434	50/50	3.2434
965052	AG1-369 E	2.1623	50/50	2.1623
965421	AG1-410 C O2	27.4014	50/50	27.4014
965422	AG1-410 E O2	18.2676	50/50	18.2676
965431	AG1-411 O2	15.2230	50/50	15.2230
966831	AG1-554 C O2	5.0656	50/50	5.0656
966832	AG1-554 E O2	2.6645	50/50	2.6645
966911	AG1-562 C O2	56.8740	50/50	56.8740
966912	AG1-562 E O2	37.9160	50/50	37.9160
WEC	WEC	0.3257	Confirmed LTF	0.3257
G-007A	G-007A	0.2302	Confirmed LTF	0.2302
VFT	VFT	0.6450	Confirmed LTF	0.6450
CALDERWOOD	CALDERWOOD	0.6337	Confirmed LTF	0.6337
PRAIRIE	PRAIRIE	1.0952	Confirmed LTF	1.0952
CHEOAH	CHEOAH	0.6336	Confirmed LTF	0.6336
CBM-N	CBM-N	0.1308	Confirmed LTF	0.1308
COTTONWOOD	COTTONWOOD	1.6611	Confirmed LTF	1.6611
HAMLET	HAMLET	0.5440	Confirmed LTF	0.5440
MEC	MEC	0.6197	Confirmed LTF	0.6197
GIBSON	GIBSON	0.7704	Confirmed LTF	0.7704
BLUEG	BLUEG	4.6421	Confirmed LTF	4.6421
TRIMBLE	TRIMBLE	1.5231	Confirmed LTF	1.5231
CATAWBA	CATAWBA	0.3598	Confirmed LTF	0.3598
CBM-W1	CBM-W1	31.4188	Confirmed LTF	31.4188

13.6 Contingency Descriptions - Secondary POI

Contingency Name	Contingency Definition
AEP_P1-3_#7222_05MALIS 765_1	CONTINGENCY 'AEP_P1-3_#7222_05MALIS 765_1' / 485 OPEN BRANCH FROM BUS 242926 TO BUS 242928 CKT 1 / 242926 05MALIS 765 242928 05MARYSV 765 1 OPEN BRANCH FROM BUS 242926 TO BUS 246751 CKT 1 / 242926 05MALIS 765 246751 05VASSEL 765 1 OPEN BRANCH FROM BUS 242926 TO BUS 243538 CKT 1 / 242926 05MALIS 765 243538 05MALISX 138 1 OPEN BRANCH FROM BUS 243537 TO BUS 243538 CKT SR / 243537 05MALIS 138 243538 05MALISX 138 SR OPEN BRANCH FROM BUS 243537 TO BUS 243538 CKT ZB / 243537 05MALIS 138 243538 05MALISX 138 ZB END
PEORIA_AA 345KV	CONTINGENCY 'PEORIA_AA 345KV' / 1870 OPEN BRANCH FROM BUS 242939 TO BUS 253251 CKT 1 / 242939 05MARYSV 345 253251 09DAYMRY 345 1 OPEN BRANCH FROM BUS 253249 TO BUS 253251 CKT 1 / 253249 09DAYMRY 69.0 253251 09DAYMRY 345 1 OPEN BRANCH FROM BUS 239133 TO BUS 242939 CKT 1 / 239133 02TANGY 345 242939 05MARYSV 345 1 OPEN BRANCH FROM BUS 242939 TO BUS 936731 CKT 1 / 242939 05MARYSV 345 936731 AD2-092 C O1 345 1 OPEN BRANCH FROM BUS 242939 TO BUS 936741 CKT 1 / 242939 05MARYSV 345 936741 AD2-093 C O1 345 1 OPEN BRANCH FROM BUS 242939 TO BUS 936751 CKT 1 / 242939 05MARYSV 345 936751 AD2-096 O1 345 1 OPEN BRANCH FROM BUS 242939 TO BUS 945620 CKT 1 / 242939 05MARYSV 345 945620 AF1-227 TAP 345 1 OPEN BRANCH FROM BUS 242939 TO BUS 959321 CKT 1 / 242939 05MARYSV 345 959321 AF2-223 C 345 1 OPEN BRANCH FROM BUS 242939 TO BUS 963660 CKT 1 / 242939 05MARYSV 345 963660 AG1-218 TAP 345 1 OPEN BRANCH FROM BUS 242939 TO BUS 966910 CKT 1 / 242939 05MARYSV 345 966910 AG1-562 TAP 345 1 OPEN BRANCH FROM BUS 242928 TO BUS 242939 CKT 2 / 242928 05MARYSV 765 242939 05MARYSV 345 2 END

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).