Generation Interconnection

Feasibility Study Report

for

Queue Project AF2-186

SOUTH CECIL 69 KV

18.9 MW Capacity / 45 MW Energy

July 2020

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1 Introduction

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

2 Preface

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

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

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 Paulding County, Ohio. The installed facilities will have a total capability of 45 MW with 18.9 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is December 31, 2023. This study does not imply a TO commitment to this in-service date.

Queue Number	AF2-186
Project Name	SOUTH CECIL 69 KV
State	Ohio
County	Paulding
Transmission Owner	AEP
MFO	45
MWE	45
MWC	18.9
Fuel	Solar
Basecase Study Year	2023

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

4 Point of Interconnection

AF2-186 will interconnect with the AEP transmission system via a direct connection to the South Cecil Switch 69 kV substation.

To accommodate the interconnection at the South Cecil Switch 69 kV, the substation will have to be expanded requiring the installation of three (3) 69 kV circuit breaker (see Attachment 1). Installation of associated 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 AF2-186 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$1,483,000
Total System Network Upgrade Costs	$100,000
Total Costs	$1,583,000

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 onsite 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.

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

This cost excludes a Federal Income Tax Gross Up charges. This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 88-129. If at a future date it is determined that the Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

6 Transmission Owner Scope of Work

The total physical interconnection costs is given in the tables 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
69kV Revenue Metering	$ 283,000
Total Attachment Facility Costs	$ 283,000

*Assumes that the generator lead conductor will consist of a single span extending directly from a structure within the POI station to a structure within the Collector station.

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
Expand the South Cecil Switch 69 kV substation: Install three (3) additional 69 kV circuit breaker. Installation of associated protection and control equipment, 69 kV line risers and SCADA will also be required.	$1,110,000
Total Direct Connection Facility Costs	$1,110,000

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 controls at the remote end of the Paulding Substation	$45,000
Review line protection and controls at the remote end of the Mark Center substation	$45,000
Total Non-Direct Connection Facility Costs	$90,000

7 Schedule

It is anticipated that the time between receipt of executed Agreements and Commercial Operation may range from 12 to 18 months if no line work is required. If line work is required, construction time would generally be between 24 to 36 months after Agreement execution.

8 Incremental Capacity Transfer Rights (ICTRs)

None

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 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 Meteorological Data Reporting Requirements

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

- Back Panel temperature (Fahrenheit)
- Irradiance (Watts/meter^2)
- Ambient air temperature (Fahrenheit) – (Accepted, not required)
- Wind speed (meters/second) – (Accepted, not required)
- 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 AF2-186 was evaluated as a 45.0 MW (Capacity 18.9 MW) injection at the South Cecil 69kV substation in the AEP area. Project AF2-186 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-186 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
95762784	246950	05TIMBSS	138.0	AEP	243383	05TILLMA	138.0	AEP	1	AEP_P4_#6533_05E LIMA 138_A	breaker	332.0	111.54	116.48	DC	16.41
95763480	246950	05TIMBSS	138.0	AEP	243383	05TILLMA	138.0	AEP	1	AEP_P7-1_#11069	tower	332.0	113.23	118.23	DC	16.61

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
95762963	243017	05HAVILN	138.0	AEP	242989	05E LIMA	138.0	AEP	1	AEP_P1-2_#7501	operation	220.0	148.84	155.23	DC	14.07
95762964	243017	05HAVILN	138.0	AEP	242989	05E LIMA	138.0	AEP	1	Base Case	operation	187.0	99.51	103.45	DC	7.38
95763019	246950	05TIMBSS	138.0	AEP	243383	05TILLMA	138.0	AEP	1	AEP_P1-2_#5227	operation	332.0	111.47	116.4	DC	16.35
95763020	246950	05TIMBSS	138.0	AEP	243383	05TILLMA	138.0	AEP	1	Base Case	operation	262.0	96.08	100.35	DC	11.18

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
95762784,95763480	1	05TIMBSS 138.0 kV - 05TILLMA 138.0 kV Ckt 1	AEPO0011a (406) : Upgrade "Sub Cond 1-1233.6 KCM ACSR/TW (38/19)" riser at Timber Switch Project Type : FAC Cost : $100,000 Time Estimate : 12-18 Months	$100,000
			TOTAL COST	$100,000

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
95763480	246950	05TIMBSS	AEP	243383	05TILLMA	AEP	1	AEP_P7-1_#11069	tower	332.0	113.23	118.23	DC	16.61

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
246953	05TIMB G C	4.2439	50/50	4.2439
247607	V1-011 C	1.6027	50/50	1.6027
247911	05TIMB G E	99.0693	50/50	99.0693
247959	V1-011 E	62.1815	50/50	62.1815
926811	AC1-167 C O1	8.4944	50/50	8.4944
926812	AC1-167 E O1	4.1208	50/50	4.1208
926901	**AC1-176 C (Withdrawn : 07/09/2020)**	**6.2328**	**50/50**	**6.2328**
926902	**AC1-176 E (Withdrawn : 07/09/2020)**	**41.9076**	**50/50**	**41.9076**
934741	AD1-101 C O1	2.7424	50/50	2.7424
934742	AD1-101 E O1	4.4752	50/50	4.4752
934901	AD1-119 C O1	6.6553	50/50	6.6553
934902	AD1-119 E O1	10.8606	50/50	10.8606
940031	AE1-245 C O1	13.9339	50/50	13.9339
940032	AE1-245 E O1	93.2501	50/50	93.2501
942801	AE2-298 C O1	17.4684	50/50	17.4684
942802	AE2-298 E O1	11.6456	50/50	11.6456
943181	AE2-322 C	10.1882	50/50	10.1882
943182	AE2-322 E	4.9804	50/50	4.9804
943581	AF1-029 C O1	7.6248	50/50	7.6248
943582	AF1-029 E O1	5.0832	50/50	5.0832
943791	AF1-047 C	5.2787	50/50	5.2787
943792	AF1-047 E	3.5191	50/50	3.5191
958091	AF2-103 C	0.9434	50/50	0.9434
958092	AF2-103 E	1.3080	50/50	1.3080
958951	AF2-186 C O1	6.9754	50/50	6.9754
958952	AF2-186 E O1	9.6327	50/50	9.6327
960851	AF2-376 C	16.4022	50/50	16.4022
960852	AF2-376 E	24.6033	50/50	24.6033
NEWTON	NEWTON	0.1504	Confirmed LTF	0.1504
FARMERCITY	FARMERCITY	0.0078	Confirmed LTF	0.0078
G-007A	G-007A	0.0456	Confirmed LTF	0.0456
VFT	VFT	0.1226	Confirmed LTF	0.1226
CALDERWOOD	CALDERWOOD	0.0323	Confirmed LTF	0.0323
PRAIRIE	PRAIRIE	0.3384	Confirmed LTF	0.3384
CHEOAH	CHEOAH	0.0320	Confirmed LTF	0.0320
EDWARDS	EDWARDS	0.0574	Confirmed LTF	0.0574
TILTON	TILTON	0.0995	Confirmed LTF	0.0995
GIBSON	GIBSON	0.0753	Confirmed LTF	0.0753
BLUEG	BLUEG	0.1788	Confirmed LTF	0.1788
TRIMBLE	TRIMBLE	0.0562	Confirmed LTF	0.0562

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
CATAWBA	CATAWBA	0.0147	Confirmed LTF	0.0147

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
AC1-167	Mark Center 69kV	Active
AC1-176	Timber Switch 138kV	Withdrawn
AD1-101	Continental 69 kV	Active
AD1-119	Payne 69 kV	Active
AE1-245	Haviland 138 kV	Active
AE2-298	Haviland-N. Van Wert 69 kV	Active
AE2-322	Mark Center 69 kV	Active
AF1-029	Haviland-N Van Wert 69 kV	Active
AF1-047	Mark Center 69 kV	Active
AF2-103	Haviland 138 kV	Active
AF2-186	South Cecil 69 kV	Active
AF2-376	Timber Switch 138 kV	Active
V1-011	Haviland 138kV	In Service

11.8 Contingency Descriptions – Primary POI

Contingency Name	Contingency Definition
AEP_P7-1_#11069	CONTINGENCY 'AEP_P7-1_#11069' OPEN BRANCH FROM BUS 242989 TO BUS 243017 CKT 1 / 242989 05E LIMA 138 243017 05HAVILN 138 1 OPEN BRANCH FROM BUS 242991 TO BUS 243051 CKT 1 / 242991 05E SIDE 138 243051 05NDELPH 138 1 OPEN BRANCH FROM BUS 242991 TO BUS 243108 CKT 1 / 242991 05E SIDE 138 243108 05STRLN1 138 1 END
AEP_P1-2_#7501	CONTINGENCY 'AEP_P1-2_#7501' OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 246264 TO BUS 247877 CKT 1 / 246264 05ST R14 8 34.5 247877 05ST.RD14 SS34.5 1 END
Base Case	
AEP_P4_#6533_05E LIMA 138_A	CONTINGENCY 'AEP_P4_#6533_05E LIMA 138_A' OPEN BRANCH FROM BUS 245775 TO BUS 243067 CKT 1 / 245775 05NWOODCEQ 999 243067 05NWOODC 138 1 OPEN BRANCH FROM BUS 245775 TO BUS 245766 CKT 1 / 245775 05NWOODCEQ 999 245766 05N WOODCK 69.0 1 OPEN BRANCH FROM BUS 245775 TO BUS 245765 CKT 1 / 245775 05NWOODCEQ 999 245765 05N WOODCK 34.5 1 OPEN BRANCH FROM BUS 242989 TO BUS 243017 CKT 1 / 242989 05E LIMA 138 243017 05HAVILN 138 1 OPEN BRANCH FROM BUS 242989 TO BUS 243067 CKT 1 / 242989 05E LIMA 138 243067 05NWOODC 138 1 OPEN BRANCH FROM BUS 243059 TO BUS 243067 CKT 1 / 243059 05NFINDL 138 243067 05NWOODC 138 1 OPEN BRANCH FROM BUS 245763 TO BUS 245766 CKT 1 / 245763 05N BLUFFT 69.0 245766 05N WOODCK 69.0 1 END
AEP_P1-2_#5227	CONTINGENCY 'AEP_P1-2_#5227' OPEN BRANCH FROM BUS 242989 TO BUS 243017 CKT 1 / 242989 05E LIMA 138 243017 05HAVILN 138 1 END

12 Light Load Analysis

Light Load Studies (As applicable)

Not applicable.

13 Short Circuit Analysis

The following Breakers are overdutied:

To be determined during later study phases.

14 Stability and Reactive Power Assessment

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

To be determined during later study phases.

15 Affected Systems

15.1 LG&E

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

15.2 MISO

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

15.3 TVA

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

15.4 Duke Energy Progress

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

15 Secondary Point of Interconnection

AF2-186 will interconnect with the AEP transmission system at a new 69 kV switching station cut into the Paulding – South Cecil 69 kV circuit.

To accommodate the interconnection on the AEP-owned Paulding – South Cecil 69 kV circuit, a new three (3) circuit breaker 69 kV switching station physically configured 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.

16 Summer Peak – Load Flow Analysis – Secondary POI

The Queue Project AF2-186 was evaluated as a 45.0 MW (Capacity 18.9 MW) injection tapping the Paulding to South Cecil 69 kV line in the AEP area. Project AF2-186 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-186 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

16.1 Generation Deliverability

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

None

16.2 Multiple Facility Contingency

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

None

16.3 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)

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95762720	243017	05HAVILN	138.0	AEP	242989	05E LIMA	138.0	AEP	1	AEP_P4_#10140_05ALLEN 138_H	breaker	220.0	138.16	144.39	DC	13.7
144851728	243017	05HAVILN	138.0	AEP	242989	05E LIMA	138.0	AEP	1	AEP_P7-1_#11065-A	tower	220.0	138.16	144.39	DC	13.7
144851729	243017	05HAVILN	138.0	AEP	242989	05E LIMA	138.0	AEP	1	AEP_P7-1_#10895-A	tower	220.0	138.03	144.26	DC	13.71
95762784	246950	05TIMBSS	138.0	AEP	243383	05TILLMA	138.0	AEP	1	AEP_P4_#6533_05ELIMA 138_A	breaker	332.0	111.54	116.64	DC	16.92
95763480	246950	05TIMBSS	138.0	AEP	243383	05TILLMA	138.0	AEP	1	AEP_P7-1_#11069	tower	332.0	113.23	118.39	DC	17.13

16.4 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
95762964	243017	05HAVILN	138.0	AEP	242989	05E LIMA	138.0	AEP	1	Base Case	operation	187.0	99.51	103.57	DC	7.6
144850878	243017	05HAVILN	138.0	AEP	242989	05E LIMA	138.0	AEP	1	AEP_P1-2_#7501-B	operation	220.0	138.07	144.27	DC	13.63
95763019	246950	05TIMBSS	138.0	AEP	243383	05TILLMA	138.0	AEP	1	AEP_P1-2_#5227	operation	332.0	111.47	116.55	DC	16.87

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
95763020	246950	05TIMBSS	138.0	AEP	243383	05TILLMA	138.0	AEP	1	Base Case	operation	262.0	96.08	100.49	DC	11.55

16.5 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".

16.5.1 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
144851729	243017	05HAVILN	AEP	242989	05E LIMA	AEP	1	AEP_P7-1_#10895-A	tower	220.0	138.03	144.26	DC	13.71

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
246953	05TIMB G C	2.8820	50/50	2.8820
247607	V1-011 C	1.2804	50/50	1.2804
247911	05TIMB G E	67.2759	50/50	67.2759
247959	V1-011 E	49.6779	50/50	49.6779
926811	AC1-167 C O1	6.8174	50/50	6.8174
926812	AC1-167 E O1	3.3073	50/50	3.3073
926901	**AC1-176 C (Withdrawn : 07/09/2020)**	**4.2326**	**50/50**	**4.2326**
926902	**AC1-176 E (Withdrawn : 07/09/2020)**	**28.4586**	**50/50**	**28.4586**
934741	AD1-101 C O1	1.9500	50/50	1.9500
934742	AD1-101 E O1	3.1822	50/50	3.1822
934901	AD1-119 C O1	5.3376	50/50	5.3376
934902	AD1-119 E O1	8.7102	50/50	8.7102
940031	AE1-245 C O1	11.1376	50/50	11.1376
940032	AE1-245 E O1	74.5364	50/50	74.5364
942801	AE2-298 C O1	13.9263	50/50	13.9263
942802	AE2-298 E O1	9.2842	50/50	9.2842
943181	AE2-322 C	8.1769	50/50	8.1769
943182	AE2-322 E	3.9971	50/50	3.9971
943581	AF1-029 C O1	6.0594	50/50	6.0594
943582	AF1-029 E O1	4.0396	50/50	4.0396
943791	AF1-047 C	4.2366	50/50	4.2366
943792	AF1-047 E	2.8244	50/50	2.8244
958091	AF2-103 C	0.7537	50/50	0.7537
958092	AF2-103 E	1.0449	50/50	1.0449
958951	AF2-186 C O2	5.7568	50/50	5.7568
958952	AF2-186 E O2	7.9498	50/50	7.9498
959331	AF2-224 C O2	22.9845	50/50	22.9845
959332	AF2-224 E O2	31.7405	50/50	31.7405
960851	AF2-376 C	11.1384	50/50	11.1384
960852	AF2-376 E	16.7076	50/50	16.7076
WEC	WEC	0.0888	Confirmed LTF	0.0888
LGEE	LGEE	0.0525	Confirmed LTF	0.0525
CBM-W2	CBM-W2	1.2121	Confirmed LTF	1.2121
NY	NY	0.0553	Confirmed LTF	0.0553
CBM-W1	CBM-W1	2.3144	Confirmed LTF	2.3144
TVA	TVA	0.1134	Confirmed LTF	0.1134
O-066	O-066	0.6451	Confirmed LTF	0.6451
CBM-S1	CBM-S1	0.7072	Confirmed LTF	0.7072
G-007	G-007	0.0998	Confirmed LTF	0.0998
MADISON	MADISON	0.4556	Confirmed LTF	0.4556

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
MEC	MEC	0.3655	Confirmed LTF	0.3655
CATAWBA	CATAWBA	0.0007	Confirmed LTF	0.0007

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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
95763480	246950	05TIMBSS	AEP	243383	05TILLMA	AEP	1	AEP_P7-1_#11069	tower	332.0	113.23	118.39	DC	17.13

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
246953	05TIMB G C	4.2439	50/50	4.2439
247607	V1-011 C	1.6027	50/50	1.6027
247911	05TIMB G E	99.0693	50/50	99.0693
247959	V1-011 E	62.1815	50/50	62.1815
926811	AC1-167 C O1	8.4944	50/50	8.4944
926812	AC1-167 E O1	4.1208	50/50	4.1208
926901	**AC1-176 C (Withdrawn : 07/09/2020)**	**6.2328**	**50/50**	**6.2328**
926902	**AC1-176 E (Withdrawn : 07/09/2020)**	**41.9076**	**50/50**	**41.9076**
934741	AD1-101 C O1	2.7424	50/50	2.7424
934742	AD1-101 E O1	4.4752	50/50	4.4752
934901	AD1-119 C O1	6.6553	50/50	6.6553
934902	AD1-119 E O1	10.8606	50/50	10.8606
940031	AE1-245 C O1	13.9339	50/50	13.9339
940032	AE1-245 E O1	93.2501	50/50	93.2501
942801	AE2-298 C O1	17.4684	50/50	17.4684
942802	AE2-298 E O1	11.6456	50/50	11.6456
943181	AE2-322 C	10.1882	50/50	10.1882
943182	AE2-322 E	4.9804	50/50	4.9804
943581	AF1-029 C O1	7.6248	50/50	7.6248
943582	AF1-029 E O1	5.0832	50/50	5.0832
943791	AF1-047 C	5.2787	50/50	5.2787
943792	AF1-047 E	3.5191	50/50	3.5191
958091	AF2-103 C	0.9434	50/50	0.9434
958092	AF2-103 E	1.3080	50/50	1.3080
958951	AF2-186 C O2	7.1947	50/50	7.1947
958952	AF2-186 E O2	9.9355	50/50	9.9355
960851	AF2-376 C	16.4022	50/50	16.4022
960852	AF2-376 E	24.6033	50/50	24.6033
NEWTON	NEWTON	0.1504	Confirmed LTF	0.1504
FARMERCITY	FARMERCITY	0.0078	Confirmed LTF	0.0078
G-007A	G-007A	0.0456	Confirmed LTF	0.0456
VFT	VFT	0.1226	Confirmed LTF	0.1226
CALDERWOOD	CALDERWOOD	0.0323	Confirmed LTF	0.0323
PRAIRIE	PRAIRIE	0.3384	Confirmed LTF	0.3384
CHEOAH	CHEOAH	0.0320	Confirmed LTF	0.0320
EDWARDS	EDWARDS	0.0574	Confirmed LTF	0.0574
TILTON	TILTON	0.0995	Confirmed LTF	0.0995
GIBSON	GIBSON	0.0753	Confirmed LTF	0.0753
BLUEG	BLUEG	0.1788	Confirmed LTF	0.1788
TRIMBLE	TRIMBLE	0.0562	Confirmed LTF	0.0562

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
CATAWBA	CATAWBA	0.0147	Confirmed LTF	0.0147

16.6 Contingency Descriptions – Secondary POI

Contingency Name	Contingency Definition
AEP_P7-1_#11065-A	CONTINGENCY 'AEP_P7-1_#11065-A' OPEN BRANCH FROM BUS 243242 TO BUS 247864 CKT 1 / 243242 05ALLEN 138 247864 05LOGTOWN 138 1 OPEN BRANCH FROM BUS 243242 TO BUS 959330 CKT 1 / 243242 05ALLEN 138 959330 AF2-224 TAP 138 1 END
AEP_P4_#10140_05ALLEN 138_H	CONTINGENCY 'AEP_P4_#10140_05ALLEN 138_H' OPEN BRANCH FROM BUS 243242 TO BUS 247864 CKT 1 / 243242 05ALLEN 138 247864 05LOGTOWN 138 1 OPEN BRANCH FROM BUS 243242 TO BUS 959330 CKT 1 / 243242 05ALLEN 138 959330 AF2-224 TAP 138 1 END
AEP_P1-2_#7501-B	CONTINGENCY 'AEP_P1-2_#7501-B' OPEN BRANCH FROM BUS 243242 TO BUS 959330 CKT 1 / 243242 05ALLEN 138 959330 AF2-224 TAP 138 1 END
AEP_P7-1_#11069	CONTINGENCY 'AEP_P7-1_#11069' OPEN BRANCH FROM BUS 242989 TO BUS 243017 CKT 1 / 242989 05E LIMA 138 243017 05HAVILN 138 1 OPEN BRANCH FROM BUS 242991 TO BUS 243051 CKT 1 / 242991 05E SIDE 138 243051 05NDELPH 138 1 OPEN BRANCH FROM BUS 242991 TO BUS 243108 CKT 1 / 242991 05E SIDE 138 243108 05STRLN1 138 1 END
Base Case	
AEP_P1-2_#5227	CONTINGENCY 'AEP_P1-2_#5227' OPEN BRANCH FROM BUS 242989 TO BUS 243017 CKT 1 / 242989 05E LIMA 138 243017 05HAVILN 138 1 END

Contingency Name	Contingency Definition
AEP_P7-1_#10895-A	CONTINGENCY 'AEP_P7-1_#10895-A' OPEN BRANCH FROM BUS 243242 TO BUS 243877 CKT 1 / 243242 05ALLEN 138 243877 05DAWKNS 138 1 OPEN BRANCH FROM BUS 243242 TO BUS 243330 CKT 1 / 243242 05ALLEN 138 243330 05LINCOL 138 1 OPEN BRANCH FROM BUS 243242 TO BUS 247864 CKT 1 / 243242 05ALLEN 138 247864 05LOGTOWN 138 1 OPEN BRANCH FROM BUS 243242 TO BUS 959330 CKT 1 / 243242 05ALLEN 138 959330 AF2-224 TAP 138 1 OPEN BRANCH FROM BUS 243877 TO BUS 243342 CKT 1 / 243877 05DAWKNS 138 243342 05MILAN 138 1 END
AEP_P4_#6533_05E LIMA 138_A	CONTINGENCY 'AEP_P4_#6533_05E LIMA 138_A' OPEN BRANCH FROM BUS 245775 TO BUS 243067 CKT 1 / 245775 05NWOODCEQ 999 243067 05NWOODC 138 1 OPEN BRANCH FROM BUS 245775 TO BUS 245766 CKT 1 / 245775 05NWOODCEQ 999 245766 05N WOODCK 69.0 1 OPEN BRANCH FROM BUS 245775 TO BUS 245765 CKT 1 / 245775 05NWOODCEQ 999 245765 05N WOODCK 34.5 1 OPEN BRANCH FROM BUS 242989 TO BUS 243017 CKT 1 / 242989 05E LIMA 138 243017 05HAVILN 138 1 OPEN BRANCH FROM BUS 242989 TO BUS 243067 CKT 1 / 242989 05E LIMA 138 243067 05NWOODC 138 1 OPEN BRANCH FROM BUS 243059 TO BUS 243067 CKT 1 / 243059 05NFINDL 138 243067 05NWOODC 138 1 OPEN BRANCH FROM BUS 245763 TO BUS 245766 CKT 1 / 245763 05N BLUFFT 69.0 245766 05N WOODCK 69.0 1 END

17 Light Load Analysis

Light Load Studies (As applicable)

Not applicable.

18 Short Circuit Analysis

The following Breakers are overdutied:

To be determined during later study phases.

19 Stability and Reactive Power Assessment

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

To be determined during later study phases.

20 Affected Systems

20.1 LG&E

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

20.2 MISO

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

20.3 TVA

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

20.4 Duke Energy Progress

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