Generation Interconnection

Feasibility Study Report

for

Queue Project AG1-237

DEQUINE-EUGENE 345 KV

26 MW Capacity / 200 MW Energy

January 2021

Table of Contents

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.

The conduct of light load analysis as required under the PJM planning process is not performed during the Generation Interconnection Feasibility Study phase of the PJM study process. Additional reinforcement requirements for this Interconnection Request may be defined during the conduct of the light load analysis which shall be performed following execution of the System Impact Study agreement.

3 General

The Interconnection Customer (IC), has proposed a Wind generating facility located in Undetermined County, Undetermined. The installed facilities will have a total capability of 200 MW with 26 MW of this output being recognized by PJM as Capacity.

The proposed in-service date for this project is December 31, 2024. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-237
Project Name	DEQUINE-EUGENE 345 KV
State	Undetermined
County	Undetermined
Transmission Owner	AEP
MFO	200
MWE	200
MWC	26
Fuel	Wind
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

AG1-237 will interconnect with the AEP transmission system along one of the following Points of Interconnection:

Primary POI: Eugene to Dequine 345 kV line.

AG1-237 will interconnect with the AEP transmission system via a new station cut into the Dequine - Eugene 345 kV circuit.

To accommodate the interconnection on the Dequine - Eugene 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.

Secondary POI: Eugene to Dequine 345 kV line (different POI TAP location).

AG1-237 will interconnect with the AEP transmission system via a new switching station cut into the Dequine - Eugene 345 kV circuit.

To accommodate the interconnection on the Dequine - Eugene 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.

5 Cost Summary

The AG1-237 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$19,822,000
Total System Network Upgrade Costs	$8,040,000
Total Costs	**$27,862,000**

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
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**

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
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, and SCADA will also be required.	$17,440,000
Total Direct Connection Facility Costs	**$17,440,000**

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

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 wind generation facility shall provide the Transmission Provider with site-specific meteorological data including:

- Wind speed (meters/second) - (Required)
- Wind direction (decimal degrees from true north) - (Required)
- Ambient air temperature (Fahrenheit) - (Required)
- Air Pressure (Hectopascals) - (Required)
- Humidity (Percent) (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 AG1-237 was evaluated as a 200.0 MW (Capacity 26.0 MW) injection tapping the Eugene to Dequine 345 kV line in the AEP area. Project AG1-237 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-237 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	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
164422906	242865	05JEFRSO	345.0	AEP	248000	06CLIFTY	345.0	OVEC	Z1	AEP_P4_#6189_05HANG R 765_D1	breaker	1868.0	156.42	157.22	DC	26.48
167347998	242865	05JEFRSO	345.0	AEP	248000	06CLIFTY	345.0	OVEC	Z1	AEP_P4_#6189_05HANG	breaker	1868.0	156.42	157.22	DC	26.48

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	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
164423222	242865	05JEFRSO	345.0	AEP	248000	06CLIFTY	345.0	OVEC	Z1	AEP_P1-2_#709_546	operation	1868.0	154.64	155.41	DC	26.54
168155114	243217	05DEQUIN	345.0	AEP	243878	05MEADOW	345.0	AEP	1	AEP_P1-2_#6490_16000	operation	1959.0	95.28	100.34	DC	99.08
168154872	243878	05MEADOW	345.0	AEP	255205	17REYNOLDS	345.0	NIPS	2	AEP_P1-2_#8695-B	operation	1868.0	154.27	159.86	DC	104.51
168154886	243878	05MEADOW	345.0	AEP	958970	AF2-188 TAP	345.0	AEP	1	AEP_P1-2_#8807	operation	1868.0	149.86	155.44	DC	104.23
168416835	255204	17REYNOLDS	765.0	NIPS	243207	05GRNTWN	765.0	AEP	1	AEP_P1-2_#363_1682	operation	2669.0	100.04	101.05	DC	52.0
169936177	958970	AF2-188 TAP	345.0	AEP	255205	17REYNOLDS	345.0	NIPS	1	AEP_P1-2_#8807	operation	1868.0	154.4	159.98	DC	104.23

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
169936406	963840	AG1-237 TAP	345.0	AEP	243217	05DEQUIN	345.0	AEP	1	Base Case	operation	1409.0	97.0	107.09	DC	142.18
169936407	963840	AG1-237 TAP	345.0	AEP	243217	05DEQUIN	345.0	AEP	1	AEP_P1-2_#363_1682	operation	1959.0	92.84	100.17	DC	143.7

10.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
164422906,167347998	1	05JEFRSO 345.0 kV - 06CLIFTY 345.0 kV Ckt Z1	**AEPI0045a (11) : Replace 4 Clifty Switches (3000A)** **Project Type : FAC** **Cost : $2,000,000** **Time Estimate : 12-18 Months** **AEPI0045b (12) : A Sag Study will be required on the 0.75 mile section of ACSR ~ 2156 ~ 64/19 ~ BLUEBIRD line to mitigate the overload . New Rating after the Sag Study : S/N: 2354 MVA S/E: 3212 MVA. Depending on the sag study results, cost for this upgrade is expected to be between $20,000 (No remediations required just sag study) and 1.96 million (complete line reconductor/rebuild required). Time Estimate: a) Sag Study: 6-12 months b) Rebuild: The standard time required for construction differs from state to state. An approximate construction time would be 24 to 36 months after signing an interconnection agreement.** **Project Type : FAC** **Cost : $20,000** **Time Estimate : 6-12 Months** **AEPI0045c (14) : Replace Clifty Bus 5"0 AL Tubular Sch 40** **Project Type : FAC** **Cost : $100,000** **Time Estimate : 12-18 Months** **AEPI0045d (13) : Rebuild 0.75 miles of ACSR ~ 2156 ~ 64/19 ~ BLUEBIRD conductor to mitigate the overload.** **Project Type : FAC** **Cost : $1,960,000** **Time Estimate : 24-36 Months** **n4106 (23) : Perform a sag study on the 345 kV line between Jefferson and Clifty Creek. The 345 kV line between Jefferson and Clifty Creek can be sag studied to increase the emergency rating from 2354 to 3212. The cost of a sag study to identify any mitigation requirements should cost around $3,680. If remediation can only be reached through a rebuild, wed expect that to cost around $1,960,000. Note that the transformer will still be limited to 2919 MVA emergency.** **Project Type : FAC** **Cost : $1,960,000** **Time Estimate : N/A Months** **n4106.1 (25) : Replace 4 Clifty switches (5000A)** **Project Type : FAC** **Cost : $2,000,000** **Time Estimate : 12-18 Months**	$8,040,000
			TOTAL COST	**$8,040,000**

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
167347998	242865	05JEFRSO	AEP	248000	06CLIFTY	OVEC	Z1	AEP_P4_#6189_05HANG	breaker	1868.0	156.42	157.22	DC	26.48

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
243441	05CKG2	19.9630	50/50	19.9630
243442	05RKG1	67.7576	50/50	67.7576
243443	05RKG2	64.9593	50/50	64.9593
243859	05FR-11G C	0.5506	50/50	0.5506
243862	05FR-12G C	0.2678	50/50	0.2678
243864	05FR-21G C	0.2785	50/50	0.2785
243866	05FR-22G C	0.2785	50/50	0.2785
243870	05FR-3G C	0.2678	50/50	0.2678
243873	05FR-4G C	0.6234	50/50	0.6234
246909	05MDL-1G C	0.5683	50/50	0.5683
246910	05MDL-2G C	0.3335	50/50	0.3335
246976	05MDL-3G C	0.3357	50/50	0.3357
246979	05MDL-4G C	0.2589	50/50	0.2589
247556	05MDL-5G	0.4432	50/50	0.4432
247900	05FR-11G E	10.6324	50/50	10.6324
247901	05FR-12G E	10.4558	50/50	10.4558
247902	05FR-21G E	11.1755	50/50	11.1755
247903	05FR-22G E	10.7003	50/50	10.7003
247904	05FR-3G E	21.6721	50/50	21.6721
247905	05FR-4G E	16.9738	50/50	16.9738
247906	05MDL-1G E	22.2111	50/50	22.2111
247907	05MDL-2G E	11.1264	50/50	11.1264
247912	05MDL-3G E	11.1264	50/50	11.1264
247913	05MDL-4G E	11.1264	50/50	11.1264
247943	T-127 E	11.1264	50/50	11.1264
250163	Y3-099 BAT	0.2242	50/50	0.2242
250167	08DEO_STUART	0.2207	50/50	0.2207
251823	Z1-065 BAT	0.6484	50/50	0.6484
270100	X2-052 CT1	3.9619	50/50	3.9619
270101	X2-052 CT2	3.9619	50/50	3.9619
270102	X2-052 ST	4.2863	50/50	4.2863
274776	LINCOLN ;7U	1.2717	50/50	1.2717
274777	LINCOLN ;8U	1.2717	50/50	1.2717
930041	AB1-006 C	0.5705	50/50	0.5705
930042	AB1-006 E	24.1999	50/50	24.1999
930461	AB1-087 CT1	53.0501	50/50	53.0501
930462	AB1-087 ST1	42.1769	50/50	42.1769
930471	AB1-088 CT1	53.0501	50/50	53.0501
930472	AB1-088 ST1	42.1769	50/50	42.1769
932601	AC2-080 C O1	3.5064	50/50	3.5064
932602	AC2-080 E O1	23.4656	50/50	23.4656
933281	AC2-140 C	0.6609	50/50	0.6609

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
933282	AC2-140 E	0.2204	50/50	0.2204
933446	AC2-157 1C	6.5793	50/50	6.5793
933447	AC2-157 2C	6.5793	50/50	6.5793
933448	AC2-157 1E	10.7347	50/50	10.7347
933449	AC2-157 2E	10.7347	50/50	10.7347
937041	AD2-138 C	4.7471	50/50	4.7471
937042	AD2-138 E	22.2249	50/50	22.2249
940581	AE2-045 C O1	11.3660	50/50	11.3660
940582	AE2-045 E O1	15.6060	50/50	15.6060
941341	AE2-130 C	152.0256	50/50	152.0256
941342	AE2-130 E	101.3504	50/50	101.3504
941571	AE2-154 C	4.5201	50/50	4.5201
941572	AE2-154 E	30.2499	50/50	30.2499
942601	AE2-276	8.6570	50/50	8.6570
944201	AF1-088 FTIR	173.1400	50/50	173.1400
945391	AF1-204 C O1	6.8620	50/50	6.8620
945392	AF1-204 E O1	20.5861	50/50	20.5861
945421	AF1-207 C O1	4.7705	50/50	4.7705
945422	AF1-207 E O1	20.4853	50/50	20.4853
945501	AF1-215 C O1	22.4748	50/50	22.4748
945502	AF1-215 E O1	14.9832	50/50	14.9832
946581	AF1-322 C	11.6827	50/50	11.6827
946582	AF1-322 E	16.1333	50/50	16.1333
957141	AF2-008 FTIR	86.5700	50/50	86.5700
957142	AF2-008 NFTI	173.1400	50/50	173.1400
957393	AF2-033 BAT	2.2110	50/50	2.2110
957841	AF2-078 C O1	16.8372	50/50	16.8372
957842	AF2-078 E O1	11.2248	50/50	11.2248
958381	AF2-132 C O1	23.2380	50/50	23.2380
958382	AF2-132 E O1	15.4920	50/50	15.4920
958391	AF2-133 C O1	23.6322	50/50	23.6322
958392	AF2-133 E O1	15.7548	50/50	15.7548
958401	AF2-134 C O1	7.4916	50/50	7.4916
958402	AF2-134 E O1	4.9944	50/50	4.9944
958971	AF2-188 C O1	9.4409	50/50	9.4409
958972	AF2-188 E O1	6.2940	50/50	6.2940
958981	AF2-189 C O1	13.7043	50/50	13.7043
958982	AF2-189 E O1	9.1362	50/50	9.1362
959141	AF2-205 C	15.9444	50/50	15.9444
959142	AF2-205 E	10.6296	50/50	10.6296
960681	AF2-359 C	8.0895	50/50	8.0895
960682	AF2-359 E	5.3930	50/50	5.3930
963741	AG1-226 C O1	41.3281	50/50	41.3281
963742	AG1-226 E O1	14.7734	50/50	14.7734
963841	AG1-237 C O1	3.4427	50/50	3.4427
963842	AG1-237 E O1	23.0393	50/50	23.0393
963851	AG1-238 C	9.5301	50/50	9.5301
963852	AG1-238 E	6.3534	50/50	6.3534
964401	AG1-302 C O1	23.2380	50/50	23.2380
964402	AG1-302 E O1	15.4920	50/50	15.4920
964861	AG1-349 C O1	20.2348	50/50	20.2348
964862	AG1-349 E O1	13.4898	50/50	13.4898

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
965681	AG1-436 C	8.0895	50/50	8.0895
965682	AG1-436 E	5.3930	50/50	5.3930
965791	AG1-447	5.9323	50/50	5.9323
965801	AG1-448	5.9323	50/50	5.9323
966531	AG1-522 C	42.4188	50/50	42.4188
966532	AG1-522 E	28.2792	50/50	28.2792
966541	AG1-523 C	42.4188	50/50	42.4188
966542	AG1-523 E	28.2792	50/50	28.2792
966551	AG1-524 C	42.4188	50/50	42.4188
966552	AG1-524 E	28.2792	50/50	28.2792
966561	AG1-525 C	42.4188	50/50	42.4188
966562	AG1-525 E	28.2792	50/50	28.2792
966841	AG1-555 C	12.0038	50/50	12.0038
966842	AG1-555 E	4.2910	50/50	4.2910
WEC	WEC	3.0438	Confirmed LTF	3.0438
CALDERWOOD	CALDERWOOD	0.8906	Confirmed LTF	0.8906
LGE-0012019	LGE-0012019	6.4405	LTF	6.4405
CBM-W2	CBM-W2	29.1110	Confirmed LTF	29.1110
NY	NY	0.9783	Confirmed LTF	0.9783
O-066	O-066	12.3697	Confirmed LTF	12.3697
SIGE	SIGE	0.0643	Confirmed LTF	0.0643
CHEOAH	CHEOAH	0.8959	Confirmed LTF	0.8959
G-007	G-007	1.9330	Confirmed LTF	1.9330
HAMLET	HAMLET	1.1192	Confirmed LTF	1.1192
MEC	MEC	12.4117	Confirmed LTF	12.4117
BLUEG	BLUEG	29.4738	Confirmed LTF	29.4738
TRIMBLE	TRIMBLE	10.2630	Confirmed LTF	10.2630
LAGN	LAGN	3.1553	Confirmed LTF	3.1553
CATAWBA	CATAWBA	0.6748	Confirmed LTF	0.6748
CBM-W1	CBM-W1	97.7474	Confirmed LTF	97.7474

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
AB1-006	Meadow Lake 345kV	In Service
AB1-087	Sullivan 345kV #1	Active
AB1-088	Sullivan 345kV #2	Active
AC2-080	Olive-Reynolds 345kV	Active
AC2-140	DC Cook Unit 2	In Service
AC2-157	Sullivan 345 kV	Active
AD2-138	Olive-Reynolds 345kV	Active
AE2-045	Olive-Reynolds 345 kV	Active
AE2-130	Rockport 765 kV	Active
AE2-154	Meadow Lake 345 kV (MLV VIII)	Active
AE2-276	Sullivan 345kV	Active
AF1-088	Sullivan 345 kV	Active
AF1-204	Eugene 345 kV	Active
AF1-207	Reynolds–Olive #1 345 kV	Active
AF1-215	Reynolds-Olive 345 kV	Active
AF1-322	Meadow Lake 345 kV	Active
AF2-008	Sullivan 345 kV	Active
AF2-033	Miami Fort GT 138 kV	Active
AF2-078	Reynolds-Olive #1 345 kV	Active
AF2-132	Reynolds-Olive #1 345 kV	Active
AF2-133	Reynolds-Olive #2 345 kV	Active
AF2-134	Reynolds-Olive #2 345 kV	Active
AF2-188	Reynolds-Meadow Lake #1 345 kV	Active
AF2-189	Greentown 138 kV	Active
AF2-205	Olive-Reynolds #2 345 kV	Active
AF2-359	Olive-University Park 345 kV	Active
AG1-226	Eugene-Dequine 345 kV	Active
AG1-237	Dequine-Eugene 345 kV	Active
AG1-238	Dumont 345 kV	Active
AG1-302	Reynolds-Olive 345 kV	Active
AG1-349	Olive-Reynolds #2 345 kV	Active
AG1-436	Olive-University Park 345 kV	Active
AG1-447	Olive-University Park 345 kV	Active
AG1-448	Olive-University Park 345 kV	Active
AG1-522	Sullivan-Rockport 765 kV	Active
AG1-523	Sullivan-Rockport 765 kV	Active
AG1-524	Sullivan-Rockport 765 kV	Active
AG1-525	Sullivan-Rockport 765 kV	Active
AG1-555	Dequine 345 kV	Active

Queue Number	Project Name	Status
X2-052	Dumont-Olive 345kV	In Service
Y3-099	Beckjord 2 MW-1	In Service
Z1-065	Wiley 34.5kV	In Service

10.8 Contingency Descriptions - Primary POI

Contingency Name	Contingency Definition
Base Case	
AEP_P1-2_#363_1682	CONTINGENCY 'AEP_P1-2_#363_1682' OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1 / 243208 05JEFRSO 765 243209 05ROCKPT 765 1 END
AEP_P1-2_#6490_16000	CONTINGENCY 'AEP_P1-2_#6490_16000' OPEN BRANCH FROM BUS 243217 TO BUS 243878 CKT 2 / 243217 05DEQUIN 345 243878 05MEADOW 345 2 END
AEP_P4_#6189_05HANG	CONTINGENCY '"AEP_P4_#6189_05HANG' R 765_D1" / 1717 OPEN BRANCH FROM BUS 242921 TO BUS 242924 CKT 1 / 242921 05CORNU 765 242924 05HANG R 765 1 OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1 / 242924 05HANG R 765 243208 05JEFRSO 765 1 OPEN BRANCH FROM BUS 242921 TO BUS 242934 CKT 1 / 242921 05CORNU 765 242934 05CORNU 345 1 REMOVE MACHINE 1A FROM BUS 247245 /* 247245 05HRKG1A 18.0 DEFAULT DISPATCH REMOVE MACHINE 1B FROM BUS 247246 /* 247246 05HRKG1B 18.0 DEFAULT DISPATCH REMOVE MACHINE 1S FROM BUS 247247 /* 247247 05HRKG1S 18.0 DEFAULT DISPATCH REMOVE MACHINE 2A FROM BUS 247248 /* 247248 05HRKG2A 18.0 DEFAULT DISPATCH REMOVE MACHINE 2B FROM BUS 247249 /* 247249 05HRKG2B 18.0 DEFAULT DISPATCH REMOVE MACHINE 2S FROM BUS 247250 /* 247250 05HRKG2S 18.0 DEFAULT DISPATCH END
AEP_P4_#6189_05HANG R 765_D1	CONTINGENCY 'AEP_P4_#6189_05HANG R 765_D1' OPEN BRANCH FROM BUS 242921 TO BUS 242924 CKT 1 / 242921 05CORNU 765 242924 05HANG R 765 1 OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1 / 242924 05HANG R 765 243208 05JEFRSO 765 1 OPEN BRANCH FROM BUS 242921 TO BUS 242934 CKT 1 / 242921 05CORNU 765 242934 05CORNU 345 1 REMOVE UNIT 1A FROM BUS 247245 / 247245 05HRKG1A 18.0 1A REMOVE UNIT 1B FROM BUS 247246 / 247246 05HRKG1B 18.0 1B REMOVE UNIT 1S FROM BUS 247247 / 247247 05HRKG1S 18.0 1S REMOVE UNIT 2A FROM BUS 247248 / 247248 05HRKG2A 18.0 2A REMOVE UNIT 2B FROM BUS 247249 / 247249 05HRKG2B 18.0 2B REMOVE UNIT 2S FROM BUS 247250 / 247250 05HRKG2S 18.0 2S END

Contingency Name	Contingency Definition
AEP_P1-2_#8695-B	CONTINGENCY 'AEP_P1-2_#8695-B' OPEN BRANCH FROM BUS 958970 TO BUS 255205 CKT 1 / 958970 AF2-188 TAP 345 255205 17REYNOLDS 345 1 END
AEP_P1-2_#709_546	CONTINGENCY 'AEP_P1-2_#709_546' OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1 / 242924 05HANG R 765 243208 05JEFRSO 765 1 END
AEP_P1-2_#8807	CONTINGENCY 'AEP_P1-2_#8807' OPEN BRANCH FROM BUS 243878 TO BUS 255205 CKT 2 / 243878 05MEADOW 345 255205 17REYNOLDS 345 2 END

11 Short Circuit Analysis - Primary POI

The following Breakers are overdutied:

None.

12 Summer Peak - Load Flow Analysis - Secondary POI

The Queue Project AG1-237 was evaluated as a 200.0 MW (Capacity 26.0 MW) injection tapping the Eugene to Dequine 345 kV line in the AEP area. Project AG1-237 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-237 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)

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
174419977	243217	05DEQUIN	345.0	AEP	243878	05MEADOW	345.0	AEP	2	AEP_P4_#4704_05DEQUIN 345_B1	breaker	1959.0	99.68	103.81	DC	80.86

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	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
164422906	242865	05JEFRSO	345.0	AEP	248000	06CLIFTY	345.0	OVEC	Z1	AEP_P4_#6189_05HANG R 765_D1	breaker	1868.0	156.67	157.42	DC	24.86
174419970	243217	05DEQUIN	345.0	AEP	243878	05MEADOW	345.0	AEP	1	AEP_P4_#6485_05DEQUIN 345_C1	breaker	1959.0	100.38	104.54	DC	81.43
174419997	255204	17REYNOLDS	765.0	NIPS	243207	05GRNTWN	765.0	AEP	1	AEP_P4_#8648_05JEFRSO 765_B	breaker	2669.0	100.59	101.42	DC	42.35

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	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
164423222	242865	05JEFRSO	345.0	AEP	248000	06CLIFTY	345.0	OVEC	Z1	AEP_P1-2_#709_546	operation	1868.0	154.88	155.61	DC	24.91
168155114	243217	05DEQUIN	345.0	AEP	243878	05MEADOW	345.0	AEP	1	AEP_P1-2_#6490_16000	operation	1959.0	96.8	100.88	DC	79.92

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
168155126	243217	05DEQUIN	345.0	AEP	243878	05MEADOW	345.0	AEP	2	AEP_P1-2_#6472_15258	operation	1959.0	96.11	100.16	DC	79.35
168154872	243878	05MEADOW	345.0	AEP	255205	17REYNOLDS	345.0	NIPS	2	AEP_P1-2_#8695-B	operation	1868.0	155.95	160.46	DC	84.28
168154886	243878	05MEADOW	345.0	AEP	958970	AF2-188 TAP	345.0	AEP	1	AEP_P1-2_#8807	operation	1868.0	151.54	156.04	DC	84.06
168416835	255204	17REYNOLDS	765.0	NIPS	243207	05GRNTWN	765.0	AEP	1	AEP_P1-2_#363_1682	operation	2669.0	100.34	101.17	DC	42.82
169936177	958970	AF2-188 TAP	345.0	AEP	255205	17REYNOLDS	345.0	NIPS	1	AEP_P1-2_#8807	operation	1868.0	156.08	160.58	DC	84.06

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	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
174419977	243217	05DEQUIN	AEP	243878	05MEADOW	AEP	2	AEP_P4_#4704_05DEQUIN 345_B1	breaker	1959.0	99.68	103.81	DC	80.86

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
243859	05FR-11G C	2.2041	50/50	2.2041
243862	05FR-12G C	1.0720	50/50	1.0720
243864	05FR-21G C	1.1149	50/50	1.1149
243866	05FR-22G C	1.1149	50/50	1.1149
243870	05FR-3G C	1.0720	50/50	1.0720
243873	05FR-4G C	2.4957	50/50	2.4957
247900	05FR-11G E	42.5631	50/50	42.5631
247901	05FR-12G E	41.8564	50/50	41.8564
247902	05FR-21G E	44.7375	50/50	44.7375
247903	05FR-22G E	42.8349	50/50	42.8349
247904	05FR-3G E	86.7570	50/50	86.7570
247905	05FR-4G E	67.9488	50/50	67.9488
930461	AB1-087 CT1	40.8676	50/50	40.8676
930462	AB1-087 ST1	32.4914	50/50	32.4914
930471	AB1-088 CT1	40.8676	50/50	40.8676
930472	AB1-088 ST1	32.4914	50/50	32.4914
933446	AC2-157 1C	5.0684	50/50	5.0684
933447	AC2-157 2C	5.0684	50/50	5.0684
933448	AC2-157 1E	8.2696	50/50	8.2696
933449	AC2-157 2E	8.2696	50/50	8.2696
942601	AE2-276	6.6690	50/50	6.6690
944201	AF1-088 FTIR	133.3800	50/50	133.3800
945391	AF1-204 C O1	12.9311	50/50	12.9311
945392	AF1-204 E O1	38.7932	50/50	38.7932
953761	J829	25.6825	PJM External (MISO)	25.6825
954681	J949 C	16.6175	PJM External (MISO)	16.6175
954772	J515 E	67.0320	PJM External (MISO)	67.0320
956451	J1139	16.3230	PJM External (MISO)	16.3230
957141	AF2-008 FTIR	66.6900	50/50	66.6900
957142	AF2-008 NFTI	133.3800	50/50	133.3800
957843	AF2-078 BAT	4.3824	50/50	4.3824
963741	AG1-226 C O2	157.9929	50/50	157.9929
963742	AG1-226 E O2	56.4771	50/50	56.4771
963841	AG1-237 C O2	10.5123	50/50	10.5123
963842	AG1-237 E O2	70.3517	50/50	70.3517
966531	AG1-522 C	18.6714	50/50	18.6714
966532	AG1-522 E	12.4476	50/50	12.4476
966541	AG1-523 C	18.6714	50/50	18.6714
966542	AG1-523 E	12.4476	50/50	12.4476
966551	AG1-524 C	18.6714	50/50	18.6714
966552	AG1-524 E	12.4476	50/50	12.4476
966561	AG1-525 C	18.6714	50/50	18.6714

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
966562	AG1-525 E	12.4476	50/50	12.4476
966841	AG1-555 C O2	36.1149	50/50	36.1149
966842	AG1-555 E O2	12.9099	50/50	12.9099
LGEE	LGEE	2.2141	Confirmed LTF	2.2141
CPLE	CPLE	0.8497	Confirmed LTF	0.8497
G-007A	G-007A	0.2733	Confirmed LTF	0.2733
VFT	VFT	0.7224	Confirmed LTF	0.7224
CBM-W2	CBM-W2	44.7642	Confirmed LTF	44.7642
TVA	TVA	4.6704	Confirmed LTF	4.6704
SIGE	SIGE	0.7032	Confirmed LTF	0.7032
CBM-S2	CBM-S2	16.2342	Confirmed LTF	16.2342
CBM-S1	CBM-S1	1.2806	Confirmed LTF	1.2806
CBM-N	CBM-N	0.1296	Confirmed LTF	0.1296
MEC	MEC	2.5853	Confirmed LTF	2.5853
LAGN	LAGN	5.7680	Confirmed LTF	5.7680

12.5.2 Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
164422906	243865	05JEFRSO	AEP	248000	06CLIFTY	OVEC	Z1	AEP_P4_#6189_05HANG R 765_D1	breaker	1868.0	156.67	157.42	DC	24.86

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
243441	05CKG2	19.9630	50/50	19.9630
243442	05RKG1	67.7576	50/50	67.7576
243443	05RKG2	64.9593	50/50	64.9593
243859	05FR-11G C	0.5506	50/50	0.5506
243862	05FR-12G C	0.2678	50/50	0.2678
243864	05FR-21G C	0.2785	50/50	0.2785
243866	05FR-22G C	0.2785	50/50	0.2785
243870	05FR-3G C	0.2678	50/50	0.2678
243873	05FR-4G C	0.6234	50/50	0.6234
246909	05MDL-1G C	0.5683	50/50	0.5683
246910	05MDL-2G C	0.3335	50/50	0.3335
246976	05MDL-3G C	0.3357	50/50	0.3357
246979	05MDL-4G C	0.2589	50/50	0.2589
247556	05MDL-5G	0.4432	50/50	0.4432
247900	05FR-11G E	10.6324	50/50	10.6324
247901	05FR-12G E	10.4558	50/50	10.4558
247902	05FR-21G E	11.1755	50/50	11.1755
247903	05FR-22G E	10.7003	50/50	10.7003
247904	05FR-3G E	21.6721	50/50	21.6721
247905	05FR-4G E	16.9738	50/50	16.9738
247906	05MDL-1G E	22.2111	50/50	22.2111
247907	05MDL-2G E	11.1264	50/50	11.1264
247912	05MDL-3G E	11.1264	50/50	11.1264
247913	05MDL-4G E	11.1264	50/50	11.1264
247943	T-127 E	11.1264	50/50	11.1264
250163	Y3-099 BAT	0.2242	50/50	0.2242
250167	08DEO_STUART	0.2207	50/50	0.2207
251823	Z1-065 BAT	0.6484	50/50	0.6484
270100	X2-052 CT1	3.9619	50/50	3.9619
270101	X2-052 CT2	3.9619	50/50	3.9619
270102	X2-052 ST	4.2863	50/50	4.2863
274776	LINCOLN ;7U	1.2717	50/50	1.2717
274777	LINCOLN ;8U	1.2717	50/50	1.2717
930041	AB1-006 C	0.5705	50/50	0.5705
930042	AB1-006 E	24.1999	50/50	24.1999
930461	AB1-087 CT1	53.0501	50/50	53.0501
930462	AB1-087 ST1	42.1769	50/50	42.1769
930471	AB1-088 CT1	53.0501	50/50	53.0501
930472	AB1-088 ST1	42.1769	50/50	42.1769
932601	AC2-080 C O1	3.5064	50/50	3.5064
932602	AC2-080 E O1	23.4656	50/50	23.4656
933281	AC2-140 C	0.6609	50/50	0.6609

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
933282	AC2-140 E	0.2204	50/50	0.2204
933446	AC2-157 1C	6.5793	50/50	6.5793
933447	AC2-157 2C	6.5793	50/50	6.5793
933448	AC2-157 1E	10.7347	50/50	10.7347
933449	AC2-157 2E	10.7347	50/50	10.7347
937041	AD2-138 C	4.7471	50/50	4.7471
937042	AD2-138 E	22.2249	50/50	22.2249
940581	AE2-045 C O1	11.3660	50/50	11.3660
940582	AE2-045 E O1	15.6060	50/50	15.6060
941341	AE2-130 C	152.0256	50/50	152.0256
941342	AE2-130 E	101.3504	50/50	101.3504
941571	AE2-154 C	4.5201	50/50	4.5201
941572	AE2-154 E	30.2499	50/50	30.2499
942601	AE2-276	8.6570	50/50	8.6570
944201	AF1-088 FTIR	173.1400	50/50	173.1400
945391	AF1-204 C O1	6.8620	50/50	6.8620
945392	AF1-204 E O1	20.5861	50/50	20.5861
945421	AF1-207 C O1	4.7705	50/50	4.7705
945422	AF1-207 E O1	20.4853	50/50	20.4853
945501	AF1-215 C O1	22.4748	50/50	22.4748
945502	AF1-215 E O1	14.9832	50/50	14.9832
946581	AF1-322 C	11.6827	50/50	11.6827
946582	AF1-322 E	16.1333	50/50	16.1333
957141	AF2-008 FTIR	86.5700	50/50	86.5700
957142	AF2-008 NFTI	173.1400	50/50	173.1400
957393	AF2-033 BAT	2.2110	50/50	2.2110
957841	AF2-078 C O1	16.8372	50/50	16.8372
957842	AF2-078 E O1	11.2248	50/50	11.2248
958381	AF2-132 C O1	23.2380	50/50	23.2380
958382	AF2-132 E O1	15.4920	50/50	15.4920
958391	AF2-133 C O1	23.6322	50/50	23.6322
958392	AF2-133 E O1	15.7548	50/50	15.7548
958401	AF2-134 C O1	7.4916	50/50	7.4916
958402	AF2-134 E O1	4.9944	50/50	4.9944
958971	AF2-188 C O1	9.4409	50/50	9.4409
958972	AF2-188 E O1	6.2940	50/50	6.2940
958981	AF2-189 C O1	13.7043	50/50	13.7043
958982	AF2-189 E O1	9.1362	50/50	9.1362
959141	AF2-205 C	15.9444	50/50	15.9444
959142	AF2-205 E	10.6296	50/50	10.6296
960681	AF2-359 C	8.0902	50/50	8.0902
960682	AF2-359 E	5.3935	50/50	5.3935
963741	AG1-226 C O2	47.0365	50/50	47.0365
963742	AG1-226 E O2	16.8140	50/50	16.8140
963841	AG1-237 C O2	3.2313	50/50	3.2313
963842	AG1-237 E O2	21.6247	50/50	21.6247
963851	AG1-238 C	9.5301	50/50	9.5301
963852	AG1-238 E	6.3534	50/50	6.3534
964401	AG1-302 C O2	23.1966	50/50	23.1966
964402	AG1-302 E O2	15.4644	50/50	15.4644
964861	AG1-349 C O2	20.2488	50/50	20.2488
964862	AG1-349 E O2	13.4992	50/50	13.4992

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
965681	AG1-436 C	8.0902	50/50	8.0902
965682	AG1-436 E	5.3935	50/50	5.3935
965791	AG1-447	5.9328	50/50	5.9328
965801	AG1-448	5.9328	50/50	5.9328
966531	AG1-522 C	42.4188	50/50	42.4188
966532	AG1-522 E	28.2792	50/50	28.2792
966541	AG1-523 C	42.4188	50/50	42.4188
966542	AG1-523 E	28.2792	50/50	28.2792
966551	AG1-524 C	42.4188	50/50	42.4188
966552	AG1-524 E	28.2792	50/50	28.2792
966561	AG1-525 C	42.4188	50/50	42.4188
966562	AG1-525 E	28.2792	50/50	28.2792
966841	AG1-555 C O2	11.0173	50/50	11.0173
966842	AG1-555 E O2	3.9383	50/50	3.9383
WEC	WEC	3.0438	Confirmed LTF	3.0438
CALDERWOOD	CALDERWOOD	0.8906	Confirmed LTF	0.8906
LGE-0012019	LGE-0012019	6.4405	LTF	6.4405
CBM-W2	CBM-W2	29.1110	Confirmed LTF	29.1110
NY	NY	0.9783	Confirmed LTF	0.9783
O-066	O-066	12.3697	Confirmed LTF	12.3697
SIGE	SIGE	0.0643	Confirmed LTF	0.0643
CHEOAH	CHEOAH	0.8959	Confirmed LTF	0.8959
G-007	G-007	1.9330	Confirmed LTF	1.9330
HAMLET	HAMLET	1.1192	Confirmed LTF	1.1192
MEC	MEC	12.4117	Confirmed LTF	12.4117
BLUEG	BLUEG	29.4738	Confirmed LTF	29.4738
TRIMBLE	TRIMBLE	10.2630	Confirmed LTF	10.2630
LAGN	LAGN	3.1553	Confirmed LTF	3.1553
CATAWBA	CATAWBA	0.6748	Confirmed LTF	0.6748
CBM-W1	CBM-W1	97.7474	Confirmed LTF	97.7474

12.5.3 Index 3

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
174419970	243217	05DEQUIN	AEP	243878	05MEADOW	AEP	1	AEP_P4_#6485_05DEQUIN 345_C1	breaker	1959.0	100.38	104.54	DC	81.43

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
243859	05FR-11G C	2.2195	50/50	2.2195
243862	05FR-12G C	1.0795	50/50	1.0795
243864	05FR-21G C	1.1227	50/50	1.1227
243866	05FR-22G C	1.1227	50/50	1.1227
243870	05FR-3G C	1.0795	50/50	1.0795
243873	05FR-4G C	2.5132	50/50	2.5132
247900	05FR-11G E	42.8614	50/50	42.8614
247901	05FR-12G E	42.1498	50/50	42.1498
247902	05FR-21G E	45.0510	50/50	45.0510
247903	05FR-22G E	43.1351	50/50	43.1351
247904	05FR-3G E	87.3650	50/50	87.3650
247905	05FR-4G E	68.4250	50/50	68.4250
930461	AB1-087 CT1	41.1556	50/50	41.1556
930462	AB1-087 ST1	32.7204	50/50	32.7204
930471	AB1-088 CT1	41.1556	50/50	41.1556
930472	AB1-088 ST1	32.7204	50/50	32.7204
933446	AC2-157 1C	5.1042	50/50	5.1042
933447	AC2-157 2C	5.1042	50/50	5.1042
933448	AC2-157 1E	8.3278	50/50	8.3278
933449	AC2-157 2E	8.3278	50/50	8.3278
942601	AE2-276	6.7160	50/50	6.7160
944201	AF1-088 FTIR	134.3200	50/50	134.3200
945391	AF1-204 C O1	13.0216	50/50	13.0216
945392	AF1-204 E O1	39.0647	50/50	39.0647
953761	J829	25.8625	PJM External (MISO)	25.8625
954681	J949 C	16.7348	PJM External (MISO)	16.7348
954772	J515 E	67.5000	PJM External (MISO)	67.5000
956451	J1139	16.4370	PJM External (MISO)	16.4370
957141	AF2-008 FTIR	67.1600	50/50	67.1600
957142	AF2-008 NFTI	134.3200	50/50	134.3200
957843	AF2-078 BAT	4.4130	50/50	4.4130
963741	AG1-226 C O2	159.1001	50/50	159.1001
963742	AG1-226 E O2	56.8729	50/50	56.8729
963841	AG1-237 C O2	10.5862	50/50	10.5862
963842	AG1-237 E O2	70.8458	50/50	70.8458
966531	AG1-522 C	18.8028	50/50	18.8028
966532	AG1-522 E	12.5352	50/50	12.5352
966541	AG1-523 C	18.8028	50/50	18.8028
966542	AG1-523 E	12.5352	50/50	12.5352
966551	AG1-524 C	18.8028	50/50	18.8028
966552	AG1-524 E	12.5352	50/50	12.5352
966561	AG1-525 C	18.8028	50/50	18.8028

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
966562	AG1-525 E	12.5352	50/50	12.5352
966841	AG1-555 C O2	36.3686	50/50	36.3686
966842	AG1-555 E O2	13.0006	50/50	13.0006
LGEE	LGEE	2.2298	Confirmed LTF	2.2298
CPLE	CPLE	0.8565	Confirmed LTF	0.8565
G-007A	G-007A	0.2757	Confirmed LTF	0.2757
VFT	VFT	0.7288	Confirmed LTF	0.7288
CBM-W2	CBM-W2	45.0778	Confirmed LTF	45.0778
TVA	TVA	4.7040	Confirmed LTF	4.7040
SIGE	SIGE	0.7081	Confirmed LTF	0.7081
CBM-S2	CBM-S2	16.3595	Confirmed LTF	16.3595
CBM-S1	CBM-S1	1.2901	Confirmed LTF	1.2901
CBM-N	CBM-N	0.1308	Confirmed LTF	0.1308
MEC	MEC	2.6044	Confirmed LTF	2.6044
LAGN	LAGN	5.8083	Confirmed LTF	5.8083

12.5.4 Index 4

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
174419997	255204	17REYNOLDS	NIPS	243207	05GRNTWN	AEP	1	AEP_P4_#8648_05JEFRSO 765_B	breaker	2669.0	100.59	101.42	DC	42.35

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
243442	05RKG1	22.8611	50/50	22.8611
243443	05RKG2	21.9170	50/50	21.9170
243859	05FR-11G C	1.1126	50/50	1.1126
243862	05FR-12G C	0.5411	50/50	0.5411
243864	05FR-21G C	0.5628	50/50	0.5628
243866	05FR-22G C	0.5628	50/50	0.5628
243870	05FR-3G C	0.5411	50/50	0.5411
243873	05FR-4G C	1.2598	50/50	1.2598
246909	05MDL-1G C	1.2928	50/50	1.2928
246910	05MDL-2G C	0.7587	50/50	0.7587
246976	05MDL-3G C	0.7637	50/50	0.7637
246979	05MDL-4G C	0.5890	50/50	0.5890
247556	05MDL-5G	1.0083	50/50	1.0083
247900	05FR-11G E	21.4855	50/50	21.4855
247901	05FR-12G E	21.1288	50/50	21.1288
247902	05FR-21G E	22.5831	50/50	22.5831
247903	05FR-22G E	21.6227	50/50	21.6227
247904	05FR-3G E	43.7942	50/50	43.7942
247905	05FR-4G E	34.3000	50/50	34.3000
247906	05MDL-1G E	50.5259	50/50	50.5259
247907	05MDL-2G E	25.3104	50/50	25.3104
247912	05MDL-3G E	25.3104	50/50	25.3104
247913	05MDL-4G E	25.3104	50/50	25.3104
247943	T-127 E	25.3104	50/50	25.3104
930041	AB1-006 C	1.2978	50/50	1.2978
930042	AB1-006 E	55.0501	50/50	55.0501
930461	AB1-087 CT1	32.7695	50/50	32.7695
930462	AB1-087 ST1	26.0530	50/50	26.0530
930471	AB1-088 CT1	32.7695	50/50	32.7695
930472	AB1-088 ST1	26.0530	50/50	26.0530
932601	AC2-080 C O1	7.4711	50/50	7.4711
932602	AC2-080 E O1	49.9989	50/50	49.9989
933446	AC2-157 1C	4.0641	50/50	4.0641
933447	AC2-157 2C	4.0641	50/50	4.0641
933448	AC2-157 1E	6.6309	50/50	6.6309
933449	AC2-157 2E	6.6309	50/50	6.6309
937041	AD2-138 C	10.1147	50/50	10.1147
937042	AD2-138 E	47.3553	50/50	47.3553
940581	AE2-045 C O1	24.2179	50/50	24.2179
940582	AE2-045 E O1	33.2521	50/50	33.2521
941341	AE2-130 C	51.2928	50/50	51.2928
941342	AE2-130 E	34.1952	50/50	34.1952

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
941571	AE2-154 C	10.2823	50/50	10.2823
941572	AE2-154 E	68.8126	50/50	68.8126
942601	AE2-276	5.3475	50/50	5.3475
944201	AF1-088 FTIR	106.9500	50/50	106.9500
945391	AF1-204 C O1	7.7195	50/50	7.7195
945392	AF1-204 E O1	23.1585	50/50	23.1585
945421	AF1-207 C O1	11.3217	50/50	11.3217
945422	AF1-207 E O1	48.6165	50/50	48.6165
945501	AF1-215 C O1	36.6552	50/50	36.6552
945502	AF1-215 E O1	24.4368	50/50	24.4368
946581	AF1-322 C	26.5759	50/50	26.5759
946582	AF1-322 E	36.7001	50/50	36.7001
954941	J968 C	6.2824	PJM External (MISO)	6.2824
954942	J968 E	33.9894	PJM External (MISO)	33.9894
955841	J1069 C	9.2115	PJM External (MISO)	9.2115
955842	J1069 E	49.8365	PJM External (MISO)	49.8365
957141	AF2-008 FTIR	53.4750	50/50	53.4750
957142	AF2-008 NFTI	106.9500	50/50	106.9500
957841	AF2-078 C O1	39.9588	50/50	39.9588
957842	AF2-078 E O1	26.6392	50/50	26.6392
958381	AF2-132 C O1	43.0380	50/50	43.0380
958382	AF2-132 E O1	28.6920	50/50	28.6920
958391	AF2-133 C O1	46.3428	50/50	46.3428
958392	AF2-133 E O1	30.8952	50/50	30.8952
958401	AF2-134 C O1	12.2184	50/50	12.2184
958402	AF2-134 E O1	8.1456	50/50	8.1456
958971	AF2-188 C O1	22.4663	50/50	22.4663
958972	AF2-188 E O1	14.9775	50/50	14.9775
959141	AF2-205 C	32.4852	50/50	32.4852
959142	AF2-205 E	21.6568	50/50	21.6568
963741	AG1-226 C O2	81.8971	50/50	81.8971
963742	AG1-226 E O2	29.2754	50/50	29.2754
963841	AG1-237 C O2	5.5052	50/50	5.5052
963842	AG1-237 E O2	36.8428	50/50	36.8428
964401	AG1-302 C O2	42.6888	50/50	42.6888
964402	AG1-302 E O2	28.4592	50/50	28.4592
964861	AG1-349 C O2	38.2153	50/50	38.2153
964862	AG1-349 E O2	25.4769	50/50	25.4769
966531	AG1-522 C	19.2438	50/50	19.2438
966532	AG1-522 E	12.8292	50/50	12.8292
966541	AG1-523 C	19.2438	50/50	19.2438
966542	AG1-523 E	12.8292	50/50	12.8292
966551	AG1-524 C	19.2438	50/50	19.2438
966552	AG1-524 E	12.8292	50/50	12.8292
966561	AG1-525 C	19.2438	50/50	19.2438
966562	AG1-525 E	12.8292	50/50	12.8292
966841	AG1-555 C O2	18.8858	50/50	18.8858
966842	AG1-555 E O2	6.7510	50/50	6.7510
WEC	WEC	1.1680	Confirmed LTF	1.1680
LGEE	LGEE	1.3490	Confirmed LTF	1.3490
CBM-W2	CBM-W2	35.6429	Confirmed LTF	35.6429
NY	NY	0.5585	Confirmed LTF	0.5585

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
TVA	TVA	3.0086	Confirmed LTF	3.0086
O-066	O-066	6.9184	Confirmed LTF	6.9184
SIGE	SIGE	0.5926	Confirmed LTF	0.5926
CBM-S1	CBM-S1	0.8166	Confirmed LTF	0.8166
G-007	G-007	1.0794	Confirmed LTF	1.0794
HAMLET	HAMLET	0.1784	Confirmed LTF	0.1784
MEC	MEC	6.5022	Confirmed LTF	6.5022
LAGN	LAGN	4.6568	Confirmed LTF	4.6568
CATAWBA	CATAWBA	0.0640	Confirmed LTF	0.0640
CBM-W1	CBM-W1	43.6302	Confirmed LTF	43.6302

12.6 Contingency Descriptions - Secondary POI

Contingency Name	Contingency Definition
AEP_P4_#4704_05DEQUIN 345_B1	CONTINGENCY 'AEP_P4_#4704_05DEQUIN 345_B1' / 2510 OPEN BRANCH FROM BUS 243217 TO BUS 243878 CKT 1 / 243217 05DEQUIN 345 243878 05MEADOW 345 1 OPEN BRANCH FROM BUS 243217 TO BUS 249525 CKT 1 / 243217 05DEQUIN 345 249525 08WESTWD 345 1 REMOVE SWSHUNT FROM BUS 243217 /* 243217 05DEQUIN 345 END
AEP_P1-2_#363_1682	CONTINGENCY 'AEP_P1-2_#363_1682' / 873 OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1 / 243208 05JEFRSO 765 243209 05ROCKPT 765 1 END
AEP_P1-2_#6490_16000	CONTINGENCY 'AEP_P1-2_#6490_16000' / 2472 OPEN BRANCH FROM BUS 243217 TO BUS 243878 CKT 2 / 243217 05DEQUIN 345 243878 05MEADOW 345 2 END
AEP_P1-2_#8695-B	CONTINGENCY 'AEP_P1-2_#8695-B' / 1153 OPEN BRANCH FROM BUS 255205 TO BUS 958970 CKT 1 / 255205 17REYNOLDS 345 958970 AF2-188 TAP 345 1 END
AEP_P1-2_#6472_15258	CONTINGENCY 'AEP_P1-2_#6472_15258' / 2508 OPEN BRANCH FROM BUS 243217 TO BUS 243878 CKT 1 / 243217 05DEQUIN 345 243878 05MEADOW 345 1 END
AEP_P4_#6485_05DEQUIN 345_C1	CONTINGENCY 'AEP_P4_#6485_05DEQUIN 345_C1' / 2467 OPEN BRANCH FROM BUS 243217 TO BUS 243878 CKT 2 / 243217 05DEQUIN 345 243878 05MEADOW 345 2 OPEN BRANCH FROM BUS 243217 TO BUS 249525 CKT 1 / 243217 05DEQUIN 345 249525 08WESTWD 345 1 REMOVE SWSHUNT FROM BUS 243217 /* 243217 05DEQUIN 345 END

Contingency Name	Contingency Definition
AEP_P4_#6189_05HANG R 765_D1	CONTINGENCY 'AEP_P4_#6189_05HANG R 765_D1' OPEN BRANCH FROM BUS 242921 TO BUS 242924 CKT 1 / 242921 05CORNU 765 242924 05HANG R 765 1 OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1 / 242924 05HANG R 765 243208 05JEFRSO 765 1 OPEN BRANCH FROM BUS 242921 TO BUS 242934 CKT 1 / 242921 05CORNU 765 242934 05CORNU 345 1 REMOVE UNIT 1A FROM BUS 247245 / 247245 05HRKG1A 18.0 1A REMOVE UNIT 1B FROM BUS 247246 / 247246 05HRKG1B 18.0 1B REMOVE UNIT 1S FROM BUS 247247 / 247247 05HRKG1S 18.0 1S REMOVE UNIT 2A FROM BUS 247248 / 247248 05HRKG2A 18.0 2A REMOVE UNIT 2B FROM BUS 247249 / 247249 05HRKG2B 18.0 2B REMOVE UNIT 2S FROM BUS 247250 / 247250 05HRKG2S 18.0 2S END
AEP_P4_#8648_05JEFRSO 765_B	CONTINGENCY 'AEP_P4_#8648_05JEFRSO 765_B' / 1305 OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1 / 243208 05JEFRSO 765 243209 05ROCKPT 765 1 OPEN BRANCH FROM BUS 243208 TO BUS 242865 CKT 2 / 243208 05JEFRSO 765 242865 05JEFRSO 345 2 OPEN BRANCH FROM BUS 242865 TO BUS 248000 CKT Z1 / 242865 05JEFRSO 345 248000 06CLIFTY 345 Z1 END
AEP_P1-2_#709_546	CONTINGENCY 'AEP_P1-2_#709_546' / 1848 OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1 / 242924 05HANG R 765 243208 05JEFRSO 765 1 END
AEP_P1-2_#8807	CONTINGENCY 'AEP_P1-2_#8807' / 1147 OPEN BRANCH FROM BUS 243878 TO BUS 255205 CKT 2 / 243878 05MEADOW 345 255205 17REYNOLDS 345 2 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).