Generation Interconnection

Feasibility Study Report

for

Queue Project AE2-302

EAST BEAVER-LICK 138 KV

37.8 MW Capacity / 63 MW Energy

October, 2019

Table of Contents

1 Preface

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

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

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

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

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

2 General

The Interconnection Customer has proposed to install PJM project # AE2-302, a Solar generating facility located in Jackson County, Ohio (See Figure 2). The installed facilities will have a total capability of 63 MW with 37.8 MW of this output being recognized by PJM as Capacity. The Primary Point of Interconnection will be to the East Beaver – Lick 138 kV section of the Don Marquis – Lick 138 kV circuit (See Figure 1). The Secondary Point of Interconnection will be a direct connection to East Beaver 138 kV substation (See Figure 3).

The proposed in-service date for this project is July 1, 2022. This study does not imply AEP's commitment to this in-service date.

The objective of this Feasibility Study is to determine budgetary cost estimates and approximate construction timelines for identified transmission facilities required to connect the proposed generating facilities to the AEP transmission system. These reinforcements include the Attachment Facilities, Local Upgrades, and Network Upgrades required for maintaining the reliability of the AEP transmission system.

The Feasibility Study includes Short Circuit and Peak Load steady state power flow analyses. The conduct of power flow studies at other load levels, stability analysis, and coordination with non-PJM Transmission Planners, 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 these additional analyses which shall be performed following execution of the System Impact Study agreement.

Queue Number	**AE2-302**
Project Name	EAST BEAVER-LICK 138 KV
State	Ohio
County	Jackson
Transmission Owner	AEP
MFO	63
MWE	63
MWC	37.8
Fuel	Solar
Base case Study Year	2022

2.1 Primary Point of Interconnection

AE2-302 will interconnect with the AEP transmission system via a new station cut into the East Beaver – Lick 138 kV section of the Don Marquis – Lick 138 kV circuit.

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

2.2 Cost Summary

The AE2-302 project will be responsible for the following costs:

Based upon the results of this Feasibility Study, the construction of the 63 MW (37.8 MW Capacity) solar generating facility of the Interconnection Customer (PJM Project #AE2-302) will require the following additional interconnection charges. This plan of service will interconnect the proposed generating facility in a manner that will provide operational reliability and flexibility to both the AEP system and the the Interconnection Customer generating facility.

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

In addition, the AE2-302 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	$77,200

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

3 Transmission Owner Scope of Work

4 Attachment Facilities

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

Description	Total Cost
138 kV Revenue Metering	$250,000
Total Attachment Facility Costs	**$6,250,000**

5 Direct Connection Cost Estimate

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

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

6 Non-Direct Connection Cost Estimate

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

Description	Total Cost
East Beaver – Lick 138 kV T-Line Cut In	$1,000,000
Upgrade line protection and controls at the Don Marquis 138 kV substation	$250,000
Upgrade line protection and controls at the Lick 138 kV substation	$250,000
Total Non-Direct Connection Facility Costs	**$1,500,000**

7 Incremental Capacity Transfer Rights (ICTRs)

Will be determined at a later study phase

8 Schedule

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

9 Interconnection Customer Requirements

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

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

Requirement from the PJM Open Access Transmission Tariff:

1. An Interconnection Customer entering the New Services Queue on or after October 1, 2012 with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.
2. The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Section 4 of PJM Manual 14D for additional information.

10 Revenue Metering and SCADA Requirements

10.1 PJM Requirements

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

10.2 AEP Requirements

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

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

11 Network Impacts – Option 1

The Queue Project AE2-302 was evaluated as a 63 MW (Capacity 37.8 MW) injection to the East Beaver – Lick 138 kV line in the AEP area. Project AE2-302 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-302 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

12 Generation Deliverability

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

None

13 Multiple Facility Contingency

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

None

14 Contribution to Previously Identified Overloads

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

ID	FROM BUS#	FROM BUS	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
7394141	243102	05SINKG8	AEP	243019	05HILLSB	AEP	1	AEP_P7-1_#10941-B	tower	185.0	101.72	106.1	DC	8.1
7394042	932450	AC2-064 TAP	AEP	243102	05SINKG8	AEP	1	AEP_P7-1_#10941-B	tower	173.0	110.97	115.66	DC	8.1

15 Potential Congestion due to Local Energy Deliverability

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

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

ID	FROM BUS#	FROM BUS	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
7393758	244283	05MINERAL SS	AEP	244198	05LEMASTER	AEP	1	AEP_P1-2_#5919	operation	180.0	96.6	101.17	DC	8.23

16 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
7394141	1	05SINKG8 138.0 kV - 05HILLSB 138.0 kV Ckt 1	AEP AEPO0016a (218) : Perform sag study on 14.3 miles of ACSR ~ 477 ~ 26/7 ~ HAWK conductor from Hillsboro to Sinking Springs Project Type : FAC Cost : $57,200 Time Estimate : 6-12 Months	$57,200
7394042	2	AC2-064 TAP 138.0 kV - 05SINKG8 138.0 kV Ckt 1	AEP AEPO0017a (219) : Perform sag study on ~2 miles of ACSR ~ 477 ~ 26/7 ~ HAWK conductor from to AC2-064 to Sinking Springs Project Type : FAC Cost : $20,000 Time Estimate : 6-12 Months	$20,000
			TOTAL COST	$77,200

17 Flow Gate Details

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

17.1 Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
7394141	243102	05SINKG8	AEP	243019	05HILLSB	AEP	1	AEP_P7-1_#10941-B	tower	185.0	101.72	106.1	DC	8.1

Bus #	Bus	MW Impact
342948	1LOVE HYDRO	1.14
916272	Z1-080 E	0.8
918802	AA1-099 E	0.53
932451	AC2-064 C	40.05
932452	AC2-064 E	26.7
935051	AD1-141 C O1	2.06
935052	AD1-141 E O1	1.37
936621	AD2-078	3.48
942831	AE2-302 C O1	4.86
942832	AE2-302 E O1	3.24
BLUEG	BLUEG	3.76
CALDERWOOD	CALDERWOOD	0.03
CANNELTON	CANNELTON	0.19
CBM-N	CBM-N	0.11
CBM-S2	CBM-S2	0.21
CHEOAH	CHEOAH	0.03
CHILHOWEE	CHILHOWEE	0.01
COFFEEN	COFFEEN	0.23
COTTONWOOD	COTTONWOOD	0.47
CPLE	CPLE	0.11
DUCKCREEK	DUCKCREEK	0.47
EDWARDS	EDWARDS	0.22
ELMERSMITH	ELMERSMITH	0.32
FARMERCITY	FARMERCITY	0.13
G-007A	G-007A	0.37
GIBSON	GIBSON	0.13
NEWTON	NEWTON	0.63
NYISO	NYISO	0.46
PRAIRIE	PRAIRIE	1.0
SANTEETLA	SANTEETLA	0.01
SMITHLAND	SMITHLAND	0.08
TATANKA	TATANKA	0.24
TILTON	TILTON	0.31
TRIMBLE	TRIMBLE	0.42
TVA	TVA	0.34
UNIONPOWER	UNIONPOWER	0.13
VFT	VFT	0.99

17.2 Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
7394042	932450	AC2-064 TAP	AEP	243102	05SINKG8	AEP	1	AEP_P7-1_#10941-B	tower	173.0	110.97	115.66	DC	8.1

Bus #	Bus	MW Impact
342948	1LOVE HYDRO	1.14
916272	Z1-080 E	0.8
918802	AA1-099 E	0.53
932451	AC2-064 C	40.05
932452	AC2-064 E	26.7
935051	AD1-141 C O1	2.06
935052	AD1-141 E O1	1.37
936621	AD2-078	3.48
942831	AE2-302 C O1	4.86
942832	AE2-302 E O1	3.24
BLUEG	BLUEG	3.76
CALDERWOOD	CALDERWOOD	0.03
CANNELTON	CANNELTON	0.19
CBM-N	CBM-N	0.11
CBM-S2	CBM-S2	0.21
CHEOAH	CHEOAH	0.03
CHILHOWEE	CHILHOWEE	0.01
COFFEEN	COFFEEN	0.23
COTTONWOOD	COTTONWOOD	0.47
CPLE	CPLE	0.11
DUCKCREEK	DUCKCREEK	0.47
EDWARDS	EDWARDS	0.22
ELMERSMITH	ELMERSMITH	0.32
FARMERCITY	FARMERCITY	0.13
G-007A	G-007A	0.37
GIBSON	GIBSON	0.13
NEWTON	NEWTON	0.63
NYISO	NYISO	0.46
PRAIRIE	PRAIRIE	1.0
SANTEETLA	SANTEETLA	0.01
SMITHLAND	SMITHLAND	0.08
TATANKA	TATANKA	0.24
TILTON	TILTON	0.31
TRIMBLE	TRIMBLE	0.42
TVA	TVA	0.34
UNIONPOWER	UNIONPOWER	0.13
VFT	VFT	0.99

Affected Systems

18 Affected Systems

18.1 LG&E

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

18.2 MISO

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

18.3 TVA

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

18.4 Duke Energy Progress

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

18.5 NYISO

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

19 Contingency Descriptions

Contingency Name	Contingency Definition
AEP_P1-2_#5919	CONTINGENCY 'AEP_P1-2_#5919' OPEN BRANCH FROM BUS 242987 TO BUS 243038 CKT 1 / 242987 05DEXTER 138 243038 05MEIG1Z 138 1 OPEN BRANCH FROM BUS 243035 TO BUS 243038 CKT 1 / 243035 05MEIG 1 138 243038 05MEIG1Z 138 1 OPEN BRANCH FROM BUS 243038 TO BUS 243084 CKT 1 / 243038 05MEIG1Z 138 243084 05RUTLAN 138 1 OPEN BRANCH FROM BUS 243084 TO BUS 242807 CKT 1 / 243084 05RUTLAN 138 242807 05SPORN 138 1 REMOVE UNIT 1 FROM BUS 243084 / 243084 05RUTLAN 138 REMOVE UNIT 2 FROM BUS 243084 / 243084 05RUTLAN 138 END
AEP_P7-1_#10941-B	CONTINGENCY 'AEP_P7-1_#10941-B' OPEN BRANCH FROM BUS 942830 TO BUS 243534 CKT 1 / 942830 AE2-302 TAP 138 243534 05LICK 138 1 OPEN BRANCH FROM BUS 243501 TO BUS 243034 CKT 1 / 243501 05E.BEAV 138 243034 05MARQUI 138 1 OPEN BRANCH FROM BUS 243034 TO BUS 243544 CKT 1 / 243034 05MARQUI 138 243544 05MILPRD 138 1 OPEN BRANCH FROM BUS 243034 TO BUS 243585 CKT 1 / 243034 05MARQUI 138 243585 05WAVERL 138 1 OPEN BRANCH FROM BUS 243544 TO BUS 243585 CKT 1 / 243544 05MILPRD 138 243585 05WAVERL 138 1 END

Short Circuit

20 Short Circuit

The following Breakers are over-duty

None

21 Secondary Point of Interconnection

AE2-302 will interconnect with the AEP transmission system at East Beaver 138 kV substation.

To accommodate the interconnection at the East Beaver 138 kV substation, the East Beaver substation will have to be expanded to a new four (4) circuit breaker 138 kV substation physically configured in a breaker and half bus arrangement (see Figure 3). Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 kV revenue metering will also be required. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.

22 Network Impacts – Option 2

The Queue Project AE2-302 was evaluated as a 63.0 MW (Capacity 37.8 MW) injection at East Beaver 138 kV in the AEP area. Project AE2-302 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-302 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

Summer Peak Load Flow

23 Generation Deliverability

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

None

24 Multiple Facility Contingency

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

None

25 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	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
12202732	243102	05SINKG8	AEP	243019	05HILLSB	AEP	1	AEP_P7-1_#10941	tower	185.0	101.8	106.18	DC	8.1
12202628	932450	AC2-064 TAP	AEP	243102	05SINKG8	AEP	1	AEP_P7-1_#10941	tower	173.0	111.05	115.74	DC	8.1

26 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	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
7393758	244283	05MINERAL SS	AEP	244198	05LEMASTER	AEP	1	AEP_P1-2_#5919	operation	180.0	96.54	100.26	DC	6.7

27 Flow Gate Details

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

27.1 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
12202732	243102	05SINKG8	AEP	243019	05HILLSB	AEP	1	AEP_P7-1_#10941	tower	185.0	101.8	106.18	DC	8.1

Bus #	Bus	MW Impact
342948	1LOVE HYDRO	1.14
916272	Z1-080 E	0.8
918802	AA1-099 E	0.53
932451	AC2-064 C	40.05
932452	AC2-064 E	26.7
935051	AD1-141 C O1	2.06
935052	AD1-141 E O1	1.37
936621	AD2-078	3.48
942831	AE2-302 C O2	4.86
942832	AE2-302 E O2	3.24
BLUEG	BLUEG	3.77
CALDERWOOD	CALDERWOOD	0.03
CANNELTON	CANNELTON	0.19
CBM-N	CBM-N	0.11
CBM-S2	CBM-S2	0.21
CHEOAH	CHEOAH	0.03
CHILHOWEE	CHILHOWEE	0.01
COFFEEN	COFFEEN	0.23
COTTONWOOD	COTTONWOOD	0.47
CPLE	CPLE	0.11
DUCKCREEK	DUCKCREEK	0.47
EDWARDS	EDWARDS	0.22
ELMERSMITH	ELMERSMITH	0.32
FARMERCITY	FARMERCITY	0.13
G-007A	G-007A	0.37
GIBSON	GIBSON	0.13
NEWTON	NEWTON	0.63
NYISO	NYISO	0.46
PRAIRIE	PRAIRIE	1.01
SANTEETLA	SANTEETLA	0.01
SMITHLAND	SMITHLAND	0.08
TATANKA	TATANKA	0.24
TILTON	TILTON	0.31
TRIMBLE	TRIMBLE	0.42
TVA	TVA	0.34
UNIONPOWER	UNIONPOWER	0.13
VFT	VFT	0.99

27.2 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
12202628	932450	AC2-064 TAP	AEP	243102	05SINKG8	AEP	1	AEP_P7-1_#10941	tower	173.0	111.05	115.74	DC	8.1

Bus #	Bus	MW Impact
342948	1LOVE HYDRO	1.14
916272	Z1-080 E	0.8
918802	AA1-099 E	0.53
932451	AC2-064 C	40.05
932452	AC2-064 E	26.7
935051	AD1-141 C O1	2.06
935052	AD1-141 E O1	1.37
936621	AD2-078	3.48
942831	AE2-302 C O2	4.86
942832	AE2-302 E O2	3.24
BLUEG	BLUEG	3.77
CALDERWOOD	CALDERWOOD	0.03
CANNELTON	CANNELTON	0.19
CBM-N	CBM-N	0.11
CBM-S2	CBM-S2	0.21
CHEOAH	CHEOAH	0.03
CHILHOWEE	CHILHOWEE	0.01
COFFEEN	COFFEEN	0.23
COTTONWOOD	COTTONWOOD	0.47
CPLE	CPLE	0.11
DUCKCREEK	DUCKCREEK	0.47
EDWARDS	EDWARDS	0.22
ELMERSMITH	ELMERSMITH	0.32
FARMERCITY	FARMERCITY	0.13
G-007A	G-007A	0.37
GIBSON	GIBSON	0.13
NEWTON	NEWTON	0.63
NYISO	NYISO	0.46
PRAIRIE	PRAIRIE	1.01
SANTEETLA	SANTEETLA	0.01
SMITHLAND	SMITHLAND	0.08
TATANKA	TATANKA	0.24
TILTON	TILTON	0.31
TRIMBLE	TRIMBLE	0.42
TVA	TVA	0.34
UNIONPOWER	UNIONPOWER	0.13
VFT	VFT	0.99

Affected Systems

28 Affected Systems

28.1 LG&E

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

28.2 MISO

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

28.3 TVA

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

28.4 Duke Energy Progress

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

28.5 NYISO

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

29 Contingency Descriptions

Contingency Name	Contingency Definition
AEP_P7-1_#10941	CONTINGENCY 'AEP_P7-1_#10941' OPEN BRANCH FROM BUS 243501 TO BUS 243534 CKT 1 / 243501 05E.BEAV 138 243534 05LICK 138 1 OPEN BRANCH FROM BUS 243501 TO BUS 243534 CKT 1 / 243501 05E.BEAV 138 243534 05LICK 138 1 OPEN BRANCH FROM BUS 243501 TO BUS 243034 CKT 1 / 243501 05E.BEAV 138 243034 05MARQUI 138 1 OPEN BRANCH FROM BUS 243034 TO BUS 243544 CKT 1 / 243034 05MARQUI 138 243544 05MILPRD 138 1 OPEN BRANCH FROM BUS 243034 TO BUS 243585 CKT 1 / 243034 05MARQUI 138 243585 05WAVERL 138 1 OPEN BRANCH FROM BUS 243544 TO BUS 243585 CKT 1 / 243544 05MILPRD 138 243585 05WAVERL 138 1 END
AEP_P1-2_#5919	CONTINGENCY 'AEP_P1-2_#5919' OPEN BRANCH FROM BUS 242987 TO BUS 243038 CKT 1 / 242987 05DEXTER 138 243038 05MEIG1Z 138 1 OPEN BRANCH FROM BUS 243035 TO BUS 243038 CKT 1 / 243035 05MEIG 1 138 243038 05MEIG1Z 138 1 OPEN BRANCH FROM BUS 243038 TO BUS 243084 CKT 1 / 243038 05MEIG1Z 138 243084 05RUTLAN 138 1 OPEN BRANCH FROM BUS 243084 TO BUS 242807 CKT 1 / 243084 05RUTLAN 138 242807 05SPORN 138 1 REMOVE UNIT 1 FROM BUS 243084 / 243084 05RUTLAN 138 REMOVE UNIT 2 FROM BUS 243084 / 243084 05RUTLAN 138 END

Short Circuit

30 Short Circuit

The following Breakers are over-duty

None