Generation Interconnection

Feasibility Study Report

for

Queue Project AE1-093

ELK 138 KV

42 MW Capacity / 42 MW Energy

June, 2019

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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.

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.

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General

The Interconnection Customer has proposed to install PJM Project #AE1-093, a Storage facility located in Vinton County, Ohio (See Figure 2) The installed facilities will have a capability of 42 MW with 42 MW of this output being recognized by PJM as capacity. This project is an increase to the Interconnection customer's previous AC1-194 project, a 125.0 MW (47.5 MW) solar facility. Note that AE1-093 will share the same connection point with AC1-194 project. The point of interconnection will be AEP's Elk 138 kV substation. The proposed in-service date for this project is December 31, 2021. 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	**AE1-093**
Project Name	ELK 138 KV
State	Ohio
County	Vinton
Transmission Owner	AEP
MFO	42
MWE	42
MWC	42
Fuel	Storage
Basecase Study Year	2022

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Point of Interconnection

AE1-093 will interconnect with the AEP transmission system at the Elk 138 kV substation.

To be constructed by the Interconnection customer's previous PJM Project # AC1-094.

Note: It is assumed that the 138kV revenue metering system and gen lead installed for #AC1-194 will be adequate for the additional generation connection requested in AE1-093.

Cost Summary

The AE1-093 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$0
Direct Connection Network Upgrade	$0
Non Direct Connection Network Upgrades	$0
Total Costs	$0

In addition, the AE1-093 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	$**20,664,000**

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

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Transmission Owner Scope of Work

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
	$0
Total Attachment Facility Costs	$0

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
	$0
Total Direct Connection Facility Costs	$0

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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
	$0
Total Non-Direct Connection Facility Costs	$0

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.

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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 Elk 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.

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Revenue Metering and SCADA Requirements

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.

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

Network Impacts

The Queue Project AE1-093 was evaluated as a 42 MW (Capacity 42 MW) injection at the Elk 138 kV substation in the AEP area. Project AE1-093 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE1-093 was studied with a commercial probability of 53%. Potential network impacts were as follows:

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Summer Peak Load Flow

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Generation Deliverability

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

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
616310	933760	AC2-035 TAP	AEP	243603	05ECHO 8	AEP	1	AEP_P1-2_#5929	single	50.0	94.97	100.94	DC	2.98

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	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
615686	243603	05ECHO 8	AEP	243610	05LICK	AEP	1	AEP_P4_#9726_05LICK 138_106	breaker	75.0	95.37	101.64	DC	4.7

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
615381	243522	05HARRIS	AEP	243593	05ZUBER	AEP	1	AEP_P4_#9679_05HARRISON 138_2E	breaker	167.0	122.87	123.86	DC	3.13
616829	243522	05HARRIS	AEP	243593	05ZUBER	AEP	1	AEP_P7-1_#10921	tower	167.0	115.39	116.38	DC	3.13
615234	246782	05FIREBRCK	AEP	247061	05JEFFERSNSS	AEP	1	AEP_P4_#9726_05LICK 138_106	breaker	50.0	125.96	136.07	DC	4.7
616890	246782	05FIREBRCK	AEP	247061	05JEFFERSNSS	AEP	1	AEP_P7-1_#10941	tower	50.0	107.51	110.72	DC	3.03
615507	246893	05BIERSRUN	AEP	243617	05SLATE	AEP	1	AEP_P4_#9726_05LICK 138_106	breaker	50.0	109.66	113.51	DC	3.63
616902	246893	05BIERSRUN	AEP	243617	05SLATE	AEP	1	AEP_P7-1_#10941	tower	50.0	106.03	108.67	DC	2.5
615492	247061	05JEFFERSNSS	AEP	933760	AC2-035 TAP	AEP	1	AEP_P4_#9726_05LICK 138_106	breaker	50.0	104.36	114.47	DC	4.7
615084	933760	AC2-035 TAP	AEP	243603	05ECHO 8	AEP	1	AEP_P4_#9726_05LICK 138_106	breaker	50.0	148.66	158.06	DC	4.7
615085	933760	AC2-035 TAP	AEP	243603	05ECHO 8	AEP	1	AEP_P4_#9866_05MARQUI 138_P	breaker	50.0	116.7	119.88	DC	2.99
616732	933760	AC2-035 TAP	AEP	243603	05ECHO 8	AEP	1	AEP_P7-1_#10941	tower	50.0	132.61	135.82	DC	3.03

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
616276	243522	05HARRIS	AEP	243550	05OBETZ	AEP	1	AEP_P1-2_#5806	operation	167.0	117.85	118.69	DC	2.64
616321	243522	05HARRIS	AEP	243593	05ZUBER	AEP	1	AEP_P1-2_#5764	operation	167.0	114.01	115.0	DC	3.13
616307	933760	AC2-035 TAP	AEP	243603	05ECHO 8	AEP	1	AEP_P1-2_#5929	operation	50.0	114.26	117.42	DC	2.98

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System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
615686	2	05ECHO 8 69.0 kV - 05LICK 69.0 kV Ckt 1	**AEP** 1) Rebuild / reconductor 0.92 miles of ACSR ~ 336.4 ~ 30/7 ~ ORIOLE - Conductor. Estimated Cost: $1.104 million. 2) Replace 600A Oil Breaker at Lick. Estimated cost: $600,000 Time Estimate : 24-36 Months Cost : $1,704,000	$1,704,000
615381,616829	3	05HARRIS 138.0 kV - 05ZUBER 138.0 kV Ckt 1	**AEP** Current Ratings: S/N: 136 S/E: 173 1) Replace 6 risers/jumpers at Harrison (6 Sub cond 300 MCM CU 37 Str): Estimated cost: $100,000 2) Replace 600A Switch at Harrison. Estimated cost: $500,000 Time Estimate : 24-36 Months Cost : $600,000	$600,000
615507,616902	5	05BIERSRUN 69.0 kV - 05SLATE 69.0 kV Ckt 1	**AEP** PJM supplemental upgrade s1559.1:Rebuild ~18.7 miles of the Ross – Highland 69kV Line using 795 ACSR conductor (128 MVA rating) and 69kV Self Supporting steel with partial reroute around Hillsboro. The baseline project has a projected in-service date of 12/01/2019. Time Estimate : Months Cost : $0	$0
615492	6	05JEFFERSNSS 69.0 kV - AC2-035 TAP 69.0 kV Ckt 1	**AEP** 2.5 miles of ACSR ~ 211.6 ~ 6/1 ~ PENGUIN (4/0) @ 320 deg- Conductor will need to be rebuilt/reconductored. Estimated cost: $3 million. Time Estimate : 24-36 Months Cost : $3,000,000	$3,000,000
615234,616890	4	05FIREBRCK 69.0 kV - 05JEFFERSNSS 69.0 kV Ckt 1	**AEP** Rebuild / reconductor 3.8 miles of ACSR ~ 211.6 ~ 6/1 ~ PENGUIN (4/0) @ 320 deg - Conductor Section 1. Estimated cost: $4.56 million. Time Estimate : 24-36 Months Cost : $4,560,000	$4,560,000
616732,615084,615085,616310	1	AC2-035 TAP 69.0 kV - 05ECHO 8 69.0 kV Ckt 1	**AEP** 1) Rebuild / reconductor 8.31 miles of ACSR ~ 211.6 ~ 6/1 ~ PENGUIN (4/0) @ 320 deg Conductor. Estimated Cost: $9.972 million. 2) Rebuild / reconductor 0.69 miles of ACSR ~ 336.4 ~ 30/7 ~ ORIOLE - Conductor. Estimated Cost: $ 828,000. Time Estimate : 24-36 Months Cost : $10,800,000	$10,800,000
			TOTAL COST	**$20,664,000**

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Flow Gate Details

The following appendices contain additional information about each flow gate presented in the body of the report. For each appendix, a description of the flow gate 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 flow gate 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.

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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
615084	933760	AC2-035 TAP	AEP	243603	05ECHO 8	AEP	1	AEP_P4_#9726_05LICK 138_106	breaker	50.0	148.66	158.06	DC	4.7

Bus #	Bus	MW Impact
933761	AC2-035 C	13.59
933762	AC2-035 E	9.06
938711	AE1-093	4.7
CARR	CARR	0.01
CBM-S1	CBM-S1	0.2
CBM-S2	CBM-S2	0.13
CBM-W2	CBM-W2	0.9
CIN	CIN	0.04
CPLE	CPLE	0.05
DEARBORN	DEARBORN	0.08
DUCKCREEK	DUCKCREEK	0.0
EDWARDS	EDWARDS	0.0
G-007	G-007	0.02
IPL	IPL	0.02
LGEE	LGEE	0.03
MEC	MEC	0.05
O-066	O-066	0.06
RENSSELAER	RENSSELAER	0.01

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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
615686	243603	05ECHO 8	AEP	243610	05LICK	AEP	1	AEP_P4_#9726_05LICK 138_106	breaker	75.0	95.37	101.64	DC	4.7

Bus #	Bus	MW Impact
933761	AC2-035 C	13.59
933762	AC2-035 E	9.06
938711	AE1-093	4.7
CARR	CARR	0.01
CBM-S1	CBM-S1	0.2
CBM-S2	CBM-S2	0.13
CBM-W2	CBM-W2	0.9
CIN	CIN	0.04
CPLE	CPLE	0.05
DEARBORN	DEARBORN	0.08
DUCKCREEK	DUCKCREEK	0.0
EDWARDS	EDWARDS	0.0
G-007	G-007	0.02
IPL	IPL	0.02
LGEE	LGEE	0.03
MEC	MEC	0.05
O-066	O-066	0.06
RENSSELAER	RENSSELAER	0.01

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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
615381	243522	05HARRIS	AEP	243593	05ZUBER	AEP	1	AEP_P4_#9679_05HARRISON 138_2E	breaker	167.0	122.87	123.86	DC	3.13

Bus #	Bus	MW Impact
924351	AB2-083 C O1	4.84
924352	AB2-083 E O1	2.28
925341	AC1-001 C O1	9.68
925342	AC1-001 E O1	4.55
927061	AC1-194 C O1	3.53
927062	AC1-194 E O1	5.77
932201	AC2-029 C	10.46
932202	AC2-029 E	17.07
932251	AC2-038 C O1	1.04
932252	AC2-038 E O1	0.69
932311	AC2-045 C	0.33
932312	AC2-045 E	0.53
932411	AC2-059 C	15.47
932412	AC2-059 E	15.96
934481	AD1-072 C	3.4
934482	AD1-072 E	1.55
936111	AD2-016 C	15.47
936112	AD2-016 E	15.96
937231	AD2-162 C	21.58
937232	AD2-162 E	10.58
938711	AE1-093	1.66
CARR	CARR	0.0
CBM-S1	CBM-S1	0.42
CBM-S2	CBM-S2	0.39
CBM-W2	CBM-W2	0.97
COFFEEN	COFFEEN	0.02
CPLE	CPLE	0.15
DEARBORN	DEARBORN	0.33
DUCKCREEK	DUCKCREEK	0.14
EDWARDS	EDWARDS	0.07
FARMERCITY	FARMERCITY	0.02
G-007A	G-007A	0.04
GIBSON	GIBSON	0.0
LGEE	LGEE	0.05
NEWTON	NEWTON	0.03
O-066A	O-066A	0.02
PRAIRIE	PRAIRIE	0.01
RENSSELAER	RENSSELAER	0.0
TATANKA	TATANKA	0.05
TILTON	TILTON	0.05
VFT	VFT	0.1

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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
615234	246782	05FIREBRCK	AEP	247061	05JEFFERSNSS	AEP	1	AEP_P4_#9726_05LICK 138_106	breaker	50.0	125.96	136.07	DC	4.7

Bus #	Bus	MW Impact
936091	AD2-012 C	0.48
936092	AD2-012 E	0.32
938711	AE1-093	4.7
CARR	CARR	0.01
CBM-S1	CBM-S1	0.2
CBM-S2	CBM-S2	0.13
CBM-W2	CBM-W2	0.9
CIN	CIN	0.04
CPLE	CPLE	0.05
DEARBORN	DEARBORN	0.08
DUCKCREEK	DUCKCREEK	0.0
EDWARDS	EDWARDS	0.0
G-007	G-007	0.02
IPL	IPL	0.02
LGEE	LGEE	0.03
MEC	MEC	0.05
O-066	O-066	0.06
RENSSELAER	RENSSELAER	0.01

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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
615507	246893	05BIERSRUN	AEP	243617	05SLATE	AEP	1	AEP_P4_#9726_05LICK 138_106	breaker	50.0	109.66	113.51	DC	3.63

Bus #	Bus	MW Impact
932381	AC2-055 C	1.63
932382	AC2-055 E	2.66
932421	AC2-060 C	5.78
932422	AC2-060 E	3.25
932651	AC2-087 C O1	4.28
932652	AC2-087 E O1	3.4
934491	AD1-073 C	1.19
934492	AD1-073 E	0.61
938271	AE1-040 C O1	2.37
938272	AE1-040 E O1	1.19
938711	AE1-093	1.92
CARR	CARR	0.01
CBM-S1	CBM-S1	0.14
CBM-S2	CBM-S2	0.0
CBM-W1	CBM-W1	0.25
CBM-W2	CBM-W2	1.11
CIN	CIN	0.17
G-007	G-007	0.02
IPL	IPL	0.12
LGEE	LGEE	0.06
MEC	MEC	0.23
MECS	MECS	0.11
O-066	O-066	0.08
RENSSELAER	RENSSELAER	0.01
WEC	WEC	0.03

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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
615492	247061	05JEFFERSNSS	AEP	933760	AC2-035 TAP	AEP	1	AEP_P4_#9726_05LICK 138_106	breaker	50.0	104.36	114.47	DC	4.7

Bus #	Bus	MW Impact
936091	AD2-012 C	0.48
936092	AD2-012 E	0.32
938711	AE1-093	4.7
CARR	CARR	0.01
CBM-S1	CBM-S1	0.2
CBM-S2	CBM-S2	0.13
CBM-W2	CBM-W2	0.9
CIN	CIN	0.04
CPLE	CPLE	0.05
DEARBORN	DEARBORN	0.08
DUCKCREEK	DUCKCREEK	0.0
EDWARDS	EDWARDS	0.0
G-007	G-007	0.02
IPL	IPL	0.02
LGEE	LGEE	0.03
MEC	MEC	0.05
O-066	O-066	0.06
RENSSELAER	RENSSELAER	0.01

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Affected Systems

LG&E

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

MISO

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

TVA

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

Duke Energy Progress

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

NYISO

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

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Contingency Name	Contingency Definition
AEP_P4_#9726_05LICK 138_106	CONTINGENCY 'AEP_P4_#9726_05LICK 138_106' OPEN BRANCH FROM BUS 243465 TO BUS 243561 CKT 1 / 243465 05ADDISO 138 243561 05RODNEY 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 243534 TO BUS 927010 CKT 1 / 243534 05LICK 138 927010 AC1-188 TAP 138 1 /* CONTINGENCY LINE ADDED FOR AE1 BUILD OPEN BRANCH FROM BUS 243465 TO BUS 243595 CKT 3 / 243465 05ADDISO 138 243595 05ADDISON 69.0 3 OPEN BRANCH FROM BUS 243501 TO BUS 243166 CKT 1 / 243501 05E.BEAV 138 243166 05E.BEAVER 69.0 1 OPEN BRANCH FROM BUS 243534 TO BUS 246738 CKT 1 / 243534 05LICK 138 246738 05JACKSON 13.8 1 OPEN BRANCH FROM BUS 243821 TO BUS 243166 CKT 1 / 243821 05BEAVER 69.0 243166 05E.BEAVER 69.0 1 OPEN BRANCH FROM BUS 244928 TO BUS 243166 CKT 1 / 244928 05BEAVER 8 69.0 243166 05E.BEAVER 69.0 1 END
AEP_P1-2_#5806	CONTINGENCY 'AEP_P1-2_#5806' OPEN BRANCH FROM BUS 243469 TO BUS 243593 CKT 1 / 243469 05BEATTY 138 243593 05ZUBER 138 1 OPEN BRANCH FROM BUS 243522 TO BUS 243593 CKT 1 / 243522 05HARRIS 138 243593 05ZUBER 138 1 OPEN BRANCH FROM BUS 243593 TO BUS 246686 CKT 1 / 243593 05ZUBER 138 246686 05ZUBER-L 13.8 1 END
AEP_P1-2_#5764	CONTINGENCY 'AEP_P1-2_#5764' OPEN BRANCH FROM BUS 243522 TO BUS 243550 CKT 1 / 243522 05HARRIS 138 243550 05OBETZ 138 1 OPEN BRANCH FROM BUS 243539 TO BUS 243550 CKT 1 / 243539 05MARION 138 243550 05OBETZ 138 1 END
AEP_P1-2_#5929	CONTINGENCY 'AEP_P1-2_#5929' 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 243501 TO BUS 243166 CKT 1 / 243501 05E.BEAV 138 243166 05E.BEAVER 69.0 1 OPEN BRANCH FROM BUS 243534 TO BUS 246738 CKT 1 / 243534 05LICK 138 246738 05JACKSON 13.8 1 OPEN BRANCH FROM BUS 243821 TO BUS 243166 CKT 1 / 243821 05BEAVER 69.0 243166 05E.BEAVER 69.0 1 OPEN BRANCH FROM BUS 244928 TO BUS 243166 CKT 1 / 244928 05BEAVER 8 69.0 243166 05E.BEAVER 69.0 1 END

Contingency Name	Contingency Definition
AEP_P7-1_#10921	CONTINGENCY 'AEP_P7-1_#10921' OPEN BRANCH FROM BUS 243522 TO BUS 243550 CKT 1 / 243522 05HARRIS 138 243550 05OBETZ 138 1 OPEN BRANCH FROM BUS 243536 TO BUS 243539 CKT 1 / 243536 05LS-II 138 243539 05MARION 138 1 OPEN BRANCH FROM BUS 243539 TO BUS 243550 CKT 1 / 243539 05MARION 138 243550 05OBETZ 138 1 END
AEP_P4_#9679_05HARRISON 138_2E	CONTINGENCY 'AEP_P4_#9679_05HARRISON 138_2E' OPEN BRANCH FROM BUS 243522 TO BUS 243550 CKT 1 / 243522 05HARRIS 138 243550 05OBETZ 138 1 OPEN BRANCH FROM BUS 243539 TO BUS 243550 CKT 1 / 243539 05MARION 138 243550 05OBETZ 138 1 OPEN BRANCH FROM BUS 243522 TO BUS 246706 CKT 1 / 243522 05HARRIS 138 246706 05HARRISON 69.0 1 END
AEP_P4_#9866_05MARQUI 138_P	CONTINGENCY 'AEP_P4_#9866_05MARQUI 138_P' 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 243544 TO BUS 243585 CKT 1 / 243544 05MILPRD 138 243585 05WAVERL 138 1 OPEN BRANCH FROM BUS 243501 TO BUS 243166 CKT 1 / 243501 05E.BEAV 138 243166 05E.BEAVER 69.0 1 OPEN BRANCH FROM BUS 243534 TO BUS 246738 CKT 1 / 243534 05LICK 138 246738 05JACKSON 13.8 1 OPEN BRANCH FROM BUS 243821 TO BUS 243166 CKT 1 / 243821 05BEAVER 69.0 243166 05E.BEAVER 69.0 1 OPEN BRANCH FROM BUS 244928 TO BUS 243166 CKT 1 / 244928 05BEAVER 8 69.0 243166 05E.BEAVER 69.0 1 END
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

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Short Circuit

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Short Circuit

The following Breakers are overduty

Bus Number	Bus Name	BREAKER	Type	Capacity (Amps)	Duty Percentage Post Queue	Duty Percentage Pre Queue

None