Generation Interconnection

Feasibility Study Report

for

Queue Project AE1-064

ROCKCASTLE 138 KV

79.4 MW Capacity / 120.1 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.

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.

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.

General

The Interconnection Customer has proposed to install PJM project # AE1-064, a Solar generating facility located in Bedford County, Virginia (See Figure 2). The installed facilities will have a total capability of 120.1 MW with 79.4 MW of this output being recognized by PJM as Capacity.

The proposed in-service date for this project is May 3, 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	AE1-064
Project Name	ROCKCASTLE 138 KV
State	Virginia
County	Bedford
Transmission Owner	AEP
MFO	120.1
MWE	120.1
MWC	79.4
Fuel	Solar
Base case Study Year	2022

Point of Interconnection

AE1-064 will interconnect with the Southside Electric Cooperative's (SEC) transmission system via a new station cut into the Whitehouse to Lone Gum 138 kV line. SEC is an ODEC member. The Whitehouse 138 kV Breaker Station is an SEC Delivery Point, served from the AEP Cloverdale-Smith Mountain 138 kV circuit at the Rockcastle 138 kV station.

Cost Summary

*For the upgrades associated with Southside Electric Cooperative's (SEC) facilities, the Attachment facilities, Direct Connection, and Non Direct Connection upgrades along with terms and conditions to interconnect AE1-064 will be specified in a separate two party Interconnection Agreement (IA) between SEC and the Interconnection Customer as this project is considered FERC non-jurisdictional per the PJM Open Access Transmission Tariff (OATT). From the transmission system perspective, network impacts were identified as detailed below.

The AE1-064 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$ To be Provided by Southside Electric Cooperative*
Direct Connection Network Upgrade	$ To be Provided by Southside Electric Cooperative*
Non Direct Connection Network Upgrades	$ 250,000 (AEP) + TBD by SEC and/or ODEC*
Total Costs	$ 250,000 + TBD costs by SEC/ODEC*

In addition, the AE1-064 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	**$34,850,000**

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

Transmission Owner Scope of Work

*For the upgrades associated with Southside Electric Cooperative's (SEC) facilities, a detailed scope, cost, and schedule will be provided in a separate two party Interconnection Agreement (IA) between SEC and the Interconnection Customer.

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
	$ To be Provided by Southside Electric Cooperative*
Total Attachment Facility Costs	$ TBD costs by SEC*

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
	$ To be Provided by Southside Electric Cooperative*
Total Direct Connection Facility Costs	$ TBD costs by SEC*

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
(AEP) Upgrade protection and controls at the Rockcastle 138 kV substation*	$250,000
Other upgrades of SSEC and/or ODEC facilities	$ TBD by SEC and/or ODEC*
Total Non-Direct Connection Facility Costs	$250,000 + TBD costs by SEC/ODEC*

*Feasibility Studies only include a very high-level review of Protection and Control (P&C) and Metering requirements. A more thorough review will be conducted during the System Impact Study stage and Facilities Study stage. Additional P&C scope may result from these more thorough reviews.

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 Rockcastle 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.

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 AE1-064 was evaluated as a 120.1 MW (Capacity 79.4 MW) injection at the Rockcastle 138 kV substation in the AEP area. Project AE1-064 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE1-064 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

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
106669	242687	05JOHNMT	AEP	242734	05NEWLDN	AEP	1	DVP_P1-2: LN 1016-B	single	240.0	97.5	101.01	DC	8.44
106657	242741	05OTTER	AEP	242687	05JOHNMT	AEP	1	DVP_P1-2: LN 1016-B	single	245.0	99.14	102.58	DC	8.44
106743	243892	05MEADS8	AEP	242607	05CLOVRD	AEP	1	AEP_P1-2_#6213	single	277.0	89.51	101.59	DC	33.47

Multiple Facility Contingency

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

None

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
106846	242632	05EDAN 2	AEP	242631	05EDAN 1	AEP	Z1	AEP_P1-2_#344-A	single	296.0	101.65	103.03	DC	4.07
106666	242687	05JOHNMT	AEP	242734	05NEWLDN	AEP	1	Base Case	single	167.0	113.18	116.84	DC	6.11
105094	242701	05LEESVI	AEP	314667	4ALTVSTA	DVP	1	AEP_P4_#10297_05OPOSSUM CK 138_D1	breaker	284.0	100.02	108.71	DC	24.67
105610	242701	05LEESVI	AEP	314667	4ALTVSTA	DVP	1	Base Case	single	205.0	102.45	108.87	DC	13.16
106421	242701	05LEESVI	AEP	314667	4ALTVSTA	DVP	1	AEP_P4_#10297_05OPOSSUM CK 138_D1	breaker	284.0	100.02	108.71	DC	24.67
106760	242701	05LEESVI	AEP	314667	4ALTVSTA	DVP	1	Base Case	single	205.0	102.45	108.87	DC	13.16
106653	242741	05OTTER	AEP	242687	05JOHNMT	AEP	1	Base Case	single	167.0	118.45	122.11	DC	6.11
106912	243892	05MEADS8	AEP	242607	05CLOVRD	AEP	1	AEP_P7-1_#10817-A	tower	277.0	110.41	132.27	DC	60.55
106913	243892	05MEADS8	AEP	242607	05CLOVRD	AEP	1	AEP_P7-1_#10808-A	tower	277.0	103.54	125.41	DC	60.56
105456	314667	4ALTVSTA	DVP	242741	05OTTER	AEP	1	Base Case	single	167.0	121.15	124.81	DC	6.11
105460	314667	4ALTVSTA	DVP	242741	05OTTER	AEP	1	DVP_P1-2: LN 1016-B	single	245.0	100.98	104.42	DC	8.44
106644	314667	4ALTVSTA	DVP	242741	05OTTER	AEP	1	Base Case	single	167.0	121.15	124.81	DC	6.11
106648	314667	4ALTVSTA	DVP	242741	05OTTER	AEP	1	DVP_P1-2: LN 1016-B	single	245.0	100.98	104.42	DC	8.44

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
106845	242632	05EDAN 2	AEP	242631	05EDAN 1	AEP	Z1	AEP_P1-2_#344-A	operation	296.0	103.26	104.2	DC	6.16
106663	242687	05JOHNMT	AEP	242734	05NEWLDN	AEP	1	DVP_P1-2: LN 1016-B	operation	240.0	129.17	134.49	DC	12.77
106664	242687	05JOHNMT	AEP	242734	05NEWLDN	AEP	1	Base Case	operation	167.0	129.65	132.15	DC	9.24
105609	242701	05LEESVI	AEP	314667	4ALTVSTA	DVP	1	Base Case	operation	205.0	108.98	118.69	DC	19.9
105611	242701	05LEESVI	AEP	314667	4ALTVSTA	DVP	1	AEP_P1-2_#5471-A	operation	284.0	98.54	107.36	DC	25.07
106759	242701	05LEESVI	AEP	314667	4ALTVSTA	DVP	1	Base Case	operation	205.0	108.98	118.69	DC	19.9
106761	242701	05LEESVI	AEP	314667	4ALTVSTA	DVP	1	AEP_P1-2_#5471-A	operation	284.0	98.54	107.36	DC	25.07
106651	242741	05OTTER	AEP	242687	05JOHNMT	AEP	1	Base Case	operation	167.0	134.92	137.42	DC	9.24
106652	242741	05OTTER	AEP	242687	05JOHNMT	AEP	1	DVP_P1-2: LN 1016-B	operation	245.0	130.16	135.37	DC	12.77
106738	243892	05MEADS8	AEP	242607	05CLOVRD	AEP	1	AEP_P1-2_#6213	operation	277.0	103.43	121.71	DC	50.62
105454	314667	4ALTVSTA	DVP	242741	05OTTER	AEP	1	Base Case	operation	167.0	137.61	140.11	DC	9.24
105455	314667	4ALTVSTA	DVP	242741	05OTTER	AEP	1	DVP_P1-2: LN 1016-B	operation	245.0	132.0	137.21	DC	12.77
106642	314667	4ALTVSTA	DVP	242741	05OTTER	AEP	1	Base Case	operation	167.0	137.61	140.11	DC	9.24
106643	314667	4ALTVSTA	DVP	242741	05OTTER	AEP	1	DVP_P1-2: LN 1016-B	operation	245.0	132.0	137.21	DC	12.77

System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
106846	4	05EDAN 2 138.0 kV - 05EDAN 1 138.0 kV Ckt Z1	**AEP** Description: No Violation. AEP Rating is Sufficient. Current AEP End Rating: S/N: 305, S/E: 305	$0
106760,105610,106421,105094	5	05LEESVI 138.0 kV - 4ALTVSTA 138.0 kV Ckt 1	**AEP** Description : 1) Replace 5 Sub cond 795 AAC 37 Str. Estimated cost: $100,000. 2) Rebuild/reconductor 8.5 miles of ACSR ~ 556.5 ~ 26/7 ~ DOVE Conductor Section 1 of Leesville - Altavista line. Estimated cost: $12,750,000. 3) An engineering study will need to be conducted to determine if the Relay Thermal limit 1197 Amps settings at Leesville can be adjusted to mitigate the overload. Estimated Cost $25,000. New relay packages will be required if the settings cannot be adjusted, Estimated Cost: $600,000 4) An engineering study will need to be conducted to determine if the CT Thermal limit 1197 Amps setting at Leesville can be adjusted to mitigate the overload. Estimated Cost: $25,000. Time Estimate : 18-24 Months Cost : $12,900,000 Note: Altavista station is owned by Dominion. PJM will have to confirm with Dominion whether the AEP upgrades listed above will require any Dominion upgrades.	$12,900,000
106912,106913,106743	3	05MEADS8 138.0 kV - 05CLOVRD 138.0 kV Ckt 1	**AEP** Description: No Violation. AEP Rating is Sufficient. Current AEP End Rating: S/N: 348, S/E: 407	$0
105456,106644,106648,105460	6	4ALTVSTA 138.0 kV - 05OTTER 138.0 kV Ckt 1	**AEP** Description : 1) Replace Sub cond 477 ACSR 26/7 STD. Estimated cost: $100,000 2) Rebuild/reconductor 1 mile of ACSR ~ 397.5 ~ 30/7 ~ LARK Conductor Section 1. Estimated cost : $1,500,000 Time Estimate : 18-24 Months Cost : $1,600,000 Note: Altavista station is owned by Dominion. PJM will have to confirm with Dominion whether the AEP upgrades listed above will require any Dominion upgrades.	$1,600,000
106657,106653	2	05OTTER 138.0 kV - 05JOHNMT 138.0 kV Ckt 1	**AEP** Description : 1) Replace Otter Sub cond 477 ACSR 26/7 STD. Estimated cost: $100,000. 2) Rebuild/reconductor 7 miles of ACSR ~ 397.5 ~ 30/7 ~ LARK Conductor Section 1. Estimated cost: $10,500,000. Time Estimate : 18-24 Months Cost : $10,600,000	$10,600,000

ID	Index	Facility	Upgrade Description	Cost
106666,106669	1	**05JOHNMT 138.0 kV - 05NEWLDN 138.0 kV Ckt 1**	**AEP** Description: 1) Rebuild/reconductor 6.5 miles of ACSR ~ 397.5 ~ 30/7 ~ LARK ~ Fe Clamps 9 d Conductor Section 1. Estimated cost : $9,750,000. Time Estimate: Time Estimate : 18-24 Months Cost : $9,750,000	$9,750,000
			TOTAL COST	**$34,850,000**

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.

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
106666	242687	05JOHNMT	AEP	242734	05NEWLDN	AEP	1	Base Case	single	167.0	113.18	116.84	DC	6.11

Bus #	Bus	MW Impact
246843	05SMG1	1.13
246844	05SMG2	2.96
246845	05SMG3	1.74
246846	05SMG4	3.06
246847	05SMG5	1.16
247284	05LEESVG	1.85
315156	1HALLBR1	3.18
315165	1HURT 1	12.79
315166	1HURT 2	12.79
315266	1PLYWOOD A	0.43
919841	AA2-070	0.56
925661	AC1-042 C	5.45
925991	AC1-075 C	6.8
926021	AC1-080 C	2.27
926051	AC1-083 C O1	2.77
926271	AC1-105 C O1	1.87
926641	AC1-145 C	6.49
927261	AC1-222 C	1.98
932821	AC2-107 C	12.09
933941	AD1-017 C	0.55
934311	AD1-055 C	1.38
936331	AD2-043 C	2.7
938451	AE1-064 C	6.11
BLUEG	BLUEG	1.3
CANNELTON	CANNELTON	0.06
CARR	CARR	0.02
CBM-S2	CBM-S2	1.19
COFFEEN	COFFEEN	0.11
COTTONWOOD	COTTONWOOD	0.03
CPLE	CPLE	0.8
DEARBORN	DEARBORN	0.22
DUCKCREEK	DUCKCREEK	0.25
EDWARDS	EDWARDS	0.12
ELMERSMITH	ELMERSMITH	0.11
FARMERCITY	FARMERCITY	0.06
GIBSON	GIBSON	0.05
NEWTON	NEWTON	0.29
PRAIRIE	PRAIRIE	0.41
RENSSELAER	RENSSELAER	0.01
SMITHLAND	SMITHLAND	0.02
TATANKA	TATANKA	0.12

Bus #	Bus	MW Impact
TILTON	TILTON	0.15
TRIMBLE	TRIMBLE	0.15
TVA	TVA	0.05

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
106653	242741	05OTTER	AEP	242687	05JOHNMT	AEP	1	Base Case	single	167.0	118.45	122.11	DC	6.11

Bus #	Bus	MW Impact
246843	05SMG1	1.13
246844	05SMG2	2.96
246845	05SMG3	1.74
246846	05SMG4	3.06
246847	05SMG5	1.16
247284	05LEESVG	1.85
315156	1HALLBR1	3.18
315165	1HURT 1	12.79
315166	1HURT 2	12.79
315266	1PLYWOOD A	0.43
919841	AA2-070	0.56
925661	AC1-042 C	5.45
925991	AC1-075 C	6.8
926021	AC1-080 C	2.27
926051	AC1-083 C O1	2.77
926271	AC1-105 C O1	1.87
926641	AC1-145 C	6.49
927261	AC1-222 C	1.98
932821	AC2-107 C	12.09
933941	AD1-017 C	0.55
934311	AD1-055 C	1.38
936331	AD2-043 C	2.7
938451	AE1-064 C	6.11
BLUEG	BLUEG	1.3
CANNELTON	CANNELTON	0.06
CARR	CARR	0.02
CBM-S2	CBM-S2	1.19
COFFEEN	COFFEEN	0.11
COTTONWOOD	COTTONWOOD	0.03
CPLE	CPLE	0.8
DEARBORN	DEARBORN	0.22
DUCKCREEK	DUCKCREEK	0.25
EDWARDS	EDWARDS	0.12
ELMERSMITH	ELMERSMITH	0.11
FARMERCITY	FARMERCITY	0.06
GIBSON	GIBSON	0.05
NEWTON	NEWTON	0.29
PRAIRIE	PRAIRIE	0.41
RENSSELAER	RENSSELAER	0.01
SMITHLAND	SMITHLAND	0.02
TATANKA	TATANKA	0.12

Bus #	Bus	MW Impact
TILTON	TILTON	0.15
TRIMBLE	TRIMBLE	0.15
TVA	TVA	0.05

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
106912	243892	05MEADS8	AEP	242607	05CLOVRD	AEP	1	AEP_P7-1_#10817-A	tower	277.0	110.41	132.27	DC	60.55

Bus #	Bus	MW Impact
244012	05PINNACLE	0.79
246843	05SMG1	4.7
246844	05SMG2	12.36
246845	05SMG3	7.25
246846	05SMG4	12.77
246847	05SMG5	4.84
247284	05LEESVG	3.46
919841	AA2-070	2.35
926051	AC1-083 C O1	11.27
926052	AC1-083 E O1	18.39
933941	AD1-017 C	2.25
933942	AD1-017 E	3.68
938451	AE1-064 C	40.03
938452	AE1-064 E	20.52
BLUEG	BLUEG	1.14
CANNELTON	CANNELTON	0.05
CARR	CARR	0.07
CBM-S1	CBM-S1	0.31
CBM-S2	CBM-S2	2.15
CBM-W2	CBM-W2	0.85
COFFEEN	COFFEEN	0.07
CPLE	CPLE	1.31
DEARBORN	DEARBORN	0.24
DUCKCREEK	DUCKCREEK	0.19
EDWARDS	EDWARDS	0.1
ELMERSMITH	ELMERSMITH	0.07
FARMERCITY	FARMERCITY	0.03
G-007	G-007	0.17
GIBSON	GIBSON	0.04
NEWTON	NEWTON	0.2
O-066	O-066	0.57
PRAIRIE	PRAIRIE	0.17
RENSSELAER	RENSSELAER	0.05
TATANKA	TATANKA	0.07
TILTON	TILTON	0.13
TRIMBLE	TRIMBLE	0.13

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
106846	242632	05EDAN 2	AEP	242631	05EDAN 1	AEP	Z1	AEP_P1-2_#344-A	single	296.0	101.65	103.03	DC	4.07

Bus #	Bus	MW Impact
246843	05SMG1	0.78
246844	05SMG2	2.07
246845	05SMG3	1.21
246846	05SMG4	2.14
246847	05SMG5	0.81
247284	05LEESVG	0.46
315150	1BUGGS 1	3.5
315151	1BUGGS 2	3.5
315158	1KERR 1	0.12
315159	1KERR 2	0.47
315160	1KERR 3	0.46
315161	1KERR 4	0.46
315162	1KERR 5	0.46
315163	1KERR 6	0.46
315164	1KERR 7	0.46
315266	1PLYWOOD A	0.42
919841	AA2-070	0.39
926051	AC1-083 C O1	5.82
926271	AC1-105 C O1	1.82
927251	AC1-221 C	1.17
927261	AC1-222 C	1.22
932761	AC2-100 C	2.7
933941	AD1-017 C	1.16
934311	AD1-055 C	0.85
934341	AD1-058 C	2.94
934611	AD1-087 C O1	2.48
934991	AD1-131 C	0.96
935171	AD1-152 C O1	2.46
936161	AD2-022 C O1	5.42
936171	AD2-023 C O1	6.64
936331	AD2-043 C	1.6
936361	AD2-046 C O1	2.78
937481	AD2-202 C O1	0.68
938451	AE1-064 C	4.07
AA2-074	AA2-074	2.45
BLUEG	BLUEG	4.74
CANNELTON	CANNELTON	0.23
CBM-N	CBM-N	0.09
CBM-S2	CBM-S2	5.21
COFFEEN	COFFEEN	0.37

Bus #	Bus	MW Impact
CPLE	CPLE	3.6
DEARBORN	DEARBORN	0.74
DUCKCREEK	DUCKCREEK	0.87
EDWARDS	EDWARDS	0.41
ELMERSMITH	ELMERSMITH	0.38
FARMERCITY	FARMERCITY	0.19
G-007A	G-007A	0.58
GIBSON	GIBSON	0.17
NEWTON	NEWTON	1.01
NYISO	NYISO	0.4
O-066A	O-066A	0.26
PRAIRIE	PRAIRIE	1.38
SMITHLAND	SMITHLAND	0.08
TATANKA	TATANKA	0.4
TILTON	TILTON	0.53
TRIMBLE	TRIMBLE	0.54
TVA	TVA	0.03
VFT	VFT	1.54

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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
106760	242701	05LEESVI	AEP	314667	4ALTVSTA	DVP	1	Base Case	single	205.0	102.45	108.87	DC	13.16

Bus #	Bus	MW Impact
246843	05SMG1	2.34
246844	05SMG2	6.15
246845	05SMG3	3.61
246846	05SMG4	6.36
246847	05SMG5	2.41
247284	05LEESVG	3.49
919841	AA2-070	1.17
926051	AC1-083 C O1	5.53
926521	AC1-123 C O1	5.96
932823	AC2-107 BAT	19.24
933941	AD1-017 C	1.11
938451	AE1-064 C	13.16
CARR	CARR	0.04
CBM-S1	CBM-S1	0.53
CBM-S2	CBM-S2	0.25
CBM-W1	CBM-W1	0.77
CBM-W2	CBM-W2	3.63
CIN	CIN	0.36
CPLE	CPLE	0.07
IPL	IPL	0.23
LGEE	LGEE	0.11
MEC	MEC	0.67
MECS	MECS	0.39
RENSSELAER	RENSSELAER	0.03
WEC	WEC	0.09

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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
106644	314667	4ALTVSTA	DVP	242741	05OTTER	AEP	1	Base Case	single	167.0	121.15	124.81	DC	6.11

Bus #	Bus	MW Impact
246843	05SMG1	1.13
246844	05SMG2	2.96
246845	05SMG3	1.74
246846	05SMG4	3.06
246847	05SMG5	1.16
247284	05LEESVG	1.85
315156	1HALLBR1	3.18
315165	1HURT 1	12.79
315166	1HURT 2	12.79
315266	1PLYWOOD A	0.43
919841	AA2-070	0.56
925661	AC1-042 C	5.45
925991	AC1-075 C	6.8
926021	AC1-080 C	2.27
926051	AC1-083 C O1	2.77
926271	AC1-105 C O1	1.87
926641	AC1-145 C	6.49
927261	AC1-222 C	1.98
932821	AC2-107 C	12.09
933941	AD1-017 C	0.55
934311	AD1-055 C	1.38
936331	AD2-043 C	2.7
938451	AE1-064 C	6.11
BLUEG	BLUEG	1.3
CANNELTON	CANNELTON	0.06
CARR	CARR	0.02
CBM-S2	CBM-S2	1.19
COFFEEN	COFFEEN	0.11
COTTONWOOD	COTTONWOOD	0.03
CPLE	CPLE	0.8
DEARBORN	DEARBORN	0.22
DUCKCREEK	DUCKCREEK	0.25
EDWARDS	EDWARDS	0.12
ELMERSMITH	ELMERSMITH	0.11
FARMERCITY	FARMERCITY	0.06
GIBSON	GIBSON	0.05
NEWTON	NEWTON	0.29
PRAIRIE	PRAIRIE	0.41
RENSSELAER	RENSSELAER	0.01
SMITHLAND	SMITHLAND	0.02
TATANKA	TATANKA	0.12

Bus #	Bus	MW Impact
TILTON	TILTON	0.15
TRIMBLE	TRIMBLE	0.15
TVA	TVA	0.05

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).

Contingency Name	Contingency Definition
AEP_P1-2_#5471-A	CONTINGENCY 'AEP_P1-2_#5471-A' OPEN BRANCH FROM BUS 242575 TO BUS 242737 CKT 1 / 242575 05CAMDLM 138 242737 05OPOSSUMCK 138 1 OPEN BRANCH FROM BUS 242575 TO BUS 242781 CKT 1 / 242575 05CAMDLM 138 242781 05RUSTBR 138 1 OPEN BRANCH FROM BUS 242575 TO BUS 926520 CKT 1 / 242575 05CAMDLM 138 926520 AC1-123 TAP 138 1 END
AEP_P1-2_#344-A	CONTINGENCY 'AEP_P1-2_#344-A' OPEN BRANCH FROM BUS 242530 TO BUS 936160 CKT 1 / 242530 05EDANV1 230 936160 AD2-022 TAP 230 1 END
AEP_P1-2_#6213	CONTINGENCY 'AEP_P1-2_#6213' OPEN BRANCH FROM BUS 242748 TO BUS 243951 CKT 1 / 242748 05PENHOK 138 243951 05REDWOOD 138 1 OPEN BRANCH FROM BUS 242748 TO BUS 242802 CKT 1 / 242748 05PENHOK 138 242802 05SMITHMTN1 138 1 OPEN BRANCH FROM BUS 243951 TO BUS 242843 CKT 1 / 243951 05REDWOOD 138 242843 05WLAKE 138 1 END
AEP_P4_#10297_05OPOSSUMCK 138_D1	CONTINGENCY 'AEP_P4_#10297_05OPOSSUMCK 138_D1' OPEN BRANCH FROM BUS 242575 TO BUS 242737 CKT 1 / 242575 05CAMDLM 138 242737 05OPOSSUMCK 138 1 OPEN BRANCH FROM BUS 242575 TO BUS 242781 CKT 1 / 242575 05CAMDLM 138 242781 05RUSTBR 138 1 OPEN BRANCH FROM BUS 242575 TO BUS 926520 CKT 1 / 242575 05CAMDLM 138 926520 AC1-123 TAP 138 1 /* CONTINGENCY LINE ADDED FOR AE1 BUILD OPEN BRANCH FROM BUS 242737 TO BUS 242785 CKT 1 / 242737 05OPOSSUMCK 138 242785 05S.LYNC 138 1 END
AEP_P7-1_#10817-A	CONTINGENCY 'AEP_P7-1_#10817-A' OPEN BRANCH FROM BUS 926520 TO BUS 247499 CKT 1 / 926520 AC1-123 TAP 138 247499 05SMITHMTN2 138 1 OPEN BRANCH FROM BUS 242701 TO BUS 314667 CKT 1 / 242701 05LEESVI 138 314667 4ALTVSTA 138 1 END
Base Case	
AEP_P7-1_#10808-A	CONTINGENCY 'AEP_P7-1_#10808-A' OPEN BRANCH FROM BUS 926520 TO BUS 247499 CKT 1 / 926520 AC1-123 TAP 138 247499 05SMITHMTN2 138 1 OPEN BRANCH FROM BUS 242701 TO BUS 247499 CKT 1 / 242701 05LEESVI 138 247499 05SMITHMTN2 138 1 OPEN BRANCH FROM BUS 242701 TO BUS 314667 CKT 1 / 242701 05LEESVI 138 314667 4ALTVSTA 138 1 OPEN BRANCH FROM BUS 242701 TO BUS 247284 CKT 1 / 242701 05LEESVI 138 247284 05LEESVG 13.8 1 END

Contingency Name	Contingency Definition
DVP_P1-2: LN 1016-B	CONTINGENCY 'DVP_P1-2: LN 1016-B' OPEN BRANCH FROM BUS 927260 TO BUS 314696 CKT 1 /* AC1-222 TAP 115.00 - 3SEDGE HILL 115.00 END

Short Circuit

Short Circuit

The following Breakers are overduty

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

None