Generation Interconnection

Feasibility Study Report

for

Queue Project AE2-280

CLAYTOR LAKE-EDGEMONT 138 KV

89 MW Capacity / 149 MW Energy

December, 2019

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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.

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.

2 General

The Interconnection Customer (IC), has proposed a Solar generating facility located in Montgomery County, VA. The installed facilities will have a total capability of 149 MW with 89 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is 12.31.2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AE2-280
Project Name	CLAYTOR LAKE-EDGEMONT 138 KV
State	VA
County	Montgomery
Transmission Owner	AEP
MFO	149
MWE	149
MWC	89
Fuel	Solar
Basecase Study Year	2022

2.1 Point of Interconnection

AE2-280 will interconnect with the AEP transmission system as a tap of the Claytor Lake to Edgemont 138 kV line.

To accommodate the interconnection on the Claytor Lake to Edgemont 138 kV Circuit, a new three (3) circuit breaker 138kV 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.

Cost Summary

This project will be responsible for the following costs:

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, this project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	$9,277,680

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
138kV Revenue Metering	$ 250,000
Total Attachment Facility Costs	$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 (See Figure 1). Installation of associated protection and control equipment, 138 kV line risers and SCADA will also be required.	$6,000,000
138kV Transmission Line Cut In	$ 1,000,000
Total Direct Connection Facility Costs	$7,000,000

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
Upgrade line protections & Controls at the 138kV Remote end Substation #1	$ 250,000
Upgrade line protections & Controls at the 138kV Remote end Substation #2	$ 250,000
Total Non-Direct Connection Facility Costs	$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 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 AEP Transmission circuit 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

The Queue Project AE2-280 was evaluated as a 149.0 MW (Capacity 89.0 MW) injection tapping the Claytor Lake to Edgemont 138 kV substation in the AEP area. Project AE2-280 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-280 was studied with a commercial probability of 0.53. 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)

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
7345215	937350	AD2-179 TAP	AEP	242651	05GLENL2	AEP	1	AEP_P4_#10191_05CLYTR3 138_C	breaker	146.0	99.39	124.49	DC	36.64

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
7345902	242620	05DANVL2	AEP	242631	05EDAN 1	AEP	1	AEP_P1-2_#1370	single	402.0	117.81	119.17	DC	5.48
7345903	242620	05DANVL2	AEP	242631	05EDAN 1	AEP	1	242509 05AXTON 765 242514 05J.FERR 765 1	single	402.0	117.81	119.17	DC	5.48
7346653	937350	AD2-179 TAP	AEP	242651	05GLENL2	AEP	1	AEP_P7-1_#10877-B	tower	146.0	101.4	126.13	DC	36.1

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
7346147	937350	AD2-179 TAP	AEP	242651	05GLENL2	AEP	1	AEP_P1-2_#10190	operation	146.0	96.8	121.96	DC	36.74

16 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
7345903,7345902	2	05DANVL2 138.0 kV - 05EDAN 1 138.0 kV Ckt 1	**AEP** **n6124 (75) : PJM Network Upgrade n6124. Increasing the Danville East Danville 138 kV circuit summer rating to 572/572/572 MVA will still require us to rebuild the line. The network project has an projected in-service date of 06/01/2021.** **Project Type : FAC** **Cost : $9,000,000**	$9,000,000
7346653,7345215	1	AD2-179 TAP 138.0 kV - 05GLENL2 138.0 kV Ckt 1	**AEP** **AEPA0009a (282) : Perform Sag Study on the 20.67 miles of ACSR ~ 397.5 ~ 30/7 ~ LARK ~ Fe Clamps 9 d conductor section of Glen Lyn-Morgans Cut 138 kV** **Project Type : FAC** **Cost : $82,680** **Time Estimate : 6 - 12 months** **AEPA0009b (283) : Replace 0.13 mi. 300 CU Overhead Cond** **Project Type : FAC** **Cost : $195,000** **Time Estimate : 24 - 36 months**	$277,680
			TOTAL COST	**$9,277,680**

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
7346653	937350	AD2-179 TAP	AEP	242651	05GLENL2	AEP	1	AEP_P7-1_#10877-B	tower	146.0	101.4	126.13	DC	36.1

Bus #	Bus	MW Impact
242906	05CLAY-1	1.19
242907	05CLAY-2	1.2
247619	Y1-049	0.11
934751	AD1-102 C	4.73
934752	AD1-102 E	31.65
937341	AD2-178 C O1	11.17
937342	AD2-178 E O1	7.45
937351	AD2-179 C O1	38.18
937352	AD2-179 E O1	25.45
938131	AE1-017 C	1.45
938132	AE1-017 E	1.19
938141	AE1-018 C	0.37
938142	AE1-018 E	0.29
942641	AE2-280 C O1	21.56
942642	AE2-280 E O1	14.54
BLUEG	BLUEG	0.39
CANNELTON	CANNELTON	0.01
CARR	CARR	0.0
CBM-S1	CBM-S1	0.13
CBM-S2	CBM-S2	0.61
CBM-W2	CBM-W2	0.31
COFFEEN	COFFEEN	0.02
CPLE	CPLE	0.29
DUCKCREEK	DUCKCREEK	0.06
EDWARDS	EDWARDS	0.03
ELMERSMITH	ELMERSMITH	0.02
FARMERCITY	FARMERCITY	0.01
G-007A	G-007A	0.01
GIBSON	GIBSON	0.01
NEWTON	NEWTON	0.07
PRAIRIE	PRAIRIE	0.05
RENSSELAER	RENSSELAER	0.0
TATANKA	TATANKA	0.02
TILTON	TILTON	0.04
TRIMBLE	TRIMBLE	0.04
VFT	VFT	0.03

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
7345903	242620	05DANVL2	AEP	242631	05EDAN 1	AEP	1	242509 05AXTON 765 242514 05J.FERR 765 1	single	402.0	117.81	119.17	DC	5.48

Bus #	Bus	MW Impact
242906	05CLAY-1	0.32
242907	05CLAY-2	0.32
247723	05PHILPOTT	0.53
926461	AC1-117 C	3.86
934751	AD1-102 C	1.32
938741	AE1-100 C O1	23.49
938931	AE1-121 O1	271.61
938941	AE1-122 O1	271.61
939441	AE1-176	0.15
940601	AE2-047 C O1	8.58
941431	AE2-140 C O1	70.37
941671	AE2-166 C	27.41
942321	AE2-245	3.51
942641	AE2-280 C O1	5.48
CALDERWOOD	CALDERWOOD	0.24
CARR	CARR	0.01
CATAWBA	CATAWBA	0.61
CBM-W1	CBM-W1	1.93
CBM-W2	CBM-W2	0.02
CHEOAH	CHEOAH	0.24
CHILHOWEE	CHILHOWEE	0.07
CIN	CIN	0.92
COTTONWOOD	COTTONWOOD	0.53
HAMLET	HAMLET	1.5
IPL	IPL	0.62
LGEE	LGEE	0.29
MEC	MEC	0.99
MECS	MECS	1.48
RENSSELAER	RENSSELAER	0.01
SANTEETLA	SANTEETLA	0.08
TVA	TVA	0.37
UNIONPOWER	UNIONPOWER	0.38
WEC	WEC	0.23

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
242509 05AXTON 765 242514 05J.FERR 765 1	CONTINGENCY '242509 05AXTON 765 242514 05J.FERR 765 1' / 8403 OPEN BRANCH FROM BUS 242509 TO BUS 242514 CKT 1 / 242509 05AXTON 765 242514 05J.FERR 765 1 END
AEP_P1-2_#10190	CONTINGENCY 'AEP_P1-2_#10190' OPEN BRANCH FROM BUS 243969 TO BUS 242640 CKT 1 / 243969 05FLOYD EQ 999 242640 05FLOYD 138 1 OPEN BRANCH FROM BUS 243969 TO BUS 243967 CKT 1 / 243969 05FLOYD EQ 999 243967 05FLOYD 69.0 1 OPEN BRANCH FROM BUS 243969 TO BUS 243966 CKT 1 / 243969 05FLOYD EQ 999 243966 05FLOYD 34.5 1 OPEN BRANCH FROM BUS 242535 TO BUS 242610 CKT 1 / 242535 05ALUMRG 138 242610 05CLYTR3 138 1 OPEN BRANCH FROM BUS 242535 TO BUS 242640 CKT 1 / 242535 05ALUMRG 138 242640 05FLOYD 138 1 OPEN BRANCH FROM BUS 242608 TO BUS 242610 CKT Z1 / 242608 05CLYTR1 138 242610 05CLYTR3 138 Z1 OPEN BRANCH FROM BUS 242609 TO BUS 242610 CKT Z1 / 242609 05CLYTR2 138 242610 05CLYTR3 138 Z1 OPEN BRANCH FROM BUS 242640 TO BUS 242750 CKT 1 / 242640 05FLOYD 138 242750 05PHILPOTT Z 138 1 OPEN BRANCH FROM BUS 247723 TO BUS 242750 CKT 1 / 247723 05PHILPOTT 138 242750 05PHILPOTT Z 138 1 OPEN BRANCH FROM BUS 242750 TO BUS 242844 CKT 1 / 242750 05PHILPOTT Z 138 242844 05W.BASS 138 1 END
AEP_P1-2_#1370	CONTINGENCY 'AEP_P1-2_#1370' OPEN BRANCH FROM BUS 242509 TO BUS 242514 CKT 1 / 242509 05AXTON 765 242514 05J.FERR 765 1 OPEN BRANCH FROM BUS 242509 TO BUS 242545 CKT 1 / 242509 05AXTON 765 242545 05AXTONX 138 1 OPEN BRANCH FROM BUS 242544 TO BUS 242545 CKT SR / 242544 05AXTON 138 242545 05AXTONX 138 SR OPEN BRANCH FROM BUS 242544 TO BUS 242545 CKT ZB / 242544 05AXTON 138 242545 05AXTONX 138 ZB END

Contingency Name	Contingency Definition
AEP_P4_#10191_05CLYTR3 138_C	CONTINGENCY 'AEP_P4_#10191_05CLYTR3 138_C' OPEN BRANCH FROM BUS 243969 TO BUS 242640 CKT 1 / 243969 05FLOYD EQ 999 242640 05FLOYD 138 1 OPEN BRANCH FROM BUS 243969 TO BUS 243967 CKT 1 / 243969 05FLOYD EQ 999 243967 05FLOYD 69.0 1 OPEN BRANCH FROM BUS 243969 TO BUS 243966 CKT 1 / 243969 05FLOYD EQ 999 243966 05FLOYD 34.5 1 OPEN BRANCH FROM BUS 242535 TO BUS 242610 CKT 1 / 242535 05ALUMRG 138 242610 05CLYTR3 138 1 OPEN BRANCH FROM BUS 242535 TO BUS 242640 CKT 1 / 242535 05ALUMRG 138 242640 05FLOYD 138 1 OPEN BRANCH FROM BUS 247869 TO BUS 242608 CKT 1 / 247869 05CLAYTR HY1 138 242608 05CLYTR1 138 1 OPEN BRANCH FROM BUS 242608 TO BUS 242610 CKT Z1 / 242608 05CLYTR1 138 242610 05CLYTR3 138 Z1 OPEN BRANCH FROM BUS 242608 TO BUS 242666 CKT 1 / 242608 05CLYTR1 138 242666 05HAZELH 138 1 OPEN BRANCH FROM BUS 242608 TO BUS 242791 CKT 1 / 242608 05CLYTR1 138 242791 05SCHRIS 138 1 OPEN BRANCH FROM BUS 242609 TO BUS 242610 CKT Z1 / 242609 05CLYTR2 138 242610 05CLYTR3 138 Z1 OPEN BRANCH FROM BUS 242640 TO BUS 242750 CKT 1 / 242640 05FLOYD 138 242750 05PHILPOTT Z 138 1 OPEN BRANCH FROM BUS 247723 TO BUS 242750 CKT 1 / 247723 05PHILPOTT 138 242750 05PHILPOTT Z 138 1 OPEN BRANCH FROM BUS 242750 TO BUS 242844 CKT 1 / 242750 05PHILPOTT Z 138 242844 05W.BASS 138 1 OPEN BRANCH FROM BUS 247869 TO BUS 242906 CKT 1 / 247869 05CLAYTR HY1 138 242906 05CLAY-1 11.0 1 REMOVE UNIT 1 FROM BUS 242906 / 242906 05CLAY-1 11.0 REMOVE UNIT 2 FROM BUS 242906 / 242906 05CLAY-1 11.0 END
AEP_P7-1_#10877-B	CONTINGENCY 'AEP_P7-1_#10877-B' OPEN BRANCH FROM BUS 242608 TO BUS 242791 CKT 1 / 242608 05CLYTR1 138 242791 05SCHRIS 138 1 OPEN BRANCH FROM BUS 942640 TO BUS 242634 CKT 1 / 942640 AE2-280 TAP 138 242634 05EDGEMO 138 1 OPEN BRANCH FROM BUS 242708 TO BUS 243874 CKT 1 / 242708 05M FUNK 138 243874 05TECHDR 138 1 OPEN BRANCH FROM BUS 242791 TO BUS 243874 CKT 1 / 242791 05SCHRIS 138 243874 05TECHDR 138 1 OPEN BRANCH FROM BUS 242791 TO BUS 244118 CKT 1 / 242791 05SCHRIS 138 244118 05SCHRISTB 69.0 1 OPEN BRANCH FROM BUS 244107 TO BUS 244118 CKT 1 / 244107 05CAMBRIA 69.0 244118 05SCHRISTB 69.0 1 END

Short Circuit

20 Short Circuit

The following Breakers are overduty

None.

Secondary Point of Interconnection

21 Network Impacts – Secondary POI

The Queue Project AE2-280 was evaluated as a 149.0 MW (Capacity 89.0 MW) injection at the Edgemont 138kV substation in the AEP area. Project AE2-280 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-280 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

Summer Peak Load Flow

22 Generation Deliverability

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

None

23 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
7345215	937350	AD2-179 TAP	AEP	242651	05GLENL2	AEP	1	AEP_P4_#10191_05CLYTR3 138_C	breaker	146.0	99.46	120.19	DC	30.26

24 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
7345902	242620	05DANVL2	AEP	242631	05EDAN 1	AEP	1	AEP_P1-2_#1370	single	402.0	117.07	118.34	DC	5.14
7345903	242620	05DANVL2	AEP	242631	05EDAN 1	AEP	1	242509 05AXTON 765 242514 05J.FERR 765 1	single	402.0	117.07	118.34	DC	5.14

25 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
7346147	937350	AD2-179 TAP	AEP	242651	05GLENL2	AEP	1	AEP_P1-2_#10190	operation	146.0	96.8	117.4	DC	30.07

26 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.

26.1 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
7345215	937350	AD2-179 TAP	AEP	242651	05GLENL2	AEP	1	AEP_P4_#10191_05CLYTR3 138_C	breaker	146.0	99.46	120.19	DC	30.26

Bus #	Bus	MW Impact
242907	05CLAY-2	1.41
247619	Y1-049	0.13
934751	AD1-102 C	5.56
934752	AD1-102 E	37.21
937341	AD2-178 C O1	13.07
937342	AD2-178 E O1	8.72
937351	AD2-179 C O1	37.49
937352	AD2-179 E O1	24.99
938131	AE1-017 C	1.69
938132	AE1-017 E	1.38
938141	AE1-018 C	0.43
938142	AE1-018 E	0.34
942641	AE2-280 C O2	18.07
942642	AE2-280 E O2	12.19
BLUEG	BLUEG	0.75
CALDERWOOD	CALDERWOOD	0.01
CANNELTON	CANNELTON	0.04
CBM-N	CBM-N	0.02
CBM-S2	CBM-S2	0.28
CHEOAH	CHEOAH	0.01
CHILHOWEE	CHILHOWEE	0.0
COFFEEN	COFFEEN	0.06
COTTONWOOD	COTTONWOOD	0.11
CPLE	CPLE	0.14
DUCKCREEK	DUCKCREEK	0.14
EDWARDS	EDWARDS	0.07
ELMERSMITH	ELMERSMITH	0.07
FARMERCITY	FARMERCITY	0.04
G-007A	G-007A	0.12
GIBSON	GIBSON	0.03
NEWTON	NEWTON	0.17
NYISO	NYISO	0.1
PRAIRIE	PRAIRIE	0.27
SANTEETLA	SANTEETLA	0.0
SMITHLAND	SMITHLAND	0.02
TATANKA	TATANKA	0.07
TILTON	TILTON	0.08
TRIMBLE	TRIMBLE	0.08
TVA	TVA	0.1
UNIONPOWER	UNIONPOWER	0.01
VFT	VFT	0.32

26.2 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
7345903	242620	05DANVL2	AEP	242631	05EDAN 1	AEP	1	242509 05AXTON 765 242514 05J.FERR 765 1	single	402.0	117.07	118.34	DC	5.14

Bus #	Bus	MW Impact
242906	05CLAY-1	0.32
242907	05CLAY-2	0.32
247723	05PHILPOTT	0.53
926461	AC1-117 C	3.86
934751	AD1-102 C	1.32
938741	AE1-100 C O1	23.49
938931	AE1-121 O1	271.61
938941	AE1-122 O1	271.61
939441	AE1-176	0.15
940601	AE2-047 C O2	8.42
941431	AE2-140 C O2	67.64
941671	AE2-166 C	27.41
942321	AE2-245	3.51
942641	AE2-280 C O2	5.14
CALDERWOOD	CALDERWOOD	0.24
CARR	CARR	0.01
CATAWBA	CATAWBA	0.61
CBM-W1	CBM-W1	1.93
CBM-W2	CBM-W2	0.02
CHEOAH	CHEOAH	0.24
CHILHOWEE	CHILHOWEE	0.07
CIN	CIN	0.92
COTTONWOOD	COTTONWOOD	0.53
HAMLET	HAMLET	1.5
IPL	IPL	0.62
LGEE	LGEE	0.29
MEC	MEC	0.98
MECS	MECS	1.48
RENSSELAER	RENSSELAER	0.01
SANTEETLA	SANTEETLA	0.08
TVA	TVA	0.37
UNIONPOWER	UNIONPOWER	0.38
WEC	WEC	0.23

Affected Systems

27 Affected Systems

27.1 LG&E

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

27.2 MISO

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

27.3 TVA

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

27.4 Duke Energy Progress

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

27.5 NYISO

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

28 Contingency Descriptions

Contingency Name	Contingency Definition
242509 05AXTON 765 242514 05J.FERR 765 1	CONTINGENCY '242509 05AXTON 765 242514 05J.FERR 765 1' / 8403 OPEN BRANCH FROM BUS 242509 TO BUS 242514 CKT 1 / 242509 05AXTON 765 242514 05J.FERR 765 1 END
AEP_P1-2_#1370	CONTINGENCY 'AEP_P1-2_#1370' OPEN BRANCH FROM BUS 242509 TO BUS 242514 CKT 1 / 242509 05AXTON 765 242514 05J.FERR 765 1 OPEN BRANCH FROM BUS 242509 TO BUS 242545 CKT 1 / 242509 05AXTON 765 242545 05AXTONX 138 1 OPEN BRANCH FROM BUS 242544 TO BUS 242545 CKT SR / 242544 05AXTON 138 242545 05AXTONX 138 SR OPEN BRANCH FROM BUS 242544 TO BUS 242545 CKT ZB / 242544 05AXTON 138 242545 05AXTONX 138 ZB END
AEP_P4_#10191_05CLYTR3 138_C	CONTINGENCY 'AEP_P4_#10191_05CLYTR3 138_C' OPEN BRANCH FROM BUS 243969 TO BUS 242640 CKT 1 / 243969 05FLOYD EQ 999 242640 05FLOYD 138 1 OPEN BRANCH FROM BUS 243969 TO BUS 243967 CKT 1 / 243969 05FLOYD EQ 999 243967 05FLOYD 69.0 1 OPEN BRANCH FROM BUS 243969 TO BUS 243966 CKT 1 / 243969 05FLOYD EQ 999 243966 05FLOYD 34.5 1 OPEN BRANCH FROM BUS 242535 TO BUS 242610 CKT 1 / 242535 05ALUMRG 138 242610 05CLYTR3 138 1 OPEN BRANCH FROM BUS 242535 TO BUS 242640 CKT 1 / 242535 05ALUMRG 138 242640 05FLOYD 138 1 OPEN BRANCH FROM BUS 247869 TO BUS 242608 CKT 1 / 247869 05CLAYTR HY1 138 242608 05CLYTR1 138 1 OPEN BRANCH FROM BUS 242608 TO BUS 242610 CKT Z1 / 242608 05CLYTR1 138 242610 05CLYTR3 138 Z1 OPEN BRANCH FROM BUS 242608 TO BUS 242666 CKT 1 / 242608 05CLYTR1 138 242666 05HAZELH 138 1 OPEN BRANCH FROM BUS 242608 TO BUS 242791 CKT 1 / 242608 05CLYTR1 138 242791 05SCHRIS 138 1 OPEN BRANCH FROM BUS 242609 TO BUS 242610 CKT Z1 / 242609 05CLYTR2 138 242610 05CLYTR3 138 Z1 OPEN BRANCH FROM BUS 242640 TO BUS 242750 CKT 1 / 242640 05FLOYD 138 242750 05PHILPOTT Z 138 1 OPEN BRANCH FROM BUS 247723 TO BUS 242750 CKT 1 / 247723 05PHILPOTT 138 242750 05PHILPOTT Z 138 1 OPEN BRANCH FROM BUS 242750 TO BUS 242844 CKT 1 / 242750 05PHILPOTT Z 138 242844 05W.BASS 138 1 OPEN BRANCH FROM BUS 247869 TO BUS 242906 CKT 1 / 247869 05CLAYTR HY1 138 242906 05CLAY-1 11.0 1 REMOVE UNIT 1 FROM BUS 242906 / 242906 05CLAY-1 11.0 REMOVE UNIT 2 FROM BUS 242906 / 242906 05CLAY-1 11.0 END

Contingency Name	Contingency Definition
AEP_P1-2_#10190	CONTINGENCY 'AEP_P1-2_#10190' OPEN BRANCH FROM BUS 243969 TO BUS 242640 CKT 1 / 243969 05FLOYD EQ 999 242640 05FLOYD 138 1 OPEN BRANCH FROM BUS 243969 TO BUS 243967 CKT 1 / 243969 05FLOYD EQ 999 243967 05FLOYD 69.0 1 OPEN BRANCH FROM BUS 243969 TO BUS 243966 CKT 1 / 243969 05FLOYD EQ 999 243966 05FLOYD 34.5 1 OPEN BRANCH FROM BUS 242535 TO BUS 242610 CKT 1 / 242535 05ALUMRG 138 242610 05CLYTR3 138 1 OPEN BRANCH FROM BUS 242535 TO BUS 242640 CKT 1 / 242535 05ALUMRG 138 242640 05FLOYD 138 1 OPEN BRANCH FROM BUS 242608 TO BUS 242610 CKT Z1 / 242608 05CLYTR1 138 242610 05CLYTR3 138 Z1 OPEN BRANCH FROM BUS 242609 TO BUS 242610 CKT Z1 / 242609 05CLYTR2 138 242610 05CLYTR3 138 Z1 OPEN BRANCH FROM BUS 242640 TO BUS 242750 CKT 1 / 242640 05FLOYD 138 242750 05PHILPOTT Z 138 1 OPEN BRANCH FROM BUS 247723 TO BUS 242750 CKT 1 / 247723 05PHILPOTT 138 242750 05PHILPOTT Z 138 1 OPEN BRANCH FROM BUS 242750 TO BUS 242844 CKT 1 / 242750 05PHILPOTT Z 138 242844 05W.BASS 138 1 END

Short Circuit

29 Short Circuit

The following Breakers are overduty

None