Generation Interconnection

Feasibility Study Report

for

Queue Project AE2-290

NOTTINGHAM 138 KV

60 MW Capacity / 100 MW Energy

October, 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 has proposed to install PJM project # AE2-290, a Solar generating facility located in Harrison County, Ohio (See Figure 2). The installed facilities will have a total capability of 100 MW with 60 MW of this output being recognized by PJM as Capacity. The Primary Point of Interconnection will be to AEP's Nottingham 138 kV substation (See Figure 1). The Secondary Point of Interconnection will be to the Nottingham – Reedsburg 138 kV section of the Nottingham – Longview 138 kV circuit in the ATSI area.

The proposed in-service date for this project is June 01, 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	AE2-290
Project Name	NOTTINGHAM 138 KV
State	Ohio
County	Harrison
Transmission Owner	AEP
MFO	100
MWE	100
MWC	60
Fuel	Solar
Base case Study Year	2022

2.1 Primary Point of Interconnection

AE2-290 will interconnect with the AEP transmission system at the Nottingham 138 kV substation.

To accommodate the interconnection at the Nottingham 138 kV substation, the substation will have to be expanded requiring building of a new string and installation of two (2) 138 kV circuit breakers (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 AE2-290 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$250,000
Direct Connection Network Upgrade	$4,000,000
Non Direct Connection Network Upgrades	$0
Total Costs	$4,250,000

In addition, the AE2-290 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	$0

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	$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
Build a new string and Install two (2) additional 138 kV circuit breakers. Installation of associated protection and control equipment, 138 kV line risers and SCADA will also be required.	$4,000,000
Total Direct Connection Facility Costs	$4,000,000

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
	$0
Total Non-Direct Connection Facility Costs	$0

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 Nottingham 138 kV substation 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 AE2-290 was evaluated as a 100 MW (Capacity 60 MW) injection at the Nottingham 138 kV substation in the AEP area. Project AE2-290 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-290 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)

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
7371089	920250	AA2-121 TAP	AEP	235707	01WYLIE R	AP	1	AEP_P1-2_#8971	single	1409.0	99.92	100.33	DC	5.69

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
7369818	247460	05NOTTINGHAM	AEP	247700	05YAGER	AEP	1	AEP_P4_#9110_05NOTTINGHAM 138_J	breaker	182.0	151.23	158.3	DC	12.87
7370118	247460	05NOTTINGHAM	AEP	247700	05YAGER	AEP	2	AEP_P4_#9113_05NOTTINGHAM 138_M	breaker	228.0	118.69	124.25	DC	12.68
7370707	247460	05NOTTINGHAM	AEP	247700	05YAGER	AEP	1	AEP_P1-2_#8867	single	182.0	150.3	154.34	DC	7.35
7370708	247460	05NOTTINGHAM	AEP	247700	05YAGER	AEP	1	Base Case	single	144.0	126.58	129.96	DC	4.88
7371019	247460	05NOTTINGHAM	AEP	247700	05YAGER	AEP	2	AEP_P1-2_#8865	single	228.0	117.92	121.1	DC	7.25

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
7370706	247460	05NOTTINGHAM	AEP	247700	05YAGER	AEP	1	AEP_P1-2_#8867	operation	182.0	150.62	157.35	DC	12.25
7370712	247460	05NOTTINGHAM	AEP	247700	05YAGER	AEP	1	Base Case	operation	144.0	117.08	119.62	DC	8.13
7371018	247460	05NOTTINGHAM	AEP	247700	05YAGER	AEP	2	AEP_P1-2_#8865	operation	228.0	118.17	123.47	DC	12.08

16 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
7371089	1	**AA2-121 TAP 345.0 kV - 01WYLIE R 345.0 kV Ckt 1**	**APS** **NV#RI_0002: No violation; Rate A = 1542 MVA, Rate B = 1878 MVA** **Project Type : FAC** **Cost : $0** **Time Estimate : N/A Months** **AEP** **NV#RI_AEP_AE1_REF_r0048: No Violation. AEP does not own limiting equipment.** **Project Type : FAC** **Cost : $0** **Time Estimate : N/A Months**	$0
7370707,7369818,7370708	2	**05NOTTINGHAM 138.0 kV - 05YAGER 138.0 kV Ckt 1**	**AEP** **AEPO0009a (118) : AEP end rating is sufficient: A/B: 398/398** **Project Type : FAC** **Cost : $0** **Time Estimate : N/A Months**	$0
7370118,7371019	3	**05NOTTINGHAM 138.0 kV - 05YAGER 138.0 kV Ckt 2**	**AEP** **AEPO0010a (119) : AEP end rating is sufficient: A/B: 398/398** **Project Type : FAC** **Cost : $0** **Time Estimate : N/A Months**	$0
			TOTAL COST	**$0**

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
7371089	920250	AA2-121 TAP	AEP	235707	01WYLIE R	AP	1	AEP_P1-2_#8971	single	1409.0	99.92	100.33	DC	5.69

Bus #	Bus	MW Impact
235344	01HANNIB	0.2
243185	05CDG3	23.78
243189	05MLG2	10.33
243190	05CDG1	8.72
243191	05CDG2	22.42
247202	05WSHG1A	1.62
247203	05WSHG1B	1.62
247204	05WSHG1S	2.3
247237	05WTRG1A	1.36
247238	05WTRG1B	1.36
247239	05WTRG1C	1.36
247240	05WTRG1S	3.18
914061	Y2-050	25.77
920251	AA2-121 O1	408.46
920431	AA2-141	0.4
924441	AB2-093	55.73
924551	AB2-104	38.76
925351	AC1-003	47.7
926251	AC1-103	97.38
932061	AC2-016	6.29
934631	AD1-090 O1	80.87
936031	AD2-005	3.32
936101	AD2-014 C O1	2.19
938583	AE1-079 CBAT	0.09
939911	AE1-227 C O1	2.16
939973	AE1-237 C2	0.09
940611	AE2-048 C O1	9.81
941391	AE2-136 C	5.52
942741	AE2-290 C O1	5.69
943143	AE2-343 BAT	0.22
CARR	CARR	1.22
CBM-S1	CBM-S1	8.49
CBM-S2	CBM-S2	2.52
CBM-W1	CBM-W1	15.72
CBM-W2	CBM-W2	64.51
CIN	CIN	7.53
CPLE	CPLE	0.74
IPL	IPL	4.89
LGEE	LGEE	2.22
MEC	MEC	13.28
MECS	MECS	7.77
RENSSELAER	RENSSELAER	0.96
WEC	WEC	1.97

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
7369818	247460	05NOTTINGHAM	AEP	247700	05YAGER	AEP	1	AEP_P4_#9110_05NOTTINGHAM 138_J	breaker	182.0	151.23	158.3	DC	12.87

Bus #	Bus	MW Impact
926251	AC1-103	132.09
936031	AD2-005	4.51
942741	AE2-290 C O1	7.72
942742	AE2-290 E O1	5.15
CARR	CARR	0.05
CBM-S1	CBM-S1	0.3
CBM-S2	CBM-S2	0.14
CBM-W1	CBM-W1	0.02
CBM-W2	CBM-W2	1.93
CIN	CIN	0.2
CPLE	CPLE	0.05
G-007	G-007	0.07
IPL	IPL	0.13
LGEE	LGEE	0.07
MEC	MEC	0.31
O-066	O-066	0.48
RENSSELAER	RENSSELAER	0.04
WEC	WEC	0.04

17.3 Index 3

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
7370118	247460	05NOTTINGHAM	AEP	247700	05YAGER	AEP	2	AEP_P4_#9113_05NOTTINGHAM 138_M	breaker	228.0	118.69	124.25	DC	12.68

Bus #	Bus	MW Impact
926251	AC1-103	130.12
936031	AD2-005	4.44
942741	AE2-290 C O1	7.61
942742	AE2-290 E O1	5.07
CARR	CARR	0.05
CBM-S1	CBM-S1	0.29
CBM-S2	CBM-S2	0.13
CBM-W1	CBM-W1	0.01
CBM-W2	CBM-W2	1.89
CIN	CIN	0.2
CPLE	CPLE	0.05
G-007	G-007	0.07
IPL	IPL	0.13
LGEE	LGEE	0.07
MEC	MEC	0.3
O-066	O-066	0.48
RENSSELAER	RENSSELAER	0.04
WEC	WEC	0.04

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_#8971	CONTINGENCY 'AEP_P1-2_#8971' OPEN BRANCH FROM BUS 242932 TO BUS 247797 CKT 1 / 242932 05CANTNC 345 247797 05STEMPLE 345 1 END
AEP_P4_#9110_05NOTTINGHAM 138_J	CONTINGENCY 'AEP_P4_#9110_05NOTTINGHAM 138_J' OPEN BRANCH FROM BUS 247131 TO BUS 247460 CKT 5 / 247131 05HOLLOW 138 247460 05NOTTINGHAM 138 5 OPEN BRANCH FROM BUS 247460 TO BUS 247700 CKT 2 / 247460 05NOTTINGHAM 138 247700 05YAGER 138 2 END
AEP_P4_#9113_05NOTTINGHAM 138_M	CONTINGENCY 'AEP_P4_#9113_05NOTTINGHAM 138_M' OPEN BRANCH FROM BUS 247131 TO BUS 247460 CKT 2 / 247131 05HOLLOW 138 247460 05NOTTINGHAM 138 2 OPEN BRANCH FROM BUS 247460 TO BUS 247700 CKT 1 / 247460 05NOTTINGHAM 138 247700 05YAGER 138 1 END
Base Case	
AEP_P1-2_#8867	CONTINGENCY 'AEP_P1-2_#8867' OPEN BRANCH FROM BUS 247460 TO BUS 247700 CKT 2 / 247460 05NOTTINGHAM 138 247700 05YAGER 138 2 END
AEP_P1-2_#8865	CONTINGENCY 'AEP_P1-2_#8865' OPEN BRANCH FROM BUS 247460 TO BUS 247700 CKT 1 / 247460 05NOTTINGHAM 138 247700 05YAGER 138 1 END

Short Circuit

20 Short Circuit

The following Breakers are over-duty

None

21 Secondary Point of Interconnection

AE2-290 will interconnect with the Nottingham – Reedsburg 138kV section of the Nottingham (AEP) – Longview (FE) 138 kV circuit in the ATSI area.

Note: The Secondary Point of Interconnection is in the ATSI-owned portion of the line. If this project proceeds to the Impact Study Phase selecting the secondary POI, then we will need to have a kick off meeting to transition this project to the First Energy (ATSI) Team.

22 Network Impacts – Option 2

The Queue Project AE2-290 was evaluated as a 100.0 MW (Capacity 60.0 MW) injection at Nottingham – Reedsburg 138kV section of the Nottingham (AEP) – Longview (FE) 138 kV circuit in the ATSI area. Project AE2-290 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-290 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
7369818	247460	05NOTTINGHAM	AEP	247700	05YAGER	AEP	1	AEP_P4_#9110_05NOTTINGHAM 138_J	breaker	182.0	151.84	158.86	DC	12.77
7370118	247460	05NOTTINGHAM	AEP	247700	05YAGER	AEP	2	AEP_P4_#9113_05NOTTINGHAM 138_M	breaker	228.0	119.15	124.67	DC	12.58
7370707	247460	05NOTTINGHAM	AEP	247700	05YAGER	AEP	1	AEP_P1-2_#8867	single	182.0	150.92	154.92	DC	7.29
7370708	247460	05NOTTINGHAM	AEP	247700	05YAGER	AEP	1	Base Case	single	144.0	127.13	130.49	DC	4.84
7371019	247460	05NOTTINGHAM	AEP	247700	05YAGER	AEP	2	AEP_P1-2_#8865	single	228.0	118.39	121.55	DC	7.19

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
7370706	247460	05NOTTINGHAM	AEP	247700	05YAGER	AEP	1	AEP_P1-2_#8867	operation	182.0	151.25	157.93	DC	12.15
7370712	247460	05NOTTINGHAM	AEP	247700	05YAGER	AEP	1	Base Case	operation	144.0	117.65	120.17	DC	8.06

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
7371018	247460	05NOTTINGHAM	AEP	247700	05YAGER	AEP	2	AEP_P1-2_#8865	operation	228.0	118.66	123.91	DC	11.99

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
7369818	247460	05NOTTINGHAM	AEP	247700	05YAGER	AEP	1	AEP_P4_#9110_05NOTTINGHAM 138_J	breaker	182.0	151.84	158.86	DC	12.77

Bus #	Bus	MW Impact
926251	AC1-103	131.91
936031	AD2-005	4.5
942741	AE2-290 C O2	7.66
942742	AE2-290 E O2	5.11
CARR	CARR	0.06
CBM-S1	CBM-S1	0.32
CBM-S2	CBM-S2	0.14
CBM-W1	CBM-W1	0.05
CBM-W2	CBM-W2	2.08
CIN	CIN	0.22
CPLE	CPLE	0.05
G-007	G-007	0.08
IPL	IPL	0.14
LGEE	LGEE	0.08
MEC	MEC	0.34
O-066	O-066	0.51
RENSSELAER	RENSSELAER	0.04
WEC	WEC	0.04

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
7370118	247460	05NOTTINGHAM	AEP	247700	05YAGER	AEP	2	AEP_P4_#9113_05NOTTINGHAM 138_M	breaker	228.0	119.15	124.67	DC	12.58

Bus #	Bus	MW Impact
926251	AC1-103	129.94
936031	AD2-005	4.43
942741	AE2-290 C O2	7.55
942742	AE2-290 E O2	5.03
CARR	CARR	0.06
CBM-S1	CBM-S1	0.32
CBM-S2	CBM-S2	0.14
CBM-W1	CBM-W1	0.05
CBM-W2	CBM-W2	2.05
CIN	CIN	0.22
CPLE	CPLE	0.05
G-007	G-007	0.08
IPL	IPL	0.14
LGEE	LGEE	0.08
MEC	MEC	0.33
O-066	O-066	0.5
RENSSELAER	RENSSELAER	0.04
WEC	WEC	0.04

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
Base Case	
AEP_P4_#9110_05NOTTINGHAM 138_J	CONTINGENCY 'AEP_P4_#9110_05NOTTINGHAM 138_J' OPEN BRANCH FROM BUS 247131 TO BUS 247460 CKT 5 / 247131 05HOLLOW 138 247460 05NOTTINGHAM 138 5 OPEN BRANCH FROM BUS 247460 TO BUS 247700 CKT 2 / 247460 05NOTTINGHAM 138 247700 05YAGER 138 2 END
AEP_P1-2_#8867	CONTINGENCY 'AEP_P1-2_#8867' OPEN BRANCH FROM BUS 247460 TO BUS 247700 CKT 2 / 247460 05NOTTINGHAM 138 247700 05YAGER 138 2 END
AEP_P4_#9113_05NOTTINGHAM 138_M	CONTINGENCY 'AEP_P4_#9113_05NOTTINGHAM 138_M' OPEN BRANCH FROM BUS 247131 TO BUS 247460 CKT 2 / 247131 05HOLLOW 138 247460 05NOTTINGHAM 138 2 OPEN BRANCH FROM BUS 247460 TO BUS 247700 CKT 1 / 247460 05NOTTINGHAM 138 247700 05YAGER 138 1 END
AEP_P1-2_#8865	CONTINGENCY 'AEP_P1-2_#8865' OPEN BRANCH FROM BUS 247460 TO BUS 247700 CKT 1 / 247460 05NOTTINGHAM 138 247700 05YAGER 138 1 END

Short Circuit

30 Short Circuit

The following Breakers are overduty

None.