# Generation Interconnection

# Feasibility Study Report

# for

# Queue Project AE2-089

# PENNVILLE-ADAMS 138 KV

# 93 MW Capacity / 155 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.

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 a Solar generating facility located in Jay County, Indiana. The installed facilities will have a total capability of 155 MW with 93 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.

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** | **AE2-089** |
|---|---|
| **Project Name** | PENNVILLE-ADAMS 138 KV |
| **State** | Indiana |
| **County** | Jay |
| **Transmission Owner** | AEP |
| **MFO** | 155 |
| **MWE** | 155 |
| **MWC** | 93 |
| **Fuel** | Solar |
| **Basecase Study Year** | 2022 |

## 2.1 Primary Point of Interconnection

AE2-089 will interconnect with the AEP transmission system via a new station cut into the Pennville to Adams 138kV section of the Jay – Adams 138kV Circuit.

To accommodate the interconnection on the Pennville to Adams 138kV section of Jay – Adams 138kV 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.

The AE2-089 project will be responsible for the following costs:

| Description | Total Cost |
|---|---|
| **Attachment Facilities** | $ 250,000 |
| **Direct Connection Network Upgrade** | $ 6,000,000 |
| **Non Direct Connection Network Upgrades** | $ 1,500,000 |
| **Total Costs** | $ 7,750,000 |

In addition, the AE2-089 project may be responsible for a contribution to the following costs

| Description | Total Cost |
|---|---|
| **System Upgrades** | $125,000 |

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 |
| | |
| **Total Direct Connection Facility Costs** | $ 6,000,000 |

## 6 Non-Direct Connection Cost Estimate

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

| Description | Total Cost |
|---|---|
| Pennville - Adams 138kV T-Line Cut In | $ 1,000,000 |
| Upgrade line protections & Controls at the Adams 138kV Substation | $ 250,000 |
| Upgrade line protections & Controls at the Jay 138kV Substation | $ 250,000 |
| **Total Non-Direct Connection Facility Costs** | $ 1,500,000 |

## 7 Incremental Capacity Transfer Rights (ICTRs)

Will be determined at a later study phase

## 8 Schedule

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

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 Pennville – Adams 138kV section of the Jay – Adams 138kV 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.

# 9 Revenue Metering and SCADA Requirements

## 9.1 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.

## 9.2 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

## 10 Network Impacts

The Queue Project AE2-089 was evaluated as a 155 MW (Capacity 93 MW) injection via a new station cut into Pennville – Adams 138kV section of Jay – Adams 138kV Circuit in the AEP area. Project AE2-089 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-089 was studied with a commercial probability of 53%. Potential network impacts were as follows:

# Summer Peak Load Flow

## 11 Generation Deliverability

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

None

## 12 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1422880** | 940980 | AE2-089 TAP | AEP | 243237 | 05ADAM | AEP | 1 | AEP_P7-1_#11019 | tower | 205.0 | 72.75 | 103.57 | DC | 63.18 |

## 13 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2171593** | 248001 | 06DEARB1 | OVEC | 248013 | 06PIERCE | OVEC | 1 | .345.DEO&K-AEP.C5 4504MFTANNERS4512EBTANNERS | tower | 972.0 | 106.24 | 106.81 | DC | 12.07 |

## 14 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1422613** | 243218 | 05DESOTO | AEP | 243232 | 05SORENS | AEP | 2 | AEP_P1-2_#4817 | operation | 971.0 | 93.24 | 93.83 | DC | 12.94 |
| **1422579** | 940980 | AE2-089 TAP | AEP | 243237 | 05ADAM | AEP | 1 | AEP_P1-2_#5598 | operation | 205.0 | 44.22 | 85.2 | DC | 84.02 |

## 15 System Reinforcements

| ID | Index | Facility | Upgrade Description | Cost |
|---|---|---|---|---|
| 1422880 | 1 | AE2-089 TAP 138.0 kV - 05ADAM 138.0 kV Ckt 1 | **b3119 (99)** : PJM Baseline Upgrade b3119. Rebuild the 138kV Jay Pennville line as double circuit 138/69kV. Build a new 9.8 mile single circuit 69 kV line from near Pennville station to North Portland station. The baseline project has an projected in-service date of 06/17/2019.<br><br>Additionally, the Jay- Allen project ( PJM has not asigned S number yet ) will be required to mitigate the identified overloads.<br>**Project Type** : FAC<br>**Cost** : $0<br>**Time Estimate** : N/A Months | $0 |
| 2171593 | 2 | 06DEARB1 345.0 kV - 06PIERCE 345.0 kV Ckt 1 | **OVEC_CPI_r0003 (826)** : Perform a sag study. OVECs cost estimate for performing the sag study is $125K.<br>**Project Type** : FAC<br>**Cost** : $125,000<br>**Time Estimate** : 6-12 Months | $125,000 |
| | | | **TOTAL COST** | **$125,000** |

# 16 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.

## 16.1 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1422880** | 940980 | AE2-089 TAP | AEP | 243237 | 05ADAM | AEP | 1 | AEP_P7-1_#11019 | tower | 205.0 | 72.75 | 103.57 | DC | 63.18 |

| Bus # | Bus | MW Impact |
|---|---|---|
| **247536** | S-071 C | 0.33 |
| **247929** | S-071 E | 10.76 |
| **933591** | AC2-176 C O1 | 2.64 |
| **933592** | AC2-176 E O1 | 17.7 |
| **936681** | AD2-087 C O1 | 3.11 |
| **936682** | AD2-087 E O1 | 14.58 |
| **940981** | AE2-089 C O1 | 37.91 |
| **940982** | AE2-089 E O1 | 25.27 |
| **940991** | AE2-090 C | 6.73 |
| **940992** | AE2-090 E | 4.49 |
| **942071** | AE2-219 C | 4.12 |
| **942072** | AE2-219 E | 5.7 |
| **CARR** | CARR | 0.01 |
| **CBM-S1** | CBM-S1 | 1.3 |
| **CBM-S2** | CBM-S2 | 0.31 |
| **CBM-W2** | CBM-W2 | 8.49 |
| **CIN** | CIN | 2.11 |
| **CPLE** | CPLE | 0.1 |
| **DUCKCREEK** | DUCKCREEK | 0.2 |
| **EDWARDS** | EDWARDS | 0.12 |
| **FARMERCITY** | FARMERCITY | 0.0 |
| **G-007** | G-007 | 0.01 |
| **IPL** | IPL | 1.88 |
| **LGEE** | LGEE | 0.55 |
| **O-066** | O-066 | 0.05 |
| **RENSSELAER** | RENSSELAER | 0.01 |
| **TATANKA** | TATANKA | 0.08 |

## 16.2 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2171593** | 248001 | 06DEARB1 | OVEC | 248013 | 06PIERCE | OVEC | 1 | .345.DEO&K-AEP.C5 4504MFTANNERS4512EBTANNERS | tower | 972.0 | 106.24 | 106.81 | DC | 12.07 |

| Bus # | Bus | MW Impact |
|---|---|---|
| **243795** | 05HDWTR1G C | 0.49 |
| **247264** | 05LAWG1A | 6.07 |
| **247265** | 05LAWG1B | 6.07 |
| **247266** | 05LAWG1S | 9.7 |
| **247267** | 05LAWG2A | 6.07 |
| **247268** | 05LAWG2B | 6.07 |
| **247269** | 05LAWG2S | 9.7 |
| **247543** | V3-007 C | 0.49 |
| **247914** | 05WLD G1 E | 8.0 |
| **247929** | S-071 E | 8.56 |
| **247935** | V3-007 E | 26.83 |
| **247958** | 05WLD G2 E | 8.4 |
| **247963** | 05HDWTR1G E | 9.66 |
| **247968** | Z2-115 E | 0.16 |
| **915662** | Y3-099 E | 0.2 |
| **915672** | Y3-100 E | 0.2 |
| **916182** | Z1-065 E | 0.38 |
| **920501** | AA2-148 C O1 | 3.54 |
| **920502** | AA2-148 E O1 | 23.67 |
| **923881** | AB2-028 C | 2.91 |
| **923882** | AB2-028 E | 19.46 |
| **925242** | AB2-178 E | 1.98 |
| **926691** | AC1-152 | 15.72 |
| **926851** | AC1-172 | 15.72 |
| **926881** | AC1-175 C | 11.72 |
| **926882** | AC1-175 E | 19.12 |
| **932681** | AC2-090 C | 5.86 |
| **932682** | AC2-090 E | 9.56 |
| **932841** | AC2-111 C O1 | 2.77 |
| **932842** | AC2-111 E O1 | 4.52 |
| **933591** | AC2-176 C O1 | 1.52 |
| **933592** | AC2-176 E O1 | 10.14 |
| **933601** | AC2-177 C O1 | 4.01 |
| **933602** | AC2-177 E O1 | 26.83 |
| **934161** | AD1-043 C O1 | 4.47 |
| **934162** | AD1-043 E O1 | 7.29 |
| **934961** | AD1-128 C O1 | 5.62 |
| **934962** | AD1-128 E O1 | 9.17 |
| **936561** | AD2-071 C | 5.94 |
| **936562** | AD2-071 E | 2.92 |
| **936681** | AD2-087 C O1 | 3.17 |

| Bus # | Bus | MW Impact |
|---|---|---|
| **936682** | AD2-087 E O1 | 14.83 |
| **938061** | AE1-008 C | 0.69 |
| **938062** | AE1-008 E | 1.13 |
| **939761** | AE1-207 C | 5.95 |
| **939762** | AE1-207 E | 8.22 |
| **939771** | AE1-208 C | 5.24 |
| **939772** | AE1-208 E | 7.14 |
| **939781** | AE1-209 C O1 | 1.28 |
| **939782** | AE1-209 E O1 | 8.58 |
| **939791** | AE1-210 C O1 | 1.61 |
| **939792** | AE1-210 E O1 | 10.76 |
| **939811** | AE1-217 C O1 | 7.95 |
| **939812** | AE1-217 E O1 | 10.98 |
| **940981** | AE2-089 C O1 | 7.24 |
| **940982** | AE2-089 E O1 | 4.83 |
| **940991** | AE2-090 C | 7.78 |
| **940992** | AE2-090 E | 5.19 |
| **941691** | AE2-169 | 3.15 |
| **941701** | AE2-170 | 4.74 |
| **941711** | AE2-171 | 2.95 |
| **941721** | AE2-172 | 3.55 |
| **942071** | AE2-219 C | 3.77 |
| **942072** | AE2-219 E | 5.2 |
| **942081** | AE2-220 C | 8.1 |
| **942082** | AE2-220 E | 11.18 |
| **942221** | AE2-234 C O1 | 1.8 |
| **942222** | AE2-234 E O1 | 0.81 |
| **942791** | AE2-297 C O1 | 13.9 |
| **942792** | AE2-297 E O1 | 9.26 |
| **950161** | J401 | 1.31 |
| **CARR** | CARR | 0.32 |
| **CATAWBA** | CATAWBA | 0.09 |
| **CBM-S1** | CBM-S1 | 4.29 |
| **CBM-W1** | CBM-W1 | 17.07 |
| **CBM-W2** | CBM-W2 | 71.97 |
| **CIN** | CIN | 13.65 |
| **G-007** | G-007 | 0.94 |
| **HAMLET** | HAMLET | 0.19 |
| **IPL** | IPL | 12.55 |
| **LGEE** | LGEE | 1.08 |
| **MEC** | MEC | 15.37 |
| **MECS** | MECS | 7.23 |
| **O-066** | O-066 | 6.01 |
| **RENSSELAER** | RENSSELAER | 0.25 |
| **WEC** | WEC | 2.43 |
| **Z1-043** | Z1-043 | 9.75 |

# Affected Systems

# 17 Affected Systems

## 17.1 LG&E

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

## 17.2 MISO

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

## 17.3 TVA

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

## 17.4 Duke Energy Progress

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

## 17.5 NYISO

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

## 18 Contingency Descriptions

| Contingency Name | Contingency Definition |
|---|---|
| **AEP_P1-2_#5598** | CONTINGENCY 'AEP_P1-2_#5598'<br>OPEN BRANCH FROM BUS 243278 TO BUS 243319 CKT 1 / 243278 05DESOTO 138 243319 05JAY 138 1<br>END |
| **AEP_P7-1_#11019** | CONTINGENCY 'AEP_P7-1_#11019'<br>OPEN BRANCH FROM BUS 243218 TO BUS 243232 CKT 2 / 243218 05DESOTO 345 243232 05SORENS 345 2<br>OPEN BRANCH FROM BUS 243225 TO BUS 243232 CKT 1 / 243225 05KEYSTN 345 243232 05SORENS 345 1<br>END |
| **.345.DEO&K-AEP.C5 4504MFTANNERS4512EBTANNERS** | CONTINGENCY '.345.DEO&K-AEP.C5 4504MFTANNERS4512EBTANNERS'<br>OPEN BRANCH FROM BUS 243233 TO BUS 249567 CKT 1<br>OPEN BRANCH FROM BUS 243233 TO BUS 249565 CKT 1<br>END |
| **AEP_P1-2_#4817** | CONTINGENCY 'AEP_P1-2_#4817'<br>OPEN BRANCH FROM BUS 243225 TO BUS 243232 CKT 1 / 243225 05KEYSTN 345 243232 05SORENS 345 1<br>END |

# Short Circuit

## 19 Short Circuit

The following Breakers are overduty

None

## 20 Secondary Point of Interconnection:

The Secondary point of Interconnection is at AEP's Pennville 138kV station.

To accommodate the Interconnection at Pennville 138kV: Expand the Pennville station , install four new 138kV circuit breakers at Pennville 138kV station. 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.

## 21 Network Impacts

The Queue Project AE2-089 was evaluated as a 155.0 MW (Capacity 93.0 MW) injection at Pennville 138kV station in the AEP area. Project AE2-089 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-089 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **11577876** | 243358 | 05PENNVI | AEP | 243237 | 05ADAM | AEP | 1 | AEP_P4_#10617_05DESOTO 138_H1 | breaker | 205.0 | 44.31 | 79.37 | DC | 71.86 |
| **12132576** | 243358 | 05PENNVI | AEP | 243237 | 05ADAM | AEP | 1 | AEP_P7-1_#11019 | tower | 205.0 | 72.71 | 96.3 | DC | 48.36 |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2171593** | 248001 | 06DEARB1 | OVEC | 248013 | 06PIERCE | OVEC | 1 | .345.DEO&K-AEP.C5 4504MFTANNERS4512EBTANNERS | tower | 972.0 | 106.31 | 106.9 | DC | 12.76 |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1422613** | 243218 | 05DESOTO | AEP | 243232 | 05SORENS | AEP | 2 | AEP_P1-2_#4817 | operation | 971.0 | 93.25 | 93.99 | DC | 16.07 |
| **11910906** | 243358 | 05PENNVI | AEP | 243237 | 05ADAM | AEP | 1 | AEP_P1-2_#5598 | operation | 205.0 | 44.22 | 79.27 | DC | 71.86 |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **12132576** | 243358 | 05PENNVI | AEP | 243237 | 05ADAM | AEP | 1 | AEP_P7-1_#11019 | tower | 205.0 | 72.71 | 96.3 | DC | 48.36 |

| Bus # | Bus | MW Impact |
|---|---|---|
| **247536** | S-071 C | 0.33 |
| **247929** | S-071 E | 10.76 |
| **933591** | AC2-176 C O1 | 2.64 |
| **933592** | AC2-176 E O1 | 17.7 |
| **936681** | AD2-087 C O1 | 3.11 |
| **936682** | AD2-087 E O1 | 14.58 |
| **940981** | AE2-089 C O2 | 29.02 |
| **940982** | AE2-089 E O2 | 19.34 |
| **940991** | AE2-090 C | 6.73 |
| **940992** | AE2-090 E | 4.49 |
| **942071** | AE2-219 C | 4.12 |
| **942072** | AE2-219 E | 5.7 |
| **CARR** | CARR | 0.01 |
| **CBM-S1** | CBM-S1 | 1.3 |
| **CBM-S2** | CBM-S2 | 0.31 |
| **CBM-W2** | CBM-W2 | 8.49 |
| **CIN** | CIN | 2.11 |
| **CPLE** | CPLE | 0.1 |
| **DUCKCREEK** | DUCKCREEK | 0.2 |
| **EDWARDS** | EDWARDS | 0.12 |
| **FARMERCITY** | FARMERCITY | 0.0 |
| **G-007** | G-007 | 0.01 |
| **IPL** | IPL | 1.88 |
| **LGEE** | LGEE | 0.55 |
| **O-066** | O-066 | 0.05 |
| **RENSSELAER** | RENSSELAER | 0.01 |
| **TATANKA** | TATANKA | 0.08 |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2171593** | 248001 | 06DEARB1 | OVEC | 248013 | 06PIERCE | OVEC | 1 | .345.DEO&K-AEP.C5 4504MFTANNERS4512EBTANNERS | tower | 972.0 | 106.31 | 106.9 | DC | 12.76 |

| Bus # | Bus | MW Impact |
|---|---|---|
| **243795** | 05HDWTR1G C | 0.49 |
| **247264** | 05LAWG1A | 6.07 |
| **247265** | 05LAWG1B | 6.07 |
| **247266** | 05LAWG1S | 9.7 |
| **247267** | 05LAWG2A | 6.07 |
| **247268** | 05LAWG2B | 6.07 |
| **247269** | 05LAWG2S | 9.7 |
| **247543** | V3-007 C | 0.49 |
| **247914** | 05WLD G1 E | 8.0 |
| **247929** | S-071 E | 8.56 |
| **247935** | V3-007 E | 26.83 |
| **247958** | 05WLD G2 E | 8.39 |
| **247963** | 05HDWTR1G E | 9.66 |
| **247968** | Z2-115 E | 0.16 |
| **915662** | Y3-099 E | 0.2 |
| **915672** | Y3-100 E | 0.2 |
| **916182** | Z1-065 E | 0.38 |
| **920501** | AA2-148 C O1 | 3.54 |
| **920502** | AA2-148 E O1 | 23.67 |
| **923881** | AB2-028 C | 2.91 |
| **923882** | AB2-028 E | 19.45 |
| **925242** | AB2-178 E | 1.98 |
| **926691** | AC1-152 | 15.72 |
| **926851** | AC1-172 | 15.72 |
| **926881** | AC1-175 C | 11.72 |
| **926882** | AC1-175 E | 19.12 |
| **932681** | AC2-090 C | 5.86 |
| **932682** | AC2-090 E | 9.56 |
| **932841** | AC2-111 C O1 | 2.77 |
| **932842** | AC2-111 E O1 | 4.51 |
| **933591** | AC2-176 C O1 | 1.52 |
| **933592** | AC2-176 E O1 | 10.14 |
| **933601** | AC2-177 C O1 | 4.01 |
| **933602** | AC2-177 E O1 | 26.83 |
| **934161** | AD1-043 C O1 | 4.46 |
| **934162** | AD1-043 E O1 | 7.28 |
| **934961** | AD1-128 C O1 | 5.62 |
| **934962** | AD1-128 E O1 | 9.17 |
| **936561** | AD2-071 C | 5.94 |
| **936562** | AD2-071 E | 2.92 |
| **936681** | AD2-087 C O1 | 3.17 |

| Bus # | Bus | MW Impact |
|---|---|---|
| **936682** | AD2-087 E O1 | 14.82 |
| **938061** | AE1-008 C | 0.69 |
| **938062** | AE1-008 E | 1.13 |
| **939761** | AE1-207 C | 5.95 |
| **939762** | AE1-207 E | 8.22 |
| **939771** | AE1-208 C | 5.24 |
| **939772** | AE1-208 E | 7.14 |
| **939781** | AE1-209 C O1 | 1.28 |
| **939782** | AE1-209 E O1 | 8.57 |
| **939791** | AE1-210 C O1 | 1.61 |
| **939792** | AE1-210 E O1 | 10.76 |
| **939811** | AE1-217 C O1 | 7.95 |
| **939812** | AE1-217 E O1 | 10.97 |
| **940981** | AE2-089 C O2 | 7.66 |
| **940982** | AE2-089 E O2 | 5.11 |
| **940991** | AE2-090 C | 7.77 |
| **940992** | AE2-090 E | 5.18 |
| **941691** | AE2-169 | 3.15 |
| **941701** | AE2-170 | 4.71 |
| **941711** | AE2-171 | 2.95 |
| **941721** | AE2-172 | 3.55 |
| **942071** | AE2-219 C | 3.76 |
| **942072** | AE2-219 E | 5.2 |
| **942081** | AE2-220 C | 8.1 |
| **942082** | AE2-220 E | 11.18 |
| **942221** | AE2-234 C O2 | 1.8 |
| **942222** | AE2-234 E O2 | 0.81 |
| **942791** | AE2-297 C O2 | 14.21 |
| **942792** | AE2-297 E O2 | 9.48 |
| **950161** | J401 | 1.31 |
| **CARR** | CARR | 0.32 |
| **CATAWBA** | CATAWBA | 0.09 |
| **CBM-S1** | CBM-S1 | 4.29 |
| **CBM-W1** | CBM-W1 | 17.07 |
| **CBM-W2** | CBM-W2 | 71.97 |
| **CIN** | CIN | 13.65 |
| **G-007** | G-007 | 0.94 |
| **HAMLET** | HAMLET | 0.19 |
| **IPL** | IPL | 12.54 |
| **LGEE** | LGEE | 1.08 |
| **MEC** | MEC | 15.38 |
| **MECS** | MECS | 7.24 |
| **O-066** | O-066 | 6.01 |
| **RENSSELAER** | RENSSELAER | 0.25 |
| **WEC** | WEC | 2.43 |
| **Z1-043** | Z1-043 | 9.75 |

# 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 |
|---|---|
| **AEP_P1-2_#5598** | CONTINGENCY 'AEP_P1-2_#5598'<br>OPEN BRANCH FROM BUS 243278 TO BUS 243319 CKT 1 / 243278 05DESOTO 138 243319 05JAY 138 1<br>END |
| **AEP_P7-1_#11019** | CONTINGENCY 'AEP_P7-1_#11019'<br>OPEN BRANCH FROM BUS 243218 TO BUS 243232 CKT 2 / 243218 05DESOTO 345 243232 05SORENS 345 2<br>OPEN BRANCH FROM BUS 243225 TO BUS 243232 CKT 1 / 243225 05KEYSTN 345 243232 05SORENS 345 1<br>END |
| **AEP_P1-2_#4817** | CONTINGENCY 'AEP_P1-2_#4817'<br>OPEN BRANCH FROM BUS 243225 TO BUS 243232 CKT 1 / 243225 05KEYSTN 345 243232 05SORENS 345 1<br>END |
| **.345.DEO&K-AEP.C5 4504MFTANNERS4512EBTANNERS** | CONTINGENCY '.345.DEO&K-AEP.C5 4504MFTANNERS4512EBTANNERS'<br>OPEN BRANCH FROM BUS 243233 TO BUS 249567 CKT 1<br>OPEN BRANCH FROM BUS 243233 TO BUS 249565 CKT 1<br>END |
| **AEP_P4_#10617_05DESOTO 138_H1** | CONTINGENCY 'AEP_P4_#10617_05DESOTO 138_H1'<br>OPEN BRANCH FROM BUS 243274 TO BUS 243343 CKT 1 / 243274 05DEERCR 138 243343 05MISSIS 138 1<br>OPEN BRANCH FROM BUS 243278 TO BUS 939810 CKT 1 / 243278 05DESOTO 138 939810 AE1-217 TAP 138 1 /* CONTINGENCY LINE ADDED FOR AE1 BUILD<br>OPEN BRANCH FROM BUS 243278 TO BUS 243319 CKT 1 / 243278 05DESOTO 138 243319 05JAY 138 1<br>END |

# Short Circuit

## 29 Short Circuit

The following Breakers are overduty

None