# Generation Interconnection

# Feasibility Study Report

# for

# Queue Project AE2-297

# MADISON-TANNERS CREEK 138 KV

# 91.5 MW Capacity / 152.5 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 Henry County, Indiana. The installed facilities will have a total capability of 152.5 MW with 91.5 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is 12.31.2021. This study does not imply a TO commitment to this in-service date.

| Queue Number | AE2-297 |
|---|---|
| Project Name | MADISON-TANNERS CREEK 138 KV |
| State | Indiana |
| County | Henry |
| Transmission Owner | AEP |
| MFO | 152.5 |
| MWE | 152.5 |
| MWC | 91.5 |
| Fuel | Solar |
| Basecase Study Year | 2022 |

## 2.1 Point of Interconnection

AE2-297 will interconnect with the AEP transmission system as a tap of the Madison to Tanners Creek 138 kV line.

To accommodate the interconnection on the Madison to Tanners Creek 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.

## 2.2 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** | $125,000 + TBD |

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 AE2-297 was evaluated as a 152.5 MW (Capacity 91.5 MW) injection tapping the Madison to Tanners Creek 138 kV line in the AEP area. Project AE2-297 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-297 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)

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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **7382669** | 243311 | 05HOGAN | AEP | 243275 | 05DELAWR | AEP | 1 | AEP_P4_#2965_05DESOTO 345_A2 | breaker | 231.0 | 113.3 | 120.39 | DC | 16.4 |
| **7382631** | 246763 | 05PIPECK | AEP | 243303 | 05GRNTTA | AEP | 1 | AEP_P4_#8781_05HOGAN 138_B | breaker | 205.0 | 120.42 | 122.67 | DC | 10.24 |
| **8956815** | 248001 | 06DEARB1 | OVEC | 248013 | 06PIERCE | OVEC | 1 | .345.DEO&K-AEP.C5 4504MFTANNERS4512EBTANNERS | tower | 972.0 | 110.62 | 113.03 | DC | 23.16 |
| **7384203** | 923880 | AB2-028 TAP | AEP | 243218 | 05DESOTO | AEP | 1 | AEP_P7-1_#11042 | tower | 1160.0 | 102.68 | 104.12 | DC | 16.65 |
| **7382576** | 936560 | AD2-071 TAP | AEP | 246763 | 05PIPECK | AEP | 1 | AEP_P4_#8781_05HOGAN 138_B | breaker | 205.0 | 122.42 | 124.67 | DC | 10.24 |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **7383783** | 243218 | 05DESOTO | AEP | 243232 | 05SORENS | AEP | 2 | AEP_P1-2_#4817 | operation | 971.0 | 101.52 | 103.48 | DC | 19.34 |

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **7383551** | 243311 | 05HOGAN | AEP | 243275 | 05DELAWR | AEP | 1 | AEP_P1-2_#673-A | operation | 231.0 | 111.79 | 119.12 | DC | 16.93 |
| **7383552** | 243311 | 05HOGAN | AEP | 243275 | 05DELAWR | AEP | 1 | Base Case | operation | 167.0 | 110.52 | 114.61 | DC | 15.17 |
| **7383578** | 246763 | 05PIPECK | AEP | 243303 | 05GRNTTA | AEP | 1 | AEP_P1-2_#6957 | operation | 205.0 | 114.87 | 116.82 | DC | 8.86 |
| **7383227** | 247588 | W4-004 C | AEP | 243382 | 05TANNER | AEP | 1 | AEP_P1-2_#8182-A | operation | 220.0 | 79.5 | 148.82 | DC | 152.5 |
| **7383556** | 936560 | AD2-071 TAP | AEP | 246763 | 05PIPECK | AEP | 1 | AEP_P1-2_#6957 | operation | 205.0 | 116.87 | 118.82 | DC | 8.86 |
| **7383222** | 942790 | AE2-297 TAP | AEP | 243333 | 05MADISO | AEP | 1 | AEP_P1-2_#8181 | operation | 220.0 | 79.5 | 148.82 | DC | 152.5 |
| **7383223** | 942790 | AE2-297 TAP | AEP | 243333 | 05MADISO | AEP | 1 | Base Case | operation | 187.0 | 74.8 | 130.85 | DC | 104.81 |

## 16 System Reinforcements

| ID | Index | Facility | Upgrade Description | Cost |
|---|---|---|---|---|
| 7382669 | 1 | 05HOGAN 138.0 kV - 05DELAWR 138.0 kV Ckt 1 | s0738 (89) : PJM Supplemental Upgrade s0738. Upgrade the Delaware - Hogan 138 kV risers. The supplemental project has an projected in-service date of 12/18/2021.<br>Project Type : FAC<br>Cost : $0<br>Time Estimate : 12-18 Months<br><br>s1498.2 (90) : PJM Supplemental Upgrade s1498.2. Replace risers at Delaware station with 1200A AAC jumpers. The supplemental project has an projected in-service date of 12/18/2021.<br>Project Type : FAC<br>Cost : $0<br>Time Estimate : 12-18 Months | $0 |
| 7384203 | 4 | AB2-028 TAP 345.0 kV - 05DESOTO 345.0 kV Ckt 1 | 7384203<br>Current AEP Ratings are S/N: 1025 MVA S/E: 1318 MVA. Current AEP ratings are sufficient to mitigate the overloads. | $0 |
| 7382576 | 5 | AD2-071 TAP 138.0 kV - 05PIPECK 138.0 kV Ckt 1 | AEP<br>(sXXXX): Contingency is no longer valid. It is going away with the Southern Muncie project proposed by AEP (waiting for a Supplemental ID# for this project) Note: This queue project may have a cost responsibility for upgrading the overloaded element if the supplemental project is not approved. Further information will be provided during the Impact Study Phase.<br>Project Type : CON<br>Cost : TBD<br>Time Estimate : TBD<br><br>An AEP supplemental project may rebuild a portion or all of this line. PJM is in the process of assigning this project a Supplemental ID number. Determination of allocation of cost for the scope of SXXXX to AE2-297 (if any) or other queue positions will occur during the System Impact Study. | TBD |
| 7382631 | 2 | 05PIPECK 138.0 kV - 05GRNTTA 138.0 kV Ckt 1 | | |
| 8956815 | 3 | 06DEARB1 345.0 kV - 06PIERCE 345.0 kV Ckt 1 | OVEC_CPI_r0003 (913) : 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 + TBD |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **7382669** | 243311 | 05HOGAN | AEP | 243275 | 05DELAWR | AEP | 1 | AEP_P4_#2965_05DESOTO 345_A2 | breaker | 231.0 | 113.3 | 120.39 | DC | 16.4 |

| Bus # | Bus | MW Impact |
|---|---|---|
| **246991** | 05WLD G1 C | 0.35 |
| **247255** | 05WLD G2 C | 0.37 |
| **247914** | 05WLD G1 E | 19.45 |
| **247958** | 05WLD G2 E | 20.41 |
| **247968** | Z2-115 E | 0.14 |
| **920501** | AA2-148 C O1 | 2.36 |
| **920502** | AA2-148 E O1 | 15.76 |
| **923881** | AB2-028 C | 1.67 |
| **923882** | AB2-028 E | 11.19 |
| **934161** | AD1-043 C O1 | 9.63 |
| **934162** | AD1-043 E O1 | 15.71 |
| **936561** | AD2-071 C | 12.55 |
| **936562** | AD2-071 E | 6.18 |
| **941692** | AE2-169 BAT | 7.71 |
| **941711** | AE2-171 | 6.35 |
| **942791** | AE2-297 C O1 | 9.84 |
| **942792** | AE2-297 E O1 | 6.56 |
| **CARR** | CARR | 0.03 |
| **CBM-S1** | CBM-S1 | 1.92 |
| **CBM-S2** | CBM-S2 | 0.35 |
| **CBM-W1** | CBM-W1 | 1.39 |
| **CBM-W2** | CBM-W2 | 22.59 |
| **CIN** | CIN | 5.06 |
| **CPLE** | CPLE | 0.1 |
| **G-007** | G-007 | 0.08 |
| **IPL** | IPL | 4.13 |
| **LGEE** | LGEE | 0.51 |
| **MEC** | MEC | 2.63 |
| **O-066** | O-066 | 0.53 |
| **RENSSELAER** | RENSSELAER | 0.03 |
| **WEC** | WEC | 0.25 |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **7382631** | 246763 | 05PIPECK | AEP | 243303 | 05GRNTTA | AEP | 1 | AEP_P4_#8781_05HOGAN 138_B | breaker | 205.0 | 120.42 | 122.67 | DC | 10.24 |

| Bus # | Bus | MW Impact |
|---|---|---|
| **246991** | 05WLD G1 C | 0.79 |
| **247255** | 05WLD G2 C | 0.83 |
| **247914** | 05WLD G1 E | 43.28 |
| **247958** | 05WLD G2 E | 45.41 |
| **920501** | AA2-148 C O1 | 1.49 |
| **920502** | AA2-148 E O1 | 9.95 |
| **934161** | AD1-043 C O1 | 19.67 |
| **934162** | AD1-043 E O1 | 32.1 |
| **936561** | AD2-071 C | 39.86 |
| **936562** | AD2-071 E | 19.63 |
| **941702** | AE2-170 BAT | 1.67 |
| **941711** | AE2-171 | 12.99 |
| **941722** | AE2-172 BAT | 1.81 |
| **942791** | AE2-297 C O1 | 6.14 |
| **942792** | AE2-297 E O1 | 4.1 |
| **CBM-N** | CBM-N | 0.02 |
| **CBM-S1** | CBM-S1 | 0.68 |
| **CBM-S2** | CBM-S2 | 0.15 |
| **CBM-W2** | CBM-W2 | 4.86 |
| **CIN** | CIN | 1.62 |
| **CPLE** | CPLE | 0.05 |
| **DUCKCREEK** | DUCKCREEK | 0.23 |
| **EDWARDS** | EDWARDS | 0.13 |
| **FARMERCITY** | FARMERCITY | 0.03 |
| **G-007A** | G-007A | 0.06 |
| **IPL** | IPL | 1.62 |
| **LGEE** | LGEE | 0.3 |
| **NYISO** | NYISO | 0.07 |
| **TATANKA** | TATANKA | 0.1 |
| **VFT** | VFT | 0.16 |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **8956815** | 248001 | 06DEARB1 | OVEC | 248013 | 06PIERCE | OVEC | 1 | .345.DEO&K-AEP.C5 4504MFTANNERS4512EBTANNERS | tower | 972.0 | 110.62 | 113.03 | DC | 23.16 |

| 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 |

## 17.4 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **7384203** | 923880 | AB2-028 TAP | AEP | 243218 | 05DESOTO | AEP | 1 | AEP_P7-1_#11042 | tower | 1160.0 | 102.68 | 104.12 | DC | 16.65 |

| Bus # | Bus | MW Impact |
|---|---|---|
| **247285** | 05AND G1 | 0.8 |
| **247286** | 05AND G2 | 0.8 |
| **247287** | 05AND G3 | 1.68 |
| **247900** | 05FR-11G E | 6.19 |
| **247901** | 05FR-12G E | 6.08 |
| **247902** | 05FR-21G E | 6.5 |
| **247903** | 05FR-22G E | 6.23 |
| **247904** | 05FR-3G E | 12.61 |
| **247905** | 05FR-4G E | 9.48 |
| **247906** | 05MDL-1G E | 12.62 |
| **247907** | 05MDL-2G E | 6.26 |
| **247912** | 05MDL-3G E | 6.54 |
| **247913** | 05MDL-4G E | 6.32 |
| **247943** | T-127 E | 6.32 |
| **920501** | AA2-148 C O1 | 2.39 |
| **920502** | AA2-148 E O1 | 16.03 |
| **923881** | AB2-028 C | 12.83 |
| **923882** | AB2-028 E | 85.84 |
| **930042** | AB1-006 E | 13.75 |
| **930461** | AB1-087 | 37.87 |
| **930471** | AB1-088 | 37.87 |
| **933441** | AC2-157 C | 5.23 |
| **933442** | AC2-157 E | 8.54 |
| **934161** | AD1-043 C O1 | 3.11 |
| **934162** | AD1-043 E O1 | 5.08 |
| **935271** | AD1-137 C | 5.14 |
| **935272** | AD1-137 E | 34.37 |
| **941571** | AE2-154 C | 2.57 |
| **941572** | AE2-154 E | 17.18 |
| **941692** | AE2-169 BAT | 1.07 |
| **941702** | AE2-170 BAT | 2.57 |
| **941711** | AE2-171 | 2.06 |
| **941722** | AE2-172 BAT | 1.57 |
| **942601** | AE2-276 | 3.45 |
| **942791** | AE2-297 C O1 | 9.99 |
| **942792** | AE2-297 E O1 | 6.66 |
| **950161** | J401 | 3.11 |
| **950302** | J453 E | 1.19 |
| **950981** | J333 | 12.48 |
| **950991** | J334 | 12.51 |
| **952471** | J708 | 20.13 |
| **952801** | J754 C | 2.55 |

| Bus # | Bus | MW Impact |
|---|---|---|
| **952802** | J754 E | 13.79 |
| **953101** | J714 C | 1.75 |
| **953102** | J714 E | 9.48 |
| **953351** | J805 | 32.88 |
| **953501** | J478 C | 1.99 |
| **953502** | J478 E | 10.79 |
| **953721** | J824 | 17.31 |
| **953761** | J829 | 17.08 |
| **953831** | J842 C | 2.1 |
| **953832** | J842 E | 11.37 |
| **953841** | J843 C | 2.17 |
| **953842** | J843 E | 11.74 |
| **953931** | J856 | 4.73 |
| **954351** | J903 | 16.06 |
| **954772** | J515 E | 27.88 |
| **CARR** | CARR | 0.11 |
| **CBM-S1** | CBM-S1 | 10.24 |
| **CBM-S2** | CBM-S2 | 2.01 |
| **CBM-W1** | CBM-W1 | 2.94 |
| **CBM-W2** | CBM-W2 | 117.1 |
| **CIN** | CIN | 26.41 |
| **CPLE** | CPLE | 0.61 |
| **G-007** | G-007 | 0.26 |
| **IPL** | IPL | 22.65 |
| **LGEE** | LGEE | 2.77 |
| **MEC** | MEC | 10.81 |
| **O-066** | O-066 | 1.66 |
| **RENSSELAER** | RENSSELAER | 0.09 |
| **WEC** | WEC | 0.58 |

## 17.5 Index 5

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **7382576** | 936560 | AD2-071 TAP | AEP | 246763 | 05PIPECK | AEP | 1 | AEP_P4_#8781_05HOGAN 138_B | breaker | 205.0 | 122.42 | 124.67 | DC | 10.24 |

| Bus # | Bus | MW Impact |
|---|---|---|
| **246991** | 05WLD G1 C | 0.79 |
| **247255** | 05WLD G2 C | 0.83 |
| **247914** | 05WLD G1 E | 43.28 |
| **247958** | 05WLD G2 E | 45.41 |
| **920501** | AA2-148 C O1 | 1.49 |
| **920502** | AA2-148 E O1 | 9.95 |
| **934161** | AD1-043 C O1 | 19.67 |
| **934162** | AD1-043 E O1 | 32.1 |
| **936561** | AD2-071 C | 39.86 |
| **936562** | AD2-071 E | 19.63 |
| **941702** | AE2-170 BAT | 1.67 |
| **941711** | AE2-171 | 12.99 |
| **941722** | AE2-172 BAT | 1.81 |
| **942791** | AE2-297 C O1 | 6.14 |
| **942792** | AE2-297 E O1 | 4.1 |
| **CBM-N** | CBM-N | 0.02 |
| **CBM-S1** | CBM-S1 | 0.68 |
| **CBM-S2** | CBM-S2 | 0.15 |
| **CBM-W2** | CBM-W2 | 4.86 |
| **CIN** | CIN | 1.62 |
| **CPLE** | CPLE | 0.05 |
| **DUCKCREEK** | DUCKCREEK | 0.23 |
| **EDWARDS** | EDWARDS | 0.13 |
| **FARMERCITY** | FARMERCITY | 0.03 |
| **G-007A** | G-007A | 0.06 |
| **IPL** | IPL | 1.62 |
| **LGEE** | LGEE | 0.3 |
| **NYISO** | NYISO | 0.07 |
| **TATANKA** | TATANKA | 0.1 |
| **VFT** | VFT | 0.16 |

# 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_#8181** | CONTINGENCY 'AEP_P1-2_#8181'<br>OPEN BRANCH FROM BUS 243382 TO BUS 247588 CKT 1 / 243382 05TANNER 138 247588 W4-004 C 138 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 |
| **AEP_P1-2_#8182-A** | CONTINGENCY 'AEP_P1-2_#8182-A'<br>OPEN BRANCH FROM BUS 243333 TO BUS 942790 CKT 1 / 243333 05MADISO 138 942790 AE2-297 TAP 138 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_#673-A** | CONTINGENCY 'AEP_P1-2_#673-A'<br>OPEN BRANCH FROM BUS 243218 TO BUS 923880 CKT 1 / 243218 05DESOTO 345 923880 AB2-028 TAP 345 1<br>END |
| **AEP_P1-2_#6957** | CONTINGENCY 'AEP_P1-2_#6957'<br>OPEN BRANCH FROM BUS 247116 TO BUS 246913 CKT 1 / 247116 05ALADDIN 138 246913 05JONES 138 1<br>OPEN BRANCH FROM BUS 247116 TO BUS 246988 CKT 1 / 247116 05ALADDIN 138 246988 05STRWTN 138 1<br>OPEN BRANCH FROM BUS 243311 TO BUS 246913 CKT 1 / 243311 05HOGAN 138 246913 05JONES 138 1<br>END |
| **AEP_P4_#2965_05DESOTO 345_A2** | CONTINGENCY 'AEP_P4_#2965_05DESOTO 345_A2'<br>OPEN BRANCH FROM BUS 243218 TO BUS 923880 CKT 1 / 243218 05DESOTO 345 923880 AB2-028 TAP 345 1 /* CONTINGENCY LINE ADDED FOR AE1 BUILD<br>OPEN BRANCH FROM BUS 243218 TO BUS 243278 CKT 1 / 243218 05DESOTO 345 243278 05DESOTO 138 1<br>END |
| **Base Case** | |
| **AEP_P7-1_#11042** | CONTINGENCY 'AEP_P7-1_#11042'<br>OPEN BRANCH FROM BUS 243878 TO BUS 255205 CKT 1 / 243878 05MEADOW 345 255205 17REYNOLDS 345 1<br>OPEN BRANCH FROM BUS 243878 TO BUS 255205 CKT 2 / 243878 05MEADOW 345 255205 17REYNOLDS 345 2<br>END |

| Contingency Name | Contingency Definition |
|---|---|
| **AEP_P4_#8781_05HOGAN 138_B** | CONTINGENCY 'AEP_P4_#8781_05HOGAN 138_B'<br>OPEN BRANCH FROM BUS 247116 TO BUS 246913 CKT 1 / 247116 05ALADDIN 138 246913 05JONES 138 1<br>OPEN BRANCH FROM BUS 247116 TO BUS 246988 CKT 1 / 247116 05ALADDIN 138 246988 05STRWTN 138 1<br>OPEN BRANCH FROM BUS 247420 TO BUS 243311 CKT 1 / 247420 05CROSS ST Z 138 243311 05HOGAN 138 1<br>OPEN BRANCH FROM BUS 243275 TO BUS 243311 CKT 1 / 243275 05DELAWR 138 243311 05HOGAN 138 1<br>OPEN BRANCH FROM BUS 243311 TO BUS 246913 CKT 1 / 243311 05HOGAN 138 246913 05JONES 138 1<br>OPEN BRANCH FROM BUS 243311 TO BUS 246046 CKT 1 / 243311 05HOGAN 138 246046 05HOGAN 34.5 1<br>OPEN BRANCH FROM BUS 243311 TO BUS 246047 CKT 1 / 243311 05HOGAN 138 246047 05HOGAN L 12.0 1<br>END |

# Short Circuit

## 20 Short Circuit

The following Breakers are overduty

None.

# Secondary Point Of Interconnection

## 21 Network Impacts – Secondary POI

The Queue Project AE2-297 was evaluated as a 152.5 MW (Capacity 91.5 MW) injection tapping the Tanners Creek to Pendleton 138kV line in the AEP area. Project AE2-297 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-297 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **12201214** | 243357 | 05PENDLE | AEP | 243339 | 05MEADOW | AEP | 1 | AEP_P7-1_#11073-B | tower | 185.0 | 41.84 | 101.01 | DC | 109.46 |
| **7383008** | 246988 | 05STRWTN | AEP | 936560 | AD2-071 TAP | AEP | 1 | AEP_P4_#8781_05HOGAN 138_B | breaker | 205.0 | 93.38 | 100.95 | DC | 15.52 |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **7382631** | 246763 | 05PIPECK | AEP | 243303 | 05GRNTTA | AEP | 1 | AEP_P4_#8781_05HOGAN 138_B | breaker | 205.0 | 120.45 | 128.02 | DC | 15.52 |
| **7382633** | 246763 | 05PIPECK | AEP | 243303 | 05GRNTTA | AEP | 1 | AEP_P4_#6959_05HOGAN 138_A | breaker | 205.0 | 114.5 | 122.07 | DC | 15.52 |
| **8956815** | 248001 | 06DEARB1 | OVEC | 248013 | 06PIERCE | OVEC | 1 | .345.DEO&K-AEP.C5 4504MFTANNERS4512EBTANNERS | tower | 972.0 | 110.72 | 113.18 | DC | 23.69 |
| **7384203** | 923880 | AB2-028 TAP | AEP | 243218 | 05DESOTO | AEP | 1 | AEP_P7-1_#11042 | tower | 1160.0 | 102.67 | 104.1 | DC | 16.52 |
| **7382576** | 936560 | AD2-071 TAP | AEP | 246763 | 05PIPECK | AEP | 1 | AEP_P4_#8781_05HOGAN 138_B | breaker | 205.0 | 122.4 | 129.97 | DC | 15.52 |
| **7382578** | 936560 | AD2-071 TAP | AEP | 246763 | 05PIPECK | AEP | 1 | AEP_P4_#6959_05HOGAN 138_A | breaker | 205.0 | 116.45 | 124.02 | DC | 15.52 |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **7383783** | 243218 | 05DESOTO | AEP | 243232 | 05SORENS | AEP | 2 | AEP_P1-2_#4817 | operation | 971.0 | 101.75 | 103.61 | DC | 18.35 |
| **7383551** | 243311 | 05HOGAN | AEP | 243275 | 05DELAWR | AEP | 1 | AEP_P1-2_#673-A | operation | 231.0 | 111.84 | 118.56 | DC | 15.52 |
| **7383552** | 243311 | 05HOGAN | AEP | 243275 | 05DELAWR | AEP | 1 | Base Case | operation | 167.0 | 110.48 | 114.2 | DC | 13.78 |
| **7383579** | 246763 | 05PIPECK | AEP | 243303 | 05GRNTTA | AEP | 1 | AEP_SUBT_P1-3_#844_05HOGAN 138_1 | operation | 205.0 | 113.96 | 121.53 | DC | 15.52 |
| **7383557** | 936560 | AD2-071 TAP | AEP | 246763 | 05PIPECK | AEP | 1 | AEP_SUBT_P1-3_#844_05HOGAN 138_1 | operation | 205.0 | 115.91 | 123.48 | DC | 15.52 |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **12201214** | 243357 | 05PENDLE | AEP | 243339 | 05MEADOW | AEP | 1 | AEP_P7-1_#11073-B | tower | 185.0 | 41.84 | 101.01 | DC | 109.46 |

| Bus # | Bus | MW Impact |
|---|---|---|
| **246991** | 05WLD G1 C | 0.39 |
| **247255** | 05WLD G2 C | 0.41 |
| **247914** | 05WLD G1 E | 21.58 |
| **247958** | 05WLD G2 E | 22.64 |
| **247968** | Z2-115 E | 0.2 |
| **934161** | AD1-043 C O1 | 16.01 |
| **934162** | AD1-043 E O1 | 26.12 |
| **936561** | AD2-071 C | 14.18 |
| **936562** | AD2-071 E | 6.98 |
| **941711** | AE2-171 | 10.57 |
| **942791** | AE2-297 C O2 | 65.68 |
| **942792** | AE2-297 E O2 | 43.79 |
| **BLUEG** | BLUEG | 1.18 |
| **CALDERWOOD** | CALDERWOOD | 0.05 |
| **CANNELTON** | CANNELTON | 0.09 |
| **CARR** | CARR | 0.01 |
| **CATAWBA** | CATAWBA | 0.02 |
| **CBM-W1** | CBM-W1 | 0.66 |
| **CHEOAH** | CHEOAH | 0.05 |
| **CHILHOWEE** | CHILHOWEE | 0.02 |
| **COFFEEN** | COFFEEN | 0.02 |
| **COTTONWOOD** | COTTONWOOD | 0.16 |
| **ELMERSMITH** | ELMERSMITH | 0.15 |
| **G-007** | G-007 | 0.03 |
| **GIBSON** | GIBSON | 0.09 |
| **HAMLET** | HAMLET | 0.04 |
| **MEC** | MEC | 0.27 |
| **MECS** | MECS | 0.51 |
| **NEWTON** | NEWTON | 0.14 |
| **O-066** | O-066 | 0.17 |
| **PRAIRIE** | PRAIRIE | 0.17 |
| **RENSSELAER** | RENSSELAER | 0.01 |
| **SANTEETLA** | SANTEETLA | 0.01 |
| **SMITHLAND** | SMITHLAND | 0.03 |
| **TILTON** | TILTON | 0.04 |
| **TRIMBLE** | TRIMBLE | 0.12 |
| **TVA** | TVA | 0.19 |
| **UNIONPOWER** | UNIONPOWER | 0.06 |
| **WEC** | WEC | 0.11 |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **7383008** | 246988 | 05STRWTN | AEP | 936560 | AD2-071 TAP | AEP | 1 | AEP_P4_#8781_05HOGAN 138_B | breaker | 205.0 | 93.38 | 100.95 | DC | 15.52 |

| Bus # | Bus | MW Impact |
|---|---|---|
| **246991** | 05WLD G1 C | 0.79 |
| **247255** | 05WLD G2 C | 0.83 |
| **247914** | 05WLD G1 E | 43.28 |
| **247958** | 05WLD G2 E | 45.41 |
| **920501** | AA2-148 C O1 | 1.49 |
| **920502** | AA2-148 E O1 | 9.95 |
| **934161** | AD1-043 C O1 | 19.67 |
| **934162** | AD1-043 E O1 | 32.1 |
| **941702** | AE2-170 BAT | 1.74 |
| **941711** | AE2-171 | 12.99 |
| **941722** | AE2-172 BAT | 1.81 |
| **942791** | AE2-297 C O2 | 9.31 |
| **942792** | AE2-297 E O2 | 6.21 |
| **CBM-N** | CBM-N | 0.02 |
| **CBM-S1** | CBM-S1 | 0.68 |
| **CBM-S2** | CBM-S2 | 0.15 |
| **CBM-W2** | CBM-W2 | 4.86 |
| **CIN** | CIN | 1.62 |
| **CPLE** | CPLE | 0.05 |
| **DUCKCREEK** | DUCKCREEK | 0.23 |
| **EDWARDS** | EDWARDS | 0.13 |
| **FARMERCITY** | FARMERCITY | 0.03 |
| **G-007A** | G-007A | 0.06 |
| **IPL** | IPL | 1.62 |
| **LGEE** | LGEE | 0.3 |
| **NYISO** | NYISO | 0.07 |
| **TATANKA** | TATANKA | 0.1 |
| **VFT** | VFT | 0.16 |

## 26.3 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **7382631** | 246763 | 05PIPECK | AEP | 243303 | 05GRNTTA | AEP | 1 | AEP_P4_#8781_05HOGAN 138_B | breaker | 205.0 | 120.45 | 128.02 | DC | 15.52 |

| Bus # | Bus | MW Impact |
|---|---|---|
| **246991** | 05WLD G1 C | 0.79 |
| **247255** | 05WLD G2 C | 0.83 |
| **247914** | 05WLD G1 E | 43.28 |
| **247958** | 05WLD G2 E | 45.41 |
| **920501** | AA2-148 C O1 | 1.49 |
| **920502** | AA2-148 E O1 | 9.95 |
| **934161** | AD1-043 C O1 | 19.67 |
| **934162** | AD1-043 E O1 | 32.1 |
| **936561** | AD2-071 C | 39.86 |
| **936562** | AD2-071 E | 19.63 |
| **941702** | AE2-170 BAT | 1.74 |
| **941711** | AE2-171 | 12.99 |
| **941722** | AE2-172 BAT | 1.81 |
| **942791** | AE2-297 C O2 | 9.31 |
| **942792** | AE2-297 E O2 | 6.21 |
| **CBM-N** | CBM-N | 0.02 |
| **CBM-S1** | CBM-S1 | 0.68 |
| **CBM-S2** | CBM-S2 | 0.15 |
| **CBM-W2** | CBM-W2 | 4.86 |
| **CIN** | CIN | 1.62 |
| **CPLE** | CPLE | 0.05 |
| **DUCKCREEK** | DUCKCREEK | 0.23 |
| **EDWARDS** | EDWARDS | 0.13 |
| **FARMERCITY** | FARMERCITY | 0.03 |
| **G-007A** | G-007A | 0.06 |
| **IPL** | IPL | 1.62 |
| **LGEE** | LGEE | 0.3 |
| **NYISO** | NYISO | 0.07 |
| **TATANKA** | TATANKA | 0.1 |
| **VFT** | VFT | 0.16 |

## 26.4 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **8956815** | 248001 | 06DEARB1 | OVEC | 248013 | 06PIERCE | OVEC | 1 | .345.DEO&K-AEP.C5 4504MFTANNERS4512EBTANNERS | tower | 972.0 | 110.72 | 113.18 | DC | 23.69 |

| 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 |

## 26.5 Index 5

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **7384203** | 923880 | AB2-028 TAP | AEP | 243218 | 05DESOTO | AEP | 1 | AEP_P7-1_#11042 | tower | 1160.0 | 102.67 | 104.1 | DC | 16.52 |

| Bus # | Bus | MW Impact |
|---|---|---|
| **247285** | 05AND G1 | 0.8 |
| **247286** | 05AND G2 | 0.8 |
| **247287** | 05AND G3 | 1.68 |
| **247900** | 05FR-11G E | 6.19 |
| **247901** | 05FR-12G E | 6.09 |
| **247902** | 05FR-21G E | 6.5 |
| **247903** | 05FR-22G E | 6.23 |
| **247904** | 05FR-3G E | 12.61 |
| **247905** | 05FR-4G E | 9.48 |
| **247906** | 05MDL-1G E | 12.62 |
| **247907** | 05MDL-2G E | 6.26 |
| **247912** | 05MDL-3G E | 6.54 |
| **247913** | 05MDL-4G E | 6.32 |
| **247943** | T-127 E | 6.32 |
| **920501** | AA2-148 C O1 | 2.4 |
| **920502** | AA2-148 E O1 | 16.03 |
| **923881** | AB2-028 C | 12.83 |
| **923882** | AB2-028 E | 85.84 |
| **930042** | AB1-006 E | 13.75 |
| **930461** | AB1-087 | 37.87 |
| **930471** | AB1-088 | 37.87 |
| **933441** | AC2-157 C | 5.23 |
| **933442** | AC2-157 E | 8.54 |
| **934161** | AD1-043 C O1 | 3.11 |
| **934162** | AD1-043 E O1 | 5.08 |
| **935271** | AD1-137 C | 5.14 |
| **935272** | AD1-137 E | 34.38 |
| **941571** | AE2-154 C | 2.57 |
| **941572** | AE2-154 E | 17.18 |
| **941692** | AE2-169 BAT | 1.07 |
| **941702** | AE2-170 BAT | 2.51 |
| **941711** | AE2-171 | 2.06 |
| **941722** | AE2-172 BAT | 1.57 |
| **942601** | AE2-276 | 3.45 |
| **942791** | AE2-297 C O2 | 9.91 |
| **942792** | AE2-297 E O2 | 6.61 |
| **950161** | J401 | 3.11 |
| **950302** | J453 E | 1.19 |
| **950981** | J333 | 12.48 |
| **950991** | J334 | 12.51 |
| **952471** | J708 | 20.13 |
| **952801** | J754 C | 2.55 |

| Bus # | Bus | MW Impact |
|---|---|---|
| **952802** | J754 E | 13.79 |
| **953101** | J714 C | 1.75 |
| **953102** | J714 E | 9.48 |
| **953351** | J805 | 32.88 |
| **953501** | J478 C | 1.99 |
| **953502** | J478 E | 10.79 |
| **953721** | J824 | 17.31 |
| **953761** | J829 | 17.08 |
| **953831** | J842 C | 2.1 |
| **953832** | J842 E | 11.37 |
| **953841** | J843 C | 2.17 |
| **953842** | J843 E | 11.74 |
| **953931** | J856 | 4.73 |
| **954351** | J903 | 16.06 |
| **954772** | J515 E | 27.88 |
| **CARR** | CARR | 0.11 |
| **CBM-S1** | CBM-S1 | 10.25 |
| **CBM-S2** | CBM-S2 | 2.02 |
| **CBM-W1** | CBM-W1 | 2.94 |
| **CBM-W2** | CBM-W2 | 117.12 |
| **CIN** | CIN | 26.41 |
| **CPLE** | CPLE | 0.61 |
| **G-007** | G-007 | 0.25 |
| **IPL** | IPL | 22.66 |
| **LGEE** | LGEE | 2.77 |
| **MEC** | MEC | 10.81 |
| **O-066** | O-066 | 1.65 |
| **RENSSELAER** | RENSSELAER | 0.09 |
| **WEC** | WEC | 0.58 |

## 26.6 Index 6

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **7382576** | 936560 | AD2-071 TAP | AEP | 246763 | 05PIPECK | AEP | 1 | AEP_P4_#8781_05HOGAN 138_B | breaker | 205.0 | 122.4 | 129.97 | DC | 15.52 |

| Bus # | Bus | MW Impact |
|---|---|---|
| **246991** | 05WLD G1 C | 0.79 |
| **247255** | 05WLD G2 C | 0.83 |
| **247914** | 05WLD G1 E | 43.28 |
| **247958** | 05WLD G2 E | 45.41 |
| **920501** | AA2-148 C O1 | 1.49 |
| **920502** | AA2-148 E O1 | 9.95 |
| **934161** | AD1-043 C O1 | 19.67 |
| **934162** | AD1-043 E O1 | 32.1 |
| **936561** | AD2-071 C | 39.86 |
| **936562** | AD2-071 E | 19.63 |
| **941702** | AE2-170 BAT | 1.74 |
| **941711** | AE2-171 | 12.99 |
| **941722** | AE2-172 BAT | 1.81 |
| **942791** | AE2-297 C O2 | 9.31 |
| **942792** | AE2-297 E O2 | 6.21 |
| **CBM-N** | CBM-N | 0.02 |
| **CBM-S1** | CBM-S1 | 0.68 |
| **CBM-S2** | CBM-S2 | 0.15 |
| **CBM-W2** | CBM-W2 | 4.86 |
| **CIN** | CIN | 1.62 |
| **CPLE** | CPLE | 0.05 |
| **DUCKCREEK** | DUCKCREEK | 0.23 |
| **EDWARDS** | EDWARDS | 0.13 |
| **FARMERCITY** | FARMERCITY | 0.03 |
| **G-007A** | G-007A | 0.06 |
| **IPL** | IPL | 1.62 |
| **LGEE** | LGEE | 0.3 |
| **NYISO** | NYISO | 0.07 |
| **TATANKA** | TATANKA | 0.1 |
| **VFT** | VFT | 0.16 |

# 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_P4_#6959_05HOGAN 138_A** | CONTINGENCY 'AEP_P4_#6959_05HOGAN 138_A'<br>OPEN BRANCH FROM BUS 247420 TO BUS 243311 CKT 1 / 247420 05CROSS ST Z 138 243311 05HOGAN 138 1<br>OPEN BRANCH FROM BUS 247420 TO BUS 243333 CKT 1 / 247420 05CROSS ST Z 138 243333 05MADISO 138 1<br>OPEN BRANCH FROM BUS 243275 TO BUS 243311 CKT 1 / 243275 05DELAWR 138 243311 05HOGAN 138 1<br>OPEN BRANCH FROM BUS 243311 TO BUS 246913 CKT 1 / 243311 05HOGAN 138 246913 05JONES 138 1<br>OPEN BRANCH FROM BUS 243311 TO BUS 246046 CKT 1 / 243311 05HOGAN 138 246046 05HOGAN 34.5 1<br>OPEN BRANCH FROM BUS 243311 TO BUS 246047 CKT 1 / 243311 05HOGAN 138 246047 05HOGAN L 12.0 1<br>END |
| **AEP_SUBT_P1-3_#844_05HOGAN 138_1** | CONTINGENCY 'AEP_SUBT_P1-3_#844_05HOGAN 138_1'<br>OPEN BRANCH FROM BUS 247420 TO BUS 243311 CKT 1 / 247420 05CROSS ST Z 138 243311 05HOGAN 138 1<br>OPEN BRANCH FROM BUS 243275 TO BUS 243311 CKT 1 / 243275 05DELAWR 138 243311 05HOGAN 138 1<br>OPEN BRANCH FROM BUS 243311 TO BUS 246913 CKT 1 / 243311 05HOGAN 138 246913 05JONES 138 1<br>OPEN BRANCH FROM BUS 243311 TO BUS 246046 CKT 1 / 243311 05HOGAN 138 246046 05HOGAN 34.5 1<br>OPEN BRANCH FROM BUS 243311 TO BUS 246047 CKT 1 / 243311 05HOGAN 138 246047 05HOGAN L 12.0 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_P1-2_#673-A** | CONTINGENCY 'AEP_P1-2_#673-A'<br>OPEN BRANCH FROM BUS 243218 TO BUS 923880 CKT 1 / 243218 05DESOTO 345 923880 AB2-028 TAP 345 1<br>END |

| Contingency Name | Contingency Definition |
|---|---|
| **AEP_P4_#8781_05HOGAN 138_B** | CONTINGENCY 'AEP_P4_#8781_05HOGAN 138_B'<br>OPEN BRANCH FROM BUS 247116 TO BUS 246913 CKT 1 / 247116 05ALADDIN 138 246913 05JONES 138 1<br>OPEN BRANCH FROM BUS 247116 TO BUS 246988 CKT 1 / 247116 05ALADDIN 138 246988 05STRWTN 138 1<br>OPEN BRANCH FROM BUS 247420 TO BUS 243311 CKT 1 / 247420 05CROSS ST Z 138 243311 05HOGAN 138 1<br>OPEN BRANCH FROM BUS 243275 TO BUS 243311 CKT 1 / 243275 05DELAWR 138 243311 05HOGAN 138 1<br>OPEN BRANCH FROM BUS 243311 TO BUS 246913 CKT 1 / 243311 05HOGAN 138 246913 05JONES 138 1<br>OPEN BRANCH FROM BUS 243311 TO BUS 246046 CKT 1 / 243311 05HOGAN 138 246046 05HOGAN 34.5 1<br>OPEN BRANCH FROM BUS 243311 TO BUS 246047 CKT 1 / 243311 05HOGAN 138 246047 05HOGAN L 12.0 1<br>END |
| **Base Case** | |
| **AEP_P7-1_#11073-B** | CONTINGENCY 'AEP_P7-1_#11073-B'<br>OPEN BRANCH FROM BUS 243292 TO BUS 243357 CKT 1 / 243292 05FALL C 138 243357 05PEND |
| **AEP_P7-1_#11042** | CONTINGENCY 'AEP_P7-1_#11042'<br>OPEN BRANCH FROM BUS 243878 TO BUS 255205 CKT 1 / 243878 05MEADOW 345 255205 17REYNOLDS 345 1<br>OPEN BRANCH FROM BUS 243878 TO BUS 255205 CKT 2 / 243878 05MEADOW 345 255205 17REYNOLDS 345 2<br>END |

# Short Circuit

## 29 Short Circuit

The following Breakers are overduty

None.