Generation Interconnection Request
System Impact Study Report
For
PJM Generation Interconnection Request
Queue Position AE1-195

CRETE 345 kV

December 2021

Preface

The intent of the System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

In some instances an Interconnection Customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, may also contribute to the need for the same network reinforcement. 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 System Impact Study is performed.

The System Impact 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. 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.

General

The Interconnection Customer (IC) has proposed a Wind generating facility located in Will County, Illinois. The installed facilities will have a total capability of 500 MW with 65 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is 9/1/2021, per Attachment N. This study does not imply a TO commitment to this in-service date.

Point of Interconnection

Queue Position AE1-195, a 500 MW windfarm facility, proposes to interconnect with the ComEd transmission system at the existing 345kV substation, TSS 945 Crete.

Cost Summary

The AE1-195project will be responsible for the following costs.

Description	Cost Estimate
Total Physical Interconnection Costs	$4,000,000
Allocation towards System Network Upgrade Costs (PJM Identified - Summer Peak)*	$17,073,504
Allocation towards System Network Upgrade Costs (PJM Identified - Light Load)*	$1,031,497
Allocation towards System Network Upgrade Costs (TO Identified)*	$0
Total Costs	$22,105,001

*As your project progresses through the study process and other projects modify their request or withdraw, then your cost allocation could change.

This cost excludes a Federal Income Tax Gross Up charges. This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 88-129. If at a future date it is determined that the Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

Note 1: PJM Open Access Transmission Tariff (OATT) section 217.3A outline cost allocation rules. The rules are further clarified in PJM Manual 14A Attachment B. The allocation of costs for a network upgrade will start with the first Queue project to cause the need for the upgrade. Later queue projects will receive cost allocation contingent on their contribution to the violation and are allocated to the queues that have not closed less than 5 years following the execution of the first Interconnection Service Agreement which identifies the need for this upgrade.

Note 2: For customers with System Reinforcements listed: If your present cost allocation to a System Reinforcement indicates $0, then please be aware that as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc., the cost responsibilities can change and a cost allocation may be assigned to your project. In addition, although your present cost allocation to a System Reinforcement is presently $0, your project may need this system reinforcement completed to be deliverable to the PJM system. If your project comes into service prior to completion of the system reinforcement, an interim deliverability study for your project will be required

Transmission Owner Scope of Work

The total physical interconnection costs is given in the table below:

Description	Cost Estimate
Attachment Facilities	$1,000,000
Direct Connection Network Upgrades	$0
Non-Direct Connection Network Upgrades	$3,000,000
Total Physical Interconnection Costs	$4,000,000

Attachment Facilities:

The AE1-195 generator lead will interconnect to 345kV bus at TSS 945 Crete (see details in Direct Connection section below). The required Attachment Facilities are one 345kV line MODs, one dead-end structure and one revenue-metering as shown in the one-line diagram.

Scope of Work	Cost Estimate
Installation of one 345kV line MOD, one dead-end structure and one set of revenue metering (see notes below on cost estimate)	$1,000,000

Non-Direct Connection Cost Estimate:

In order to accommodate interconnection of AE1-195, Crete TSS 945 would need to be expanded to create a bus position.
Two prior PJM queue positions have chosen to interconnect at Crete TSS 945 i.e. AE1-193 secondary POI and AE1-194 primary POI. The scope of work includes installation of one 345kV circuit breaker, to create a line position for AE1-195 generator lead.
The preliminary cost estimate for Direct Connection Network Upgrade is given in the following table.

Scope of Work	Cost Estimate
Installation of one 345kV circuit breaker at 345kV TSS 945 Crete.	$3,000,000

Notes on Cost Estimate:

1) These estimates are Order-of-Magnitude estimates of the costs that ComEd would bill to the customer for this interconnection. These estimates are based on a one-line electrical diagram of the project and the information provided by the Interconnection Customer.
2) There were no site visits performed for these estimates. There may be costs related to specific site related issues that are not identified in these estimates. The site reviews will be performed during the Facilities Study or during detailed engineering.
3) These estimates are not a guarantee of the maximum amount payable by the Interconnection Customer and the actual costs of ComEd's work may differ significantly from these estimates. Interconnection Customer will be responsible for paying actual costs of ComEd's work in accordance with Sections 212.1 and 217 of the PJM Open Access Transmission Tariff.
4) The Interconnection Customer is responsible for all engineering, procurement, testing and construction of all equipment on the Interconnection Customer's side of the POI.
5) These cost estimates do not include cost of acquiring right-of-way for the transmission line and purchasing any additional land, if needed, for the line terminations. The need and cost for acquiring property and associated legal costs will be investigation during Facilities Study for this project.

Schedule:

Normally it takes about 24-months to engineer, design, procure material and construct 345kV facilities after ISA/ICSA are signed.

Revenue Metering and SCADA Requirements

PJM Requirements

The Interconnection Customer will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Section 8 of Attachment O.

Meteorological Data Reporting Requirements

The wind generation facility shall provide the Transmission Provider with site-specific meteorological data including:

- Wind speed (meters/second) - (Required)
- Wind direction (decimal degrees from true north) - (Required)
- Ambient air temperature (Fahrenheit) - (Required)
- Air Pressure (Hectopascals) - (Required)
- Humidity (Percent) (Accepted, not required)

Interconnected Transmission Owner Requirements

The IC will be required to comply with all Interconnected Transmission Owner's revenue metering requirements for generation interconnection customers located at the following link:

http://www.pjm.com/planning/design-engineering/to-tech-standards/

Network Impacts

The Queue Project AE1-195 was evaluated as a 500.0 MW (Capacity 65.0 MW) injection at CRETE substation in the ComEd area. Project AE1-195 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE1-195 was studied with a commercial probability of 100%. Potential network impacts were as follows:

Summer Peak Analysis - 2021

Generator Deliverability

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

None

Multiple Facility Contingency

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

Overload Number	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Circuit	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Flowgate Appendix
1	LFFB	AEP_P4_#2978_05DUMONT 765_B	MISO NIPS - CE	17GREEN_ACRE-GREENACRE; T 345 kV line	255104	270771	1	AC	99.63	100.16	ER	1091	83.95	1

Notes

Overload 1: Not a violation. Rating is sufficient

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)

Overload Number	Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Circuit	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Flowgate Appendix
2	LFFB	COMED_P4_023-65-BT2-3__	MISO NIPS - CE	17STJOHN-ST JOHN ; T 345 kV line	255112	270886	1	AC	109.87	122.97	ER	1091	146.07	2
3	LFFB	AEP_P4_#2978_05DUMONT 765_B	MISO NIPS - CE	17STJOHN-ST JOHN ; T 345 kV line	255112	270886	1	DC	109.18	122.61	ER	1091	145.56	
4	LFFB	COMED_P4_112-65-BT4-5__	MISO NIPS - CE	17STJOHN-ST JOHN ; T 345 kV line	255112	270886	1	DC	108.47	121.94	ER	1091	146.08	
5	LFFB	COMED_P4_112-65-BT3-4__	MISO NIPS - CE	17STJOHN-ST JOHN ; T 345 kV line	255112	270886	1	DC	108.46	121.94	ER	1091	146.08	
6	LFFB	AEP_P4_#2978_05DUMONT 765_B	MISO NIPS - AEP	17STILLWELL-05DUMONT 345 kV line	255113	243219	1	AC	125.1	126.68	ER	1409	79.21	3
7	LFFB	AEP_P4_#2978_05DUMONT 765_B	CE - AEP	GREENACRE; T-05OLIVE 345 kV line	270771	243229	1	AC	111.94	112.54	ER	971	83.95	4
8	LFFB	COMED_P4_023-65-BT2-3__	CE - MISO NIPS	ST JOHN ; T-17GREEN_ACRE 345 kV line	270886	255104	1	AC	109.87	122.96	ER	1091	146.07	5
9	LFFB	AEP_P4_#2978_05DUMONT 765_B	CE - MISO NIPS	ST JOHN ; T-17GREEN_ACRE 345 kV line	270886	255104	1	DC	109.17	122.6	ER	1091	145.56	
10	LFFB	COMED_P4_112-65-BT4-5__	CE - MISO NIPS	ST JOHN ; T-17GREEN_ACRE 345 kV line	270886	255104	1	DC	108.47	121.94	ER	1091	146.08	
11	LFFB	COMED_P4_112-65-BT3-4__	CE - MISO NIPS	ST JOHN ; T-17GREEN_ACRE 345 kV line	270886	255104	1	DC	108.46	121.94	ER	1091	146.08	
12	LFFB	COMED_P4_112-65-BT4-5__	CE - MISO NIPS	CRETE EC ;BP-17STJOHN 345 kV line	274750	255112	1	AC	131.17	149.16	ER	1399	249.95	6
13	LFFB	COMED_P4_112-65-BT3-4__	CE - MISO NIPS	CRETE EC ;BP-17STJOHN 345 kV line	274750	255112	1	AC	131.16	149.16	ER	1399	249.95	
14	LFFB	AEP_P4_#2978_05DUMONT 765_B	CE - MISO NIPS	CRETE EC ;BP-17STJOHN 345 kV line	274750	255112	1	AC	129.12	147.08	ER	1399	249.47	

Steady-State Voltage Requirements

(Results of the steady-state voltage studies should be inserted here)

To be determined

Delivery of Energy Portion of Interconnection Request

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.

Only the most severely overloaded conditions are listed. 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 will study all overload conditions associated with the overloaded element(s) identified.

Overload Number	Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Circuit	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Flowgate Appendix
15	N-1	AEP_P1-2_#695A	MISO NIPS - CE	17STJOHN-ST JOHN ; T 345 kV line	255112	270886	1	DC	108.5	121.96	ER	1091	146.08	
16	N-1	AEP_P1-2_#695A	MISO NIPS - AEP	17STILLWELL-05DUMONT 345 kV line	255113	243219	1	AC	121.86	123.52	NR	1409	82.32	
17	N-1	COMED_P1-2_345-L94507_B-S	CE - CE	E FRANKFO; B-GOODINGS ;3B 345 kV line	270728	270766	1	AC	98.11	118.15	ER	1726	356.95	
18	Non	Non	CE - CE	E FRANKFO; B-GOODINGS ;3B 345 kV line	270728	270766	1	AC	106.17	119.71	NR	1334	187.94	
19	N-1	AEP_P1-2_#695A	CE - MISO NIPS	ST JOHN ; T-17GREEN_ACRE 345 kV line	270886	255104	1	DC	108.5	121.95	ER	1091	146.08	
20	N-1	AEP_P1-2_#695A	CE - MISO NIPS	CRETE EC ;BP-17STJOHN 345 kV line	274750	255112	1	AC	128.65	146.61	ER	1399	249.96	
21	Non	Non	CE - MISO NIPS	CRETE EC ;BP-17STJOHN 345 kV line	274750	255112	1	AC	69.61	91.08	NR	1091	234.34	
22	N-1	COMED_P1-2_345-L94507_B-S	CE - CE	CRETE EC ;BP-E FRANKFO; B 345 kV line	274750	270728	1	AC	91.18	125.77	ER	1399	499.22	
23	Non	Non	CE - CE	CRETE EC ;BP-E FRANKFO; B 345 kV line	274750	270728	1	AC	90.59	113.98	NR	1091	264.89	

Short Circuit

(Summary of impacted circuit breakers)

To be determined

Affected System Analysis & Mitigation

MISO Impacts:

Preliminary MISO impacts have been identified. Please refer to the MISO Affected System report for details. Final MISO Impacts to be determined in the Facilities Study phase

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

To be determined

Light Load Analysis – 2022

Light Load Studies to be conducted during the System Impact Study phase (as required by PJM Manual 14B).

Generator Deliverability

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

Overload Number	Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Circuit	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Flowgate Appendix
1	Non	Non	CE - MISO NIPS	CRETE EC ;BP-17STJOHN 345 kV line	274750	255112	1	AC	97.1	111.13	NR	1310	186.09	
2	N-1	COMED_P1-2_1094_B2	CE - MISO NIPS	CRETE EC ;BP-17STJOHN 345 kV line	274750	255112	1	DC	92.66	104.49	ER	1557	184.24	

Multiple Facility Contingency

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

None

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

Overload Number	Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Circuit	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Flowgate Appendix
3	N-1	AEP_P1-2_#7441-B	AEP - AEP	05ALLEN-05RPMONE 345 kV line	243211	242933	1	DC	104.58	108.12	NR	897	30.9	1
4	N-1	AEP_P1-2_#7441-A	AEP - AEP	05ALLEN-05RPMONE 345 kV line	243211	242933	1	DC	104.53	108.06	NR	897	30.9	
5	LFFB	AEP_P4_#2978_05DUMONT 765_B	MISO NIPS - AEP	17STILLWELL-05DUMONT 345 kV line	255113	243219	1	DC	101.89	106.21	ER	1409	61.11	2
6	N-1	AEP_P1-2_#695A	MISO NIPS - AEP	17STILLWELL-05DUMONT 345 kV line	255113	243219	1	DC	100.65	105	NR	1409	63.62	
7	LFFB	COMED_P4_112-65-BT5-6__	CE - CE	WILTON ; B-WILTON ;3M 345 kV line	270926	275232	1	DC	120.99	122.91		1379	44.86	3
8	LFFB	COMED_P4_112-65-BT2-3__	CE - CE	WILTON ; R-WILTON ;4M 345 kV line	270927	275233	1	DC	123.54	125.5		1379	45.82	4
9	LFFB	AEP_P4_#2978_05DUMONT 765_B	CE - MISO NIPS	CRETE EC ;BP-17STJOHN 345 kV line	274750	255112	1	AC	117.5	129.88	ER	1557	197.48	5
10	LFFB	COMED_P4_023-65-BT4-5__	CE - MISO NIPS	CRETE EC ;BP-17STJOHN 345 kV line	274750	255112	1	AC	117.22	129.68	ER	1557	197.88	
11	N-1	AEP_P1-2_#695A	CE - MISO NIPS	CRETE EC ;BP-17STJOHN 345 kV line	274750	255112	1	DC	117.43	129.43	ER	1557	197.88	
12	N-1	AEP_P1-2_#695A	CE - AEP	UNIV PK N;RP-05OLIVE 345 kV line	274804	243229	1	DC	103.24	105.67	NR	971	23.62	6
13	LFFB	COMED_P4_112-65-BT5-6__	CE - CE	WILTON ; 765/345 kV transformer	275232	270644	1	DC	112.23	115.48		1379	44.86	7
14	LFFB	COMED_P4_112-65-BT2-3__	CE - CE	WILTON ; 765/345 kV transformer	275233	270644	1	DC	115.69	119.01		1379	45.82	8

Delivery of Energy Portion of Interconnection Request

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.

Only the most severely overloaded conditions are listed. 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 will study all overload conditions associated with the overloaded element(s) identified.

System Reinforcements

Summer Peak Load Flow Analysis Reinforcement

Note : For customers with System Reinforcements listed: If your present cost allocation to a System Reinforcement indicates $0, then please be aware that as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, the cost responsibilities can change and a cost allocation may be assigned to your project. In addition, although your present cost allocation to a System Reinforcement is presently $0, your project may need this system reinforcement completed to be deliverable to the PJM system. If your project comes into service prior to completion of the system reinforcement, an interim deliverability study for your project will be required.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

None

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)
(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

<table>
<tr><th>Facility</th><th>Upgrade Description</th><th>Cost</th><th>Cost Allocation</th><th>Upgrade Number</th></tr>
<tr><td>17ST JOHN-ST JOHN ; T 345 kV line</td><td><u>ComEd</u>
ComEd SSTE rating is 1134 MVA.

<u>ComEd Reinforcement:</u>
<u>Project ID</u>: n5833
<u>Description</u>: The upgrade will be to mitigate the sag on the line. A preliminary estimate for the upgrade is $ 3.8 M with a construction estimated timeline of 30 months. The estimate provided does not include potential tower upgrades. The cost for this potential work will not be identified until the Facilities Study phase. Upon completion of this work the new line will be a minimum of 1091/1399/1483/1674 MVA (SN/SLTE/SSTE/SLD).
<u>Type</u>: FAC
<u>Cost:</u> $3,800,000
<u>Time Estimate</u>: 30 Months
<u>Ratings</u>: 1091/1399/1483/1674 MVA (SN/SLTE/SSTE/SLD)

<table><tr><th>Queue</th><th>MW contribution</th><th>Percentage of Cost</th><th>$ cost ($3.8 M)</th></tr></table></td><td>$3,800,000</td><td>$1,900,000</td><td>n5833</td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td>AE1-194</td><td>146.07</td><td>50.0%</td><td>1.90</td></tr>
<tr><td>AE1-195</td><td>146.07</td><td>50.0%</td><td>1.90</td></tr>
</table>

<u>Notes</u>:
1. AE1-195 is currently the driver for the upgrade. Since the cost of the upgrade is less than $5M, AE1 projects that contribute to the loading on the facility will receive the allocated cost.
2. If Queue Project AE1-195 comes into service prior to completion of the upgrade, Queue Project AE1-195 will need an interim study.
3. This facility was purchased and is now owned by NEXTERA. NEXTERA will evaluate this violation in the Facility Study phase.

<u>MISO Reinforcement:</u>
MISO-end ratings (1313/1591 MVA SN/SE) are sufficient.
</td><td></td><td></td><td></td></tr>
<tr><td>17ST JOHN ; T - 17GREEN_ACRE 345 kV line</td><td>
<u>ComEd</u>
ComEd SSTE rating is 1134 MVA.

<u>ComEd Reinforcement:</u>
<u>Project ID</u>: n5834
<u>Description</u>: The upgrade is to mitigate the sag on the line. A preliminary estimate for this upgrade is $3.8 M with a preliminary construction timeline of 30 months. The estimate provided does not include potential tower upgrades. The cost for this potential work will not be identified until the Facilities Study phase. Upon completion of the upgrade the new ratings will be 1091/1399/1483/1674 MVA (SN/SLTE/SSTE/SLD).
<u>Type</u>: FAC
<u>Cost:</u> $3,800,000
<u>Time Estimate</u>: 30 Months
<u>Ratings</u>: 1091/1399/1483/1674 MVA (SN/SLTE/SSTE/SLD)

<table>
<tr><th>Queue</th><th>MW contribution</th><th>Percentage of Cost</th><th>$ cost ($3.8 M)</th></tr>
<tr><td>AE1-194</td><td>146.07</td><td>50.0%</td><td>1.90</td></tr>
<tr><td>AE1-195</td><td>146.07</td><td>50.0%</td><td>1.90</td></tr>
</table>

<u>Notes</u>:
1. Since the cost of the upgrade is less than $5M, AE1 projects that contribute to the loading on the facility will receive the allocated cost.
2. If Queue Project AE1-195 comes into service prior to completion of the upgrade, Queue Project AE1-195 will need an interim study.
3. This facility was purchased and is now owned by NEXTERA. NEXTERA will evaluate this violation in the Facility Study phase.

<u>MISO</u>
MISO-end ratings (1313/1591 MVA -SN/SE) are sufficient.
</td><td>$3,800,000</td><td>$1,900,000</td><td>n5834</td></tr>
<tr><td>17STILLWELL-05DUMONT 345 kV Ckt. 1</td><td>
<u>Project ID</u>: n4058
<u>Description</u>: Sag mitigation work will include the replacement of tower 20 with a custom steel pole, replacement of tower 24 with a custom H-frame and the removal of swing angle brackets on 2 structures. Cost estimate is $1.613M. New SE rating will be 1718 MVA limited by a Dumont wave trap.
<u>Type</u>: FAC
<u>Cost:</u> $1,613,000
<u>Time Estimate</u>: Projected in service date 6/1/2022
<u>Ratings</u>:
AEP SE: 1409 MVA
MISO SE: 1779 MVA (MISO rating is sufficient)
<u>Notes</u>:
1. Since the cost of the upgrade is less than $5M, based on PJM cost allocation criteria, AE1-195 currently does not receive cost allocation towards this upgrade.
</td><td>$1,613,000</td><td>$0</td><td>n4058</td></tr>
</table>

<table>
<tr><td></td><td>2. As changes to the PJM queue process occur (such as prior queued projects withdrawing from the queue, reducing in size, etc.) AE1-195 could receive cost allocation.
3. Although Queue Project AE1-195may not presently have cost responsibility for this upgrade, Queue Project AE1-195 may need this upgrade in-service to be deliverable to the PJM system.
4. If Queue Project AE1-195 comes into service prior to completion of the upgrade, Queue Project AE1-195 will need an interim study.</td><td></td><td></td><td></td></tr>
<tr><td>GREENACRE; T-05OLIVE 345 kV Ckt. 1</td><td><u>Project ID</u>: n5913
<u>Description</u>: Upgrade is a sag study will be required for the entire 40.64 miles of ACSR/PE ~ 1414 ~ 62/19 Conductor section 1 to determine if the line can be operated above its emergency rating 971 MVA. Estimated Cost: $162,560.

If deemed necessary to rebuild the entire 40.64 miles of the section of the line, Estimated Cost: $81,280,000. New expected SE rating is 1318 MVA.

<u>Type</u>: FAC
<u>Cost:</u> $162,560
<u>Time Estimate</u>: N/A
<u>Ratings</u>: Existing Ratings are as follows:
AEP SE: 971 MVA
ComEd SE: 1134 MVA (Rating is sufficient)
<u>Notes</u>:
1. Since the cost of the upgrade is less than $5M, based on PJM cost allocation criteria, AE1-195 currently does not receive cost allocation towards this upgrade.
2. As changes to the PJM queue process occur (such as prior queued projects withdrawing from the queue, reducing in size, etc.) AE1-1 could receive cost allocation.
3. Although Queue Project AE1-195 may not presently have cost responsibility for this upgrade, Queue Project AE1-195 may need this upgrade in-service to be deliverable to the PJM system.
4. If Queue Project AE1-195 comes into service prior to completion of the upgrade, Queue Project AE1-195 will need an interim study.</td><td>$162,560</td><td>$0</td><td>n5913</td></tr>
<tr><td>Crete – St John 345 kV line</td><td><u>ComEd</u>
ComEd SSTE rating is 1483 MVA.

<u>ComEd Reinforcement:</u>
<u>Project ID</u>: n5253
<u>Description</u>: The upgrade will be to reconductor the line. A preliminary estimate for this upgrade is $14.9M with a preliminary construction timeline of 30-36 months. The estimate provided does not consider potential tower upgrades. This cost component will be determined during the Facilities Study phase. Upon completion of this upgrade, the new will be a minimum of 1334/1726/1837/2084 MVA (SN/SLTE/SSTE/SLD).
<u>Type</u>: FAC
<u>Cost:</u> $14,900,000
<u>Time Estimate</u>: 30-36 Months
<u>Ratings</u>: 1334/1726/1837/2084 MVA (SN/SLTE/SSTE/SLD)

The cost allocation is as follows:
<table><tr><th rowspan="2">Queue</th><th rowspan="2">MW contribution</th><th rowspan="2">Percentage of Cost</th><th>$ cost</th></tr><tr><th>($14.9 M)</th></tr><tr><td>AE1-193</td><td>251.82</td><td>33.42%</td><td>$4.98</td></tr><tr><td>AE1-194</td><td>251.82</td><td>33.42%</td><td>$4.98</td></tr><tr><td>AE1-195</td><td>249.95</td><td>33.17%</td><td>$4.94</td></tr></table></td><td>$23,900,000</td><td>$13,272,504</td><td>n5253
n6629</td></tr>
</table>

ComEd Reinforcement:

eue	MW contribution	Percentage of Cost	$ cost ($2 M)
AE1-195	249.95	100%	$ 2,000,000

Project ID: n6629
Description: Replace a 345kV circuit breaker and associated equipment at Crete. A preliminary estimate for this upgrade is $6.0 M with a preliminary construction timeline of 30 months. Upon completion of this upgrade, the new ratings will be 1754/2246/2297/2488 MVA (SN/SLTE/SSTE/SLD).

Type: FAC
Cost: $6,000,000
Time Estimate: 30
Ratings: 1754/2246/2297/2488 MVA (SN/SLTE/SSTE/SLD).

Queue	MW contribution	Percentage of Cost	$ cost ($6 M)
AE1-195	249.95	100%	$6,000,000

Notes:
This facility was purchased and is now owned by NEXTERA. NEXTERA will evaluate this violation in the Facility Study phase.

MISO Reinforcement:
Description: MISO end upgrade is to upgrade St John substation conductor drop and switch. $1M cost estimate. New MISO end SE rating will be 1900 MVA.
Type: FAC
Cost: $1,000,000
Time Estimate: N/A Months
Ratings: 1900 MVA SE

Queue	MW contribution	Percentage of Cost	$Cost ($1M)
AE1-193	251.82	33.50%	334,992
AE1-194	249.95	33.25%	332,504
AE1-195	249.95	33.25%	332,504

MISO Reinforcement:
Description: Upgrade switch to 4000 A and upgrade substation conductor drop to bundled 1590 AL. $2M. New MISO-end ratings to be 1961/2390 MVA SN/SE
Type: FAC
Cost: $2,000,000
Time Estimate: N/A Months
Ratings: 2390 MVA SE

	TOTAL	$33,275,560	$17,073,504	

Light Load - Load Flow Analysis Reinforcements

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

None

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)
(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

<table>
<tr><th>Facility</th><th>Upgrade Description</th><th>Cost</th><th>Cost Allocation</th><th>Upgrade Number</th></tr>
<tr><td>ALLEN – RPMONE 345 kV line</td><td><u>Project ID</u>: n6740 & n6740.1
<u>Description</u>: A sag study will be required on ACSR/PE~ 1275 ~ 54/19, conductor section 3, 12.25 miles of line. Cost of sag study is $49,000. New SE rating of conductor section 3 after sag study: 1301 MVA SE. New expected SE rating of line to be 971 MVA.

If the sag study concludes a complete Rebuild/Reconductor is required, the estimated cost is $24.5M. PJM Network Upgrade n6740.

A sag study will be required on ACSR/PE~ 1414 ~ 62/19, conductor section 2, 6.07 miles of line. The cost of the sag study is expected to be $24,280. New Ratings of conductor section 2 after sag study: S/N: 971 MVA S/E: 1419 MVA. New expected SE rating of line to be 1301 MVA. If the sag study concludes a complete Rebuild/Reconductor, cost: $12.14M. PJM Network Upgrade n6740.1
Both Sag studies would be required.
<u>Type</u>: FAC
<u>Cost:</u> $73,280
<u>Time Estimate</u>: N/A
<u>Ratings</u>: AEP SE: 971 MVA

<table>
<tr><th>Queue</th><th>MW Contribution</th><th>Percentage of Cost</th><th>Cost($73,280)</th></tr>
<tr><td>AE1-193</td><td>30.9</td><td>33.33%</td><td>$24,424</td></tr>
<tr><td>AE1-194</td><td>30.904</td><td>33.33%</td><td>$24,427</td></tr>
<tr><td>AE1-195</td><td>30.904</td><td>33.33%</td><td>$24,427</td></tr>
</table>

<u>Notes</u>:
1. If sag study results in reconductor/re-build AE1-195 will incur additional costs.
2. If Queue Project AE1-195 comes into service prior to completion of the upgrade, Queue Project AE1-195 will need an interim study.</td><td>$73,280</td><td>$24,427</td><td>n6740
n6740.1</td></tr>
</table>

<table>
<tr>
<td>WILTON ; B-WILTON ;3M 345 kV line/
WILTON ; R-WILTON ;4M 345 kV line/
WILTON ; 765/345 kV transformer</td>
<td><u>Project ID</u>: n5145

<u>Description:</u> Build out the Wilton 765kV bus thereby allowing for 765kV L11216 (currently on Bus 6) to be relocated to Bus 8. Along with this line relocation, installation of 2-765kV BT CB’s (6-8 & 8-2). This will eliminate the stuck breaker contingency '112-65-BT5-6__' and contingency outage of '112-65-BT2-3__'. No other contingency updates needed.

Estimated Cost: $12,000,000

Estimated Time : 30 Months

<table>
<tr><th>Queue</th><th>MW contribution</th><th>Percentage of Cost</th><th>$ cost ($ 12 M)</th></tr>
<tr><td>AD1-100</td><td>116.8</td><td>20.25%</td><td>$2.430</td></tr>
<tr><td>AD2-047</td><td>26.4</td><td>4.58%</td><td>$0.549</td></tr>
<tr><td>AD2-066</td><td>17.7</td><td>3.07%</td><td>$0.369</td></tr>
<tr><td>AD2-102</td><td>29.7</td><td>5.14%</td><td>$0.617</td></tr>
<tr><td>AD2-134</td><td>16.2</td><td>2.81%</td><td>$0.337</td></tr>
<tr><td>AD2-159</td><td>16.6</td><td>2.88%</td><td>$0.345</td></tr>
<tr><td>AD2-194</td><td>19.6</td><td>3.40%</td><td>$0.408</td></tr>
<tr><td>AE1-113</td><td>45.7</td><td>7.92%</td><td>$0.951</td></tr>
<tr><td>AE1-114</td><td>21.8</td><td>3.78%</td><td>$0.454</td></tr>
<tr><td>AE1-163</td><td>53.1</td><td>9.21%</td><td>$1.105</td></tr>
<tr><td>AE1-166</td><td>28.6</td><td>4.96%</td><td>$0.595</td></tr>
<tr><td>AE1-172</td><td>47.1</td><td>8.17%</td><td>$0.980</td></tr>
<tr><td>AE1-193</td><td>45.8</td><td>7.94%</td><td>$0.953</td></tr>
<tr><td>AE1-194</td><td>45.8</td><td>7.94%</td><td>$0.953</td></tr>
<tr><td>AE1-195</td><td>45.8</td><td>7.94%</td><td>$0.953</td></tr>
</table>
</td>
<td>12,000,000</td>
<td>953,000</td>
<td>n5145</td>
</tr>
<tr>
<td>CRETE EC ;BP-17STJOHN 345 kV</td>
<td>Refer Summer Peak study for cost allocation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNIV PK N;RP-05OLIVE 345 kV Ckt. 1</td>
<td><u>AEP Upgrade:</u>
<u>Project ID</u>: n4057
<u>Description</u>: To increase SE rating: AEP: a sag check will be required for the ACSR/PE ~ 1414 ~ 62/19 ~ Conductor Section 1 to determine if the line section can be operated above its emergency rating of 971 MVA. The results could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 40.61 mile section of line would need to be rebuilt. Estimated Cost: $162,440 (2016 dollars). If deemed necessary to rebuild the entire 40.61 miles of the section of the line, Estimated Cost: $81,220,000.
Schedule: (1) Sag Study: 6 to 12 months. (2) Rebuild: The standard time required for construction differs from state to state.</td>
<td>$162,410</td>
<td>$54,070</td>
<td>n4057</td>
</tr>
</table>

	An approximate construction time would be 24 to 36 months after signing an interconnection agreement. **Type**: FAC **Cost:** $162,440 **Time Estimate**: 6-12 or 24-36 Months **Ratings**: 971/1304 MVA SN/SE **Notes**: 1. If sag study results in reconductor/re-build AE1-195 will incur additional costs. 2. If Queue Project AE1-195 comes into service prior to completion of the upgrade, Queue Project AE1-195 will need an interim study.			
	Total Cost	**$12,235,690**	**$1,031,497**	

Queue	MW contribution	Percentage of Cost	$ cost ($162,440)
AE1-193	23.7	33.43%	54,299
AE1-194	23.6	33.29%	54,070
AE1-195	23.6	33.29%	54,070

Note : For customers with System Reinforcements listed: If your present cost allocation to a System Reinforcement indicates $0, then please be aware that as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, the cost responsibilities can change and a cost allocation may be assigned to your project. In addition, although your present cost allocation to a System Reinforcement is presently $0, your project may need this system reinforcement completed to be deliverable to the PJM system. If your project comes into service prior to completion of the system reinforcement, an interim deliverability study for your project will be required.

Short Circuit System Reinforcement

(Summary form of Cost allocation for breakers will be inserted here if any)

To be determined

Contingencies (Summer Peak Analysis)

Contingency Name	Description
AEP_P1-2_#695A	CONTINGENCY 'AEP_P1-2_#695A' OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTON ; 765 1

	END
AEP_P4_#2978_05DUMONT 765_B	CONTINGENCY 'AEP_P4_#2978_05DUMONT 765_B' OPEN BRANCH FROM BUS 243206 TO BUS 243207 CKT 1 / 243206 05DUMONT 765 243207 05GRNTWN 765 1 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTON ; 765 1 END
COMED_P1-2_345-L94507_B-S	CONTINGENCY 'COMED_P1-2_345-L94507_B-S' TRIP BRANCH FROM BUS 274750 TO BUS 255112 CKT 1 / CRETE;BP 345 17STJOHN 345 END
COMED_P4_023-65-BT2-3__	CONTINGENCY 'COMED_P4_023-65-BT2-3__' TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765 TRIP BRANCH FROM BUS 270607 TO BUS 270630 CKT 1 / COLLI; 765 PLANO; 765 END
COMED_P4_112-65-BT3-4__	CONTINGENCY 'COMED_P4_112-65-BT3-4__' TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765 TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1 / WILTO;3M 345 WILTO; 765 TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1 / WILTO;3M 345 WILTO; B 345 TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1 / WILTO;3M 345 WILTO;3C 33 END
COMED_P4_112-65-BT4-5__	CONTINGENCY 'COMED_P4_112-65-BT4-5__' TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1 / WILTO;4M 345 WILTO; 765 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1 / WILTO;4M 345 WILTO; R 345 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1 / WILTO;4M 345 WILTO;4C 33

	END

Appendices (Summer Peak Analysis)

Appendix 1

(MISO NIPS - CE) The 17GREEN_ACRE-GREENACRE; T 345 kV line (from bus 255104 to bus 270771 ckt 1) loads from 99.63% to 100.16% (AC power flow) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765_B'. This project contributes approximately 83.95 MW to the thermal violation.

CONTINGENCY 'AEP_P4_#2978_05DUMONT 765_B'
OPEN BRANCH FROM BUS 243206 TO BUS 243207 CKT 1 / 243206 05DUMONT 765 243207 05GRNTWN 765 1
OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTON ; 765 1
END

Bus Number	*Bus Name*	*Full Contribution*
932881	*AC2-115 1*	*1.59*
932891	*AC2-115 2*	*1.59*
932921	*AC2-116*	*0.56*
933411	*AC2-154 C*	*1.69*
933412	*AC2-154 E*	*2.76*
933911	*AD1-013 C*	*1.23*
933912	*AD1-013 E*	*1.96*
933931	*AD1-016 C*	*0.62*
933932	*AD1-016 E*	*1.02*
934051	*AD1-031 C O1*	*1.88*
934052	*AD1-031 E O1*	*3.07*
934101	*AD1-039 1*	*4.69*
934111	*AD1-039 2*	*4.9*
934431	*AD1-067 C*	*0.09*
934432	*AD1-067 E*	*0.37*
934701	*AD1-098 C O1*	*4.6*
934702	*AD1-098 E O1*	*3.35*
934721	*AD1-100 C*	*13.01*
934722	*AD1-100 E*	*60.71*
934871	*AD1-116 C*	*0.62*
934872	*AD1-116 E*	*1.01*
934971	*AD1-129 C*	*0.61*
934972	*AD1-129 E*	*0.4*
935001	*AD1-133 C O1*	*13.81*
935002	*AD1-133 E O1*	*9.21*
936291	*AD2-038 C O1*	*1.55*
936292	*AD2-038 E O1*	*10.38*

936371	*AD2-047 C O1*	*3.03*
936372	*AD2-047 E O1*	*14.78*
936461	*AD2-060*	*1.78*
936511	*AD2-066 C O1*	*5.6*
936512	*AD2-066 E O1*	*3.73*
936791	*AD2-102 C*	*9.47*
936792	*AD2-102 E*	*6.31*
937001	*AD2-134 C*	*1.73*
937002	*AD2-134 E*	*6.9*
937311	*AD2-172 C*	*1.65*
937312	*AD2-172 E*	*2.27*
937401	*AD2-194 1*	*5.27*
937411	*AD2-194 2*	*5.27*
937531	*AD2-214 C*	*2.94*
937532	*AD2-214 E*	*1.96*
938511	*AE1-070 1*	*6.19*
938521	*AE1-070 2*	*5.66*
938851	*AE1-113 C O1*	*5.39*
938852	*AE1-113 E O1*	*19.1*
938861	*AE1-114 C O1*	*2.63*
938862	*AE1-114 E O1*	*8.96*
939051	*AE1-134 1*	*0.91*
939061	*AE1-134 2*	*0.91*
939321	*AE1-163 C O1*	*3.9*
939322	*AE1-163 E O1*	*23.94*
939351	*AE1-166 C O1*	*6.87*
939352	*AE1-166 E O1*	*6.34*
939401	*AE1-172 C O1*	*3.5*
939402	*AE1-172 E O1*	*16.4*
939631	*AE1-193 C O1*	*10.91*
939632	*AE1-193 E O1*	*73.04*
939641	*AE1-194 C*	*10.91*
939642	*AE1-194 E*	*73.04*
939651	*AE1-195 C*	*10.91*
939652	*AE1-195 E*	*73.04*
939681	*AE1-198 C O1*	*32.41*
939682	*AE1-198 E O1*	*27.54*
939741	*AE1-205 C O1*	*5.79*
939742	*AE1-205 E O1*	*8.*
940101	*AE1-252 C O1*	*7.02*
940102	*AE1-252 E O1*	*4.68*
LTF	*BLUEG*	*2.63*
294401	*BSHIL;1U E*	*5.66*
294410	*BSHIL;2U E*	*5.66*
LTF	*CARR*	*0.48*

LTF	*CATAWBA*	*0.15*
274890	*CAYUG;1U E*	*8.97*
274891	*CAYUG;2U E*	*8.97*
LTF	*CBM-S1*	*1.49*
LTF	*CBM-W1*	*20.35*
LTF	*CBM-W2*	*39.71*
LTF	*CHOCTAW /* 35% REVERSE 4566958 4511400*	*< 0.01*
LTF	*CIN*	*0.23*
274751	*CRETE EC ;1U*	*2.22*
274752	*CRETE EC ;2U*	*2.22*
274753	*CRETE EC ;3U*	*2.22*
274754	*CRETE EC ;4U*	*2.22*
274859	*EASYR;U1 E*	*7.34*
274860	*EASYR;U2 E*	*7.34*
LTF	*G-007*	*1.33*
290051	*GSG-6; E*	*6.98*
LTF	*HAMLET*	*0.3*
953871	*J847*	*2.7*
275149	*KEMPTON ;1E*	*12.46*
990901	*L-005 E*	*8.29*
290108	*LEEDK;1U E*	*16.23*
LTF	*MEC*	*25.26*
293061	*N-015 E*	*10.29*
293516	*O-009 E1*	*6.08*
293517	*O-009 E2*	*3.09*
293518	*O-009 E3*	*3.4*
293715	*O-029 E*	*6.5*
293716	*O-029 E*	*3.56*
293717	*O-029 E*	*3.28*
293771	*O-035 E*	*4.23*
LTF	*O-066*	*8.55*
293644	*O22 E1*	*7.28*
293645	*O22 E2*	*14.13*
290021	*O50 E*	*13.06*
294392	*P-010 E*	*13.07*
294763	*P-046 E*	*6.27*
274888	*PILOT HIL;1E*	*12.46*
270859	*PWR VTR EC;R*	*8.1*
LTF	*RENSSELAER*	*0.38*
274722	*S-055 E*	*7.56*
295111	*SUBLETTE E*	*1.82*
LTF	*TRIMBLE*	*0.32*
LTF	*WEC*	*5.35*
295109	*WESTBROOK E*	*3.74*

910542	*X3-005 E*	*0.52*
915011	*Y3-013 1*	*2.52*
915021	*Y3-013 2*	*2.52*
915031	*Y3-013 3*	*2.52*
916211	*Z1-072 E*	*3.2*
916221	*Z1-073 E*	*3.6*
916502	*Z1-106 E1*	*0.85*
916504	*Z1-106 E2*	*0.85*
916512	*Z1-107 E*	*1.72*
916522	*Z1-108 E*	*1.67*
917502	*Z2-087 E*	*11.99*
918052	*AA1-018 E*	*10.68*
919221	*AA1-146*	*11.73*
919581	*AA2-030*	*11.73*
920272	*AA2-123 E*	*1.64*
930481	*AB1-089*	*44.01*
930501	*AB1-091 O1*	*49.4*
930741	*AB1-122 1O1*	*47.85*
930751	*AB1-122 2O1*	*50.02*
924041	*AB2-047 C O1*	*2.24*
924042	*AB2-047 E O1*	*14.99*
924471	*AB2-096*	*28.36*
925302	*AB2-191 E*	*0.92*
925581	*AC1-033 C*	*0.93*
925582	*AC1-033 E*	*6.21*
926311	*AC1-109 1*	*1.28*
926321	*AC1-109 2*	*1.28*
926331	*AC1-110 1*	*1.27*
926341	*AC1-110 2*	*1.27*
926351	*AC1-111 1*	*0.51*
926361	*AC1-111 2*	*0.51*
926371	*AC1-111 3*	*0.51*
926381	*AC1-111 4*	*0.51*
926391	*AC1-111 5*	*0.51*
926401	*AC1-111 6*	*0.51*
927511	*AC1-113 1*	*0.8*
927521	*AC1-113 2*	*0.8*
926431	*AC1-114*	*1.59*
927451	*AC1-142A 1*	*2.85*
927461	*AC1-142A 2*	*2.85*
926821	*AC1-168 C O1*	*0.76*
926822	*AC1-168 E O1*	*5.11*
927091	*AC1-204 1*	*49.02*
927101	*AC1-204 2*	*48.98*
927201	*AC1-214 C O1*	*1.36*

927202	*AC1-214 E O1*	*4.32*

Appendix 2

(MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 109.87% to 122.97% (AC power flow) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 146.07 MW to the thermal violation.

CONTINGENCY 'COMED_P4_023-65-BT2-3__'
TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765
TRIP BRANCH FROM BUS 270607 TO BUS 270630 CKT 1 / COLLI; 765 PLANO; 765
END

Bus Number	*Bus Name*	*Full Contribution*
932881	*AC2-115 1*	*1.78*
932891	*AC2-115 2*	*1.78*
932921	*AC2-116*	*0.62*
933411	*AC2-154 C*	*1.75*
933412	*AC2-154 E*	*2.85*
933911	*AD1-013 C*	*1.38*
933912	*AD1-013 E*	*2.2*
933931	*AD1-016 C*	*0.7*
933932	*AD1-016 E*	*1.14*
934101	*AD1-039 1*	*5.22*
934111	*AD1-039 2*	*5.55*
934431	*AD1-067 C*	*0.1*
934432	*AD1-067 E*	*0.41*
934701	*AD1-098 C O1*	*5.14*
934702	*AD1-098 E O1*	*3.76*
934721	*AD1-100 C*	*14.35*
934722	*AD1-100 E*	*66.95*
934871	*AD1-116 C*	*0.68*
934872	*AD1-116 E*	*1.11*
934971	*AD1-129 C*	*0.68*
934972	*AD1-129 E*	*0.45*
935001	*AD1-133 C O1*	*15.25*
935002	*AD1-133 E O1*	*10.17*
936291	*AD2-038 C O1*	*1.72*
936292	*AD2-038 E O1*	*11.52*
936371	*AD2-047 C O1*	*3.13*
936372	*AD2-047 E O1*	*15.27*
936461	*AD2-060*	*1.84*
936511	*AD2-066 C O1*	*6.23*

936512	*AD2-066 E O1*	*4.15*
936791	*AD2-102 C*	*10.6*
936792	*AD2-102 E*	*7.07*
937001	*AD2-134 C*	*1.94*
937002	*AD2-134 E*	*7.73*
937311	*AD2-172 C*	*1.84*
937312	*AD2-172 E*	*2.54*
937401	*AD2-194 1*	*5.97*
937411	*AD2-194 2*	*5.96*
938511	*AE1-070 1*	*7.01*
938521	*AE1-070 2*	*6.4*
938851	*AE1-113 C O1*	*6.08*
938852	*AE1-113 E O1*	*21.55*
938861	*AE1-114 C O1*	*2.94*
938862	*AE1-114 E O1*	*10.02*
939051	*AE1-134 1*	*1.02*
939061	*AE1-134 2*	*1.02*
939321	*AE1-163 C O1*	*4.32*
939322	*AE1-163 E O1*	*26.57*
939351	*AE1-166 C O1*	*7.64*
939352	*AE1-166 E O1*	*7.05*
939401	*AE1-172 C O1*	*3.83*
939402	*AE1-172 E O1*	*17.91*
939631	*AE1-193 C O1*	*18.99*
939632	*AE1-193 E O1*	*127.09*
939641	*AE1-194 C*	*18.99*
939642	*AE1-194 E*	*127.09*
939651	*AE1-195 C*	*18.99*
939652	*AE1-195 E*	*127.09*
939681	*AE1-198 C O1*	*56.38*
939682	*AE1-198 E O1*	*47.91*
940101	*AE1-252 C O1*	*7.67*
940102	*AE1-252 E O1*	*5.12*
LTF	*BLUEG*	*4.79*
274654	*BRAIDWOOD;1U*	*22.*
274655	*BRAIDWOOD;2U*	*21.06*
LTF	*CALDERWOOD*	*0.06*
LTF	*CANNELTON*	*0.09*
LTF	*CARR*	*0.54*
LTF	*CATAWBA*	*0.21*
274890	*CAYUG;1U E*	*8.79*
274891	*CAYUG;2U E*	*8.79*
LTF	*CBM-S1*	*0.91*
LTF	*CBM-W1*	*20.43*
LTF	*CBM-W2*	*38.51*

LTF	*CHEOAH*	*0.06*
LTF	*CHOCTAW /* 35% REVERSE 4566958 4511400*	*< 0.01*
274751	*CRETE EC ;1U*	*3.87*
274752	*CRETE EC ;2U*	*3.87*
274753	*CRETE EC ;3U*	*3.87*
274754	*CRETE EC ;4U*	*3.87*
274859	*EASYR;U1 E*	*8.22*
274860	*EASYR;U2 E*	*8.22*
LTF	*G-007*	*1.52*
LTF	*GIBSON*	*0.05*
290051	*GSG-6; E*	*7.82*
LTF	*HAMLET*	*0.4*
275149	*KEMPTON ;1E*	*12.88*
274704	*KENDALL ;1C*	*3.25*
274705	*KENDALL ;1S*	*2.17*
274706	*KENDALL ;2C*	*3.25*
274707	*KENDALL ;2S*	*2.17*
274661	*LASCO STA;2U*	*20.32*
290108	*LEEDK;1U E*	*18.19*
LTF	*MEC*	*27.81*
293061	*N-015 E*	*11.68*
293516	*O-009 E1*	*6.79*
293517	*O-009 E2*	*3.45*
293518	*O-009 E3*	*3.8*
293715	*O-029 E*	*7.26*
293716	*O-029 E*	*3.98*
293717	*O-029 E*	*3.66*
LTF	*O-066*	*9.77*
293644	*O22 E1*	*8.54*
293645	*O22 E2*	*16.59*
290021	*O50 E*	*14.73*
294392	*P-010 E*	*14.83*
294763	*P-046 E*	*7.02*
274888	*PILOT HIL;1E*	*12.88*
270859	*PWR VTR EC;R*	*9.09*
LTF	*RENSSELAER*	*0.43*
274722	*S-055 E*	*8.49*
295111	*SUBLETTE E*	*2.04*
274861	*TOP CROP ;1U*	*0.38*
274862	*TOP CROP ;2U*	*0.73*
LTF	*TRIMBLE*	*0.56*
LTF	*WEC*	*6.*
295109	*WESTBROOK E*	*4.19*
274687	*WILL CNTY;4U*	*9.27*

915011	*Y3-013 1*	*2.83*
915021	*Y3-013 2*	*2.83*
915031	*Y3-013 3*	*2.83*
916221	*Z1-073 E*	*4.03*
916502	*Z1-106 E1*	*0.95*
916504	*Z1-106 E2*	*0.95*
916512	*Z1-107 E*	*1.86*
916522	*Z1-108 E*	*1.87*
918052	*AA1-018 E*	*11.7*
919221	*AA1-146*	*13.12*
919581	*AA2-030*	*13.12*
920272	*AA2-123 E*	*1.84*
930481	*AB1-089*	*49.32*
930501	*AB1-091 O1*	*50.89*
930741	*AB1-122 1O1*	*53.27*
930751	*AB1-122 2O1*	*56.61*
924471	*AB2-096*	*31.8*
925302	*AB2-191 E*	*1.04*
926311	*AC1-109 1*	*1.43*
926321	*AC1-109 2*	*1.43*
926331	*AC1-110 1*	*1.43*
926341	*AC1-110 2*	*1.43*
926351	*AC1-111 1*	*0.57*
926361	*AC1-111 2*	*0.57*
926371	*AC1-111 3*	*0.57*
926381	*AC1-111 4*	*0.57*
926391	*AC1-111 5*	*0.57*
926401	*AC1-111 6*	*0.57*
927511	*AC1-113 1*	*0.89*
927521	*AC1-113 2*	*0.89*
926431	*AC1-114*	*1.78*
927451	*AC1-142A 1*	*3.22*
927461	*AC1-142A 2*	*3.22*
926821	*AC1-168 C O1*	*0.85*
926822	*AC1-168 E O1*	*5.72*
927091	*AC1-204 1*	*55.48*
927101	*AC1-204 2*	*55.4*

Appendix 3

(MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 125.1% to 126.68% (AC power flow) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765_B'. This project contributes approximately 79.21 MW to the thermal violation.

CONTINGENCY 'AEP_P4_#2978_05DUMONT 765_B'
OPEN BRANCH FROM BUS 243206 TO BUS 243207 CKT 1 / 243206 05DUMONT 765 243207 05GRNTWN 765 1
OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTON ; 765 1
END

Bus Number	*Bus Name*	*Full Contribution*
932881	*AC2-115 1*	*2.76*
932891	*AC2-115 2*	*2.76*
932921	*AC2-116*	*0.96*
932931	*AC2-117*	*5.85*
933411	*AC2-154 C*	*3.04*
933412	*AC2-154 E*	*4.96*
933911	*AD1-013 C*	*2.13*
933912	*AD1-013 E*	*3.4*
933931	*AD1-016 C*	*1.07*
933932	*AD1-016 E*	*1.75*
934051	*AD1-031 C O1*	*3.3*
934052	*AD1-031 E O1*	*5.39*
934101	*AD1-039 1*	*8.13*
934111	*AD1-039 2*	*8.37*
934431	*AD1-067 C*	*0.15*
934432	*AD1-067 E*	*0.64*
934701	*AD1-098 C O1*	*7.96*
934702	*AD1-098 E O1*	*5.81*
934721	*AD1-100 C*	*22.58*
934722	*AD1-100 E*	*105.36*
934871	*AD1-116 C*	*1.1*
934872	*AD1-116 E*	*1.79*
934971	*AD1-129 C*	*1.05*
934972	*AD1-129 E*	*0.7*
935001	*AD1-133 C O1*	*24.22*
935002	*AD1-133 E O1*	*16.14*
936291	*AD2-038 C O1*	*2.71*
936292	*AD2-038 E O1*	*18.14*
936371	*AD2-047 C O1*	*5.44*

936372	*AD2-047 E O1*	*26.58*
936461	*AD2-060*	*3.2*
936511	*AD2-066 C O1*	*9.74*
936512	*AD2-066 E O1*	*6.49*
936791	*AD2-102 C*	*16.39*
936792	*AD2-102 E*	*10.93*
937001	*AD2-134 C*	*3.*
937002	*AD2-134 E*	*11.96*
937311	*AD2-172 C*	*2.85*
937312	*AD2-172 E*	*3.94*
937401	*AD2-194 1*	*9.*
937411	*AD2-194 2*	*9.*
937531	*AD2-214 C*	*5.12*
937532	*AD2-214 E*	*3.42*
938511	*AE1-070 1*	*10.58*
938521	*AE1-070 2*	*9.68*
938851	*AE1-113 C O1*	*9.26*
938852	*AE1-113 E O1*	*32.83*
938861	*AE1-114 C O1*	*4.56*
938862	*AE1-114 E O1*	*15.54*
939051	*AE1-134 1*	*1.59*
939061	*AE1-134 2*	*1.59*
939321	*AE1-163 C O1*	*6.81*
939322	*AE1-163 E O1*	*41.83*
939351	*AE1-166 C O1*	*11.86*
939352	*AE1-166 E O1*	*10.95*
939401	*AE1-172 C O1*	*6.16*
939402	*AE1-172 E O1*	*28.85*
939631	*AE1-193 C O1*	*10.3*
939632	*AE1-193 E O1*	*68.91*
939641	*AE1-194 C*	*10.3*
939642	*AE1-194 E*	*68.91*
939651	*AE1-195 C*	*10.3*
939652	*AE1-195 E*	*68.91*
939681	*AE1-198 C O1*	*30.58*
939682	*AE1-198 E O1*	*25.98*
939741	*AE1-205 C O1*	*10.32*
939742	*AE1-205 E O1*	*14.25*
940101	*AE1-252 C O1*	*12.36*
940102	*AE1-252 E O1*	*8.24*
LTF	*BLUEG*	*0.64*
294401	*BSHIL;1U E*	*9.93*
294410	*BSHIL;2U E*	*9.93*
LTF	*CARR*	*0.87*
LTF	*CATAWBA*	*0.19*

274890	*CAYUG;1U E*	*15.86*
274891	*CAYUG;2U E*	*15.86*
LTF	*CBM-S1*	*4.21*
LTF	*CBM-W1*	*36.52*
LTF	*CBM-W2*	*84.42*
LTF	*CHOCTAW /* 35% REVERSE 4566958 4511400*	*< 0.01*
LTF	*CIN*	*3.51*
274859	*EASYR;U1 E*	*12.75*
274860	*EASYR;U2 E*	*12.75*
LTF	*G-007*	*2.42*
290051	*GSG-6; E*	*12.09*
LTF	*HAMLET*	*0.43*
LTF	*IPL*	*1.25*
954751	*J351*	*165.42*
275149	*KEMPTON ;1E*	*22.42*
990901	*L-005 E*	*14.6*
290108	*LEEDK;1U E*	*28.09*
LTF	*MEC*	*45.08*
293061	*N-015 E*	*17.64*
293516	*O-009 E1*	*10.59*
293517	*O-009 E2*	*5.38*
293518	*O-009 E3*	*5.92*
293715	*O-029 E*	*11.32*
293716	*O-029 E*	*6.21*
293717	*O-029 E*	*5.71*
293771	*O-035 E*	*7.42*
LTF	*O-066*	*15.53*
293644	*O22 E1*	*12.02*
293645	*O22 E2*	*23.33*
290021	*O50 E*	*22.45*
294392	*P-010 E*	*22.4*
294763	*P-046 E*	*10.86*
274888	*PILOT HIL;1E*	*22.42*
270859	*PWR VTR EC;R*	*14.01*
LTF	*RENSSELAER*	*0.69*
274724	*RIVER EC ;11*	*5.49*
274722	*S-055 E*	*13.02*
274795	*SE CHICAG;2U*	*1.29*
274788	*SE CHICAG;5U*	*1.31*
274789	*SE CHICAG;6U*	*1.31*
274790	*SE CHICAG;7U*	*1.31*
274791	*SE CHICAG;8U*	*1.31*
295111	*SUBLETTE E*	*3.15*
LTF	*TRIMBLE*	*0.12*

LTF	WEC	9.25
295109	WESTBROOK E	6.48
910542	X3-005 E	1.
915011	Y3-013 1	4.34
915021	Y3-013 2	4.34
915031	Y3-013 3	4.34
916211	Z1-072 E	5.61
916221	Z1-073 E	6.24
916502	Z1-106 E1	1.46
916504	Z1-106 E2	1.46
916512	Z1-107 E	3.05
916522	Z1-108 E	2.88
917502	Z2-087 E	21.38
918052	AA1-018 E	18.85
919221	AA1-146	20.41
919581	AA2-030	20.41
920272	AA2-123 E	2.83
930481	AB1-089	76.13
930501	AB1-091 O1	88.69
930741	AB1-122 1O1	82.91
930751	AB1-122 2O1	85.44
924041	AB2-047 C O1	3.99
924042	AB2-047 E O1	26.73
924471	AB2-096	49.02
925302	AB2-191 E	1.6
925581	AC1-033 C	1.63
925582	AC1-033 E	10.89
926311	AC1-109 1	2.2
926321	AC1-109 2	2.2
926331	AC1-110 1	2.19
926341	AC1-110 2	2.19
926351	AC1-111 1	0.88
926361	AC1-111 2	0.88
926371	AC1-111 3	0.88
926381	AC1-111 4	0.88
926391	AC1-111 5	0.88
926401	AC1-111 6	0.88
927511	AC1-113 1	1.38
927521	AC1-113 2	1.38
926431	AC1-114	2.76
927451	AC1-142A 1	4.86
927461	AC1-142A 2	4.86
926821	AC1-168 C O1	1.33
926822	AC1-168 E O1	8.91
927091	AC1-204 1	83.73

927101	*AC1-204 2*	*83.7*
927201	*AC1-214 C O1*	*2.38*
927202	*AC1-214 E O1*	*7.57*

Appendix 4

(CE - AEP) The GREENACRE; T-05OLIVE 345 kV line (from bus 270771 to bus 243229 ckt 1) loads from 111.94% to 112.54% (AC power flow) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765_B'. This project contributes approximately 83.95 MW to the thermal violation.

CONTINGENCY 'AEP_P4_#2978_05DUMONT 765_B'
OPEN BRANCH FROM BUS 243206 TO BUS 243207 CKT 1 / 243206 05DUMONT 765 243207 05GRNTWN 765 1
OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTON ; 765 1
END

Bus Number	*Bus Name*	*Full Contribution*
932881	*AC2-115 1*	*1.59*
932891	*AC2-115 2*	*1.59*
932921	*AC2-116*	*0.56*
933411	*AC2-154 C*	*1.69*
933412	*AC2-154 E*	*2.76*
933911	*AD1-013 C*	*1.23*
933912	*AD1-013 E*	*1.96*
933931	*AD1-016 C*	*0.62*
933932	*AD1-016 E*	*1.02*
934051	*AD1-031 C O1*	*1.88*
934052	*AD1-031 E O1*	*3.07*
934101	*AD1-039 1*	*4.69*
934111	*AD1-039 2*	*4.9*
934431	*AD1-067 C*	*0.09*
934432	*AD1-067 E*	*0.37*
934701	*AD1-098 C O1*	*4.6*
934702	*AD1-098 E O1*	*3.35*
934721	*AD1-100 C*	*13.01*
934722	*AD1-100 E*	*60.71*
934871	*AD1-116 C*	*0.62*
934872	*AD1-116 E*	*1.01*
934971	*AD1-129 C*	*0.61*
934972	*AD1-129 E*	*0.4*
935001	*AD1-133 C O1*	*13.81*
935002	*AD1-133 E O1*	*9.21*
936291	*AD2-038 C O1*	*1.55*
936292	*AD2-038 E O1*	*10.38*
936371	*AD2-047 C O1*	*3.03*
936372	*AD2-047 E O1*	*14.78*
936461	*AD2-060*	*1.78*

936511	*AD2-066 C O1*	*5.6*
936512	*AD2-066 E O1*	*3.73*
936791	*AD2-102 C*	*9.47*
936792	*AD2-102 E*	*6.31*
937001	*AD2-134 C*	*1.73*
937002	*AD2-134 E*	*6.9*
937311	*AD2-172 C*	*1.65*
937312	*AD2-172 E*	*2.27*
937401	*AD2-194 1*	*5.27*
937411	*AD2-194 2*	*5.27*
937531	*AD2-214 C*	*2.94*
937532	*AD2-214 E*	*1.96*
938511	*AE1-070 1*	*6.19*
938521	*AE1-070 2*	*5.66*
938851	*AE1-113 C O1*	*5.39*
938852	*AE1-113 E O1*	*19.1*
938861	*AE1-114 C O1*	*2.63*
938862	*AE1-114 E O1*	*8.96*
939051	*AE1-134 1*	*0.91*
939061	*AE1-134 2*	*0.91*
939321	*AE1-163 C O1*	*3.9*
939322	*AE1-163 E O1*	*23.94*
939351	*AE1-166 C O1*	*6.87*
939352	*AE1-166 E O1*	*6.34*
939401	*AE1-172 C O1*	*3.5*
939402	*AE1-172 E O1*	*16.4*
939631	*AE1-193 C O1*	*10.91*
939632	*AE1-193 E O1*	*73.04*
939641	*AE1-194 C*	*10.91*
939642	*AE1-194 E*	*73.04*
939651	*AE1-195 C*	*10.91*
939652	*AE1-195 E*	*73.04*
939681	*AE1-198 C O1*	*32.41*
939682	*AE1-198 E O1*	*27.54*
939741	*AE1-205 C O1*	*5.79*
939742	*AE1-205 E O1*	*8.*
940101	*AE1-252 C O1*	*7.02*
940102	*AE1-252 E O1*	*4.68*
LTF	*BLUEG*	*2.63*
294401	*BSHIL;1U E*	*5.66*
294410	*BSHIL;2U E*	*5.66*
LTF	*CARR*	*0.48*
LTF	*CATAWBA*	*0.15*
274890	*CAYUG;1U E*	*8.97*
274891	*CAYUG;2U E*	*8.97*

LTF	*CBM-S1*	*1.49*
LTF	*CBM-W1*	*20.35*
LTF	*CBM-W2*	*39.71*
LTF	*CHOCTAW /* 35% REVERSE 4566958 4511400*	*< 0.01*
LTF	*CIN*	*0.23*
274751	*CRETE EC ;1U*	*2.22*
274752	*CRETE EC ;2U*	*2.22*
274753	*CRETE EC ;3U*	*2.22*
274754	*CRETE EC ;4U*	*2.22*
274859	*EASYR;U1 E*	*7.34*
274860	*EASYR;U2 E*	*7.34*
LTF	*G-007*	*1.33*
290051	*GSG-6; E*	*6.98*
LTF	*HAMLET*	*0.3*
953871	*J847*	*2.7*
275149	*KEMPTON ;1E*	*12.46*
990901	*L-005 E*	*8.29*
290108	*LEEDK;1U E*	*16.23*
LTF	*MEC*	*25.26*
293061	*N-015 E*	*10.29*
293516	*O-009 E1*	*6.08*
293517	*O-009 E2*	*3.09*
293518	*O-009 E3*	*3.4*
293715	*O-029 E*	*6.5*
293716	*O-029 E*	*3.56*
293717	*O-029 E*	*3.28*
293771	*O-035 E*	*4.23*
LTF	*O-066*	*8.55*
293644	*O22 E1*	*7.28*
293645	*O22 E2*	*14.13*
290021	*O50 E*	*13.06*
294392	*P-010 E*	*13.07*
294763	*P-046 E*	*6.27*
274888	*PILOT HIL;1E*	*12.46*
270859	*PWR VTR EC;R*	*8.1*
LTF	*RENSSELAER*	*0.38*
274722	*S-055 E*	*7.56*
295111	*SUBLETTE E*	*1.82*
LTF	*TRIMBLE*	*0.32*
LTF	*WEC*	*5.35*
295109	*WESTBROOK E*	*3.74*
910542	*X3-005 E*	*0.52*
915011	*Y3-013 1*	*2.52*
915021	*Y3-013 2*	*2.52*

915031	*Y3-013 3*	*2.52*
916211	*Z1-072 E*	*3.2*
916221	*Z1-073 E*	*3.6*
916502	*Z1-106 E1*	*0.85*
916504	*Z1-106 E2*	*0.85*
916512	*Z1-107 E*	*1.72*
916522	*Z1-108 E*	*1.67*
917502	*Z2-087 E*	*11.99*
918052	*AA1-018 E*	*10.68*
919221	*AA1-146*	*11.73*
919581	*AA2-030*	*11.73*
920272	*AA2-123 E*	*1.64*
930481	*AB1-089*	*44.01*
930501	*AB1-091 O1*	*49.4*
930741	*AB1-122 1O1*	*47.85*
930751	*AB1-122 2O1*	*50.02*
924041	*AB2-047 C O1*	*2.24*
924042	*AB2-047 E O1*	*14.99*
924471	*AB2-096*	*28.36*
925302	*AB2-191 E*	*0.92*
925581	*AC1-033 C*	*0.93*
925582	*AC1-033 E*	*6.21*
926311	*AC1-109 1*	*1.28*
926321	*AC1-109 2*	*1.28*
926331	*AC1-110 1*	*1.27*
926341	*AC1-110 2*	*1.27*
926351	*AC1-111 1*	*0.51*
926361	*AC1-111 2*	*0.51*
926371	*AC1-111 3*	*0.51*
926381	*AC1-111 4*	*0.51*
926391	*AC1-111 5*	*0.51*
926401	*AC1-111 6*	*0.51*
927511	*AC1-113 1*	*0.8*
927521	*AC1-113 2*	*0.8*
926431	*AC1-114*	*1.59*
927451	*AC1-142A 1*	*2.85*
927461	*AC1-142A 2*	*2.85*
926821	*AC1-168 C O1*	*0.76*
926822	*AC1-168 E O1*	*5.11*
927091	*AC1-204 1*	*49.02*
927101	*AC1-204 2*	*48.98*
927201	*AC1-214 C O1*	*1.36*
927202	*AC1-214 E O1*	*4.32*

Appendix 5

(CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 109.87% to 122.96% (AC power flow) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 146.07 MW to the thermal violation.

CONTINGENCY 'COMED_P4_023-65-BT2-3__'
TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765
TRIP BRANCH FROM BUS 270607 TO BUS 270630 CKT 1 / COLLI; 765 PLANO; 765
END

Bus Number	*Bus Name*	*Full Contribution*
932881	*AC2-115 1*	*1.78*
932891	*AC2-115 2*	*1.78*
932921	*AC2-116*	*0.62*
933411	*AC2-154 C*	*1.75*
933412	*AC2-154 E*	*2.85*
933911	*AD1-013 C*	*1.38*
933912	*AD1-013 E*	*2.2*
933931	*AD1-016 C*	*0.7*
933932	*AD1-016 E*	*1.14*
934101	*AD1-039 1*	*5.22*
934111	*AD1-039 2*	*5.55*
934431	*AD1-067 C*	*0.1*
934432	*AD1-067 E*	*0.41*
934701	*AD1-098 C O1*	*5.14*
934702	*AD1-098 E O1*	*3.76*
934721	*AD1-100 C*	*14.35*
934722	*AD1-100 E*	*66.95*
934871	*AD1-116 C*	*0.68*
934872	*AD1-116 E*	*1.11*
934971	*AD1-129 C*	*0.68*
934972	*AD1-129 E*	*0.45*
935001	*AD1-133 C O1*	*15.25*
935002	*AD1-133 E O1*	*10.17*
936291	*AD2-038 C O1*	*1.72*
936292	*AD2-038 E O1*	*11.52*
936371	*AD2-047 C O1*	*3.13*
936372	*AD2-047 E O1*	*15.27*
936461	*AD2-060*	*1.84*
936511	*AD2-066 C O1*	*6.23*
936512	*AD2-066 E O1*	*4.15*
936791	*AD2-102 C*	*10.6*

936792	*AD2-102 E*	*7.07*
937001	*AD2-134 C*	*1.94*
937002	*AD2-134 E*	*7.73*
937311	*AD2-172 C*	*1.84*
937312	*AD2-172 E*	*2.54*
937401	*AD2-194 1*	*5.97*
937411	*AD2-194 2*	*5.96*
938511	*AE1-070 1*	*7.01*
938521	*AE1-070 2*	*6.4*
938851	*AE1-113 C O1*	*6.08*
938852	*AE1-113 E O1*	*21.55*
938861	*AE1-114 C O1*	*2.94*
938862	*AE1-114 E O1*	*10.02*
939051	*AE1-134 1*	*1.02*
939061	*AE1-134 2*	*1.02*
939321	*AE1-163 C O1*	*4.32*
939322	*AE1-163 E O1*	*26.57*
939351	*AE1-166 C O1*	*7.64*
939352	*AE1-166 E O1*	*7.05*
939401	*AE1-172 C O1*	*3.83*
939402	*AE1-172 E O1*	*17.91*
939631	*AE1-193 C O1*	*18.99*
939632	*AE1-193 E O1*	*127.09*
939641	*AE1-194 C*	*18.99*
939642	*AE1-194 E*	*127.09*
939651	*AE1-195 C*	*18.99*
939652	*AE1-195 E*	*127.09*
939681	*AE1-198 C O1*	*56.38*
939682	*AE1-198 E O1*	*47.91*
940101	*AE1-252 C O1*	*7.67*
940102	*AE1-252 E O1*	*5.12*
LTF	*BLUEG*	*4.79*
274654	*BRAIDWOOD;1U*	*22.*
274655	*BRAIDWOOD;2U*	*21.06*
LTF	*CALDERWOOD*	*0.06*
LTF	*CANNELTON*	*0.09*
LTF	*CARR*	*0.54*
LTF	*CATAWBA*	*0.21*
274890	*CAYUG;1U E*	*8.79*
274891	*CAYUG;2U E*	*8.79*
LTF	*CBM-S1*	*0.91*
LTF	*CBM-W1*	*20.43*
LTF	*CBM-W2*	*38.51*
LTF	*CHEOAH*	*0.06*

LTF	*CHOCTAW /* 35% REVERSE 4566958 4511400*	*< 0.01*
274751	*CRETE EC ;1U*	*3.87*
274752	*CRETE EC ;2U*	*3.87*
274753	*CRETE EC ;3U*	*3.87*
274754	*CRETE EC ;4U*	*3.87*
274859	*EASYR;U1 E*	*8.22*
274860	*EASYR;U2 E*	*8.22*
LTF	*G-007*	*1.52*
LTF	*GIBSON*	*0.05*
290051	*GSG-6; E*	*7.82*
LTF	*HAMLET*	*0.4*
275149	*KEMPTON ;1E*	*12.88*
274704	*KENDALL ;1C*	*3.25*
274705	*KENDALL ;1S*	*2.17*
274706	*KENDALL ;2C*	*3.25*
274707	*KENDALL ;2S*	*2.17*
274661	*LASCO STA;2U*	*20.32*
290108	*LEEDK;1U E*	*18.19*
LTF	*MEC*	*27.81*
293061	*N-015 E*	*11.68*
293516	*O-009 E1*	*6.79*
293517	*O-009 E2*	*3.45*
293518	*O-009 E3*	*3.8*
293715	*O-029 E*	*7.26*
293716	*O-029 E*	*3.98*
293717	*O-029 E*	*3.66*
LTF	*O-066*	*9.77*
293644	*O22 E1*	*8.54*
293645	*O22 E2*	*16.59*
290021	*O50 E*	*14.73*
294392	*P-010 E*	*14.83*
294763	*P-046 E*	*7.02*
274888	*PILOT HIL;1E*	*12.88*
270859	*PWR VTR EC;R*	*9.09*
LTF	*RENSSELAER*	*0.43*
274722	*S-055 E*	*8.49*
295111	*SUBLETTE E*	*2.04*
274861	*TOP CROP ;1U*	*0.38*
274862	*TOP CROP ;2U*	*0.73*
LTF	*TRIMBLE*	*0.56*
LTF	*WEC*	*6.*
295109	*WESTBROOK E*	*4.19*
274687	*WILL CNTY;4U*	*9.27*
915011	*Y3-013 1*	*2.83*

915021	*Y3-013 2*	*2.83*
915031	*Y3-013 3*	*2.83*
916221	*Z1-073 E*	*4.03*
916502	*Z1-106 E1*	*0.95*
916504	*Z1-106 E2*	*0.95*
916512	*Z1-107 E*	*1.86*
916522	*Z1-108 E*	*1.87*
918052	*AA1-018 E*	*11.7*
919221	*AA1-146*	*13.12*
919581	*AA2-030*	*13.12*
920272	*AA2-123 E*	*1.84*
930481	*AB1-089*	*49.32*
930501	*AB1-091 O1*	*50.89*
930741	*AB1-122 1O1*	*53.27*
930751	*AB1-122 2O1*	*56.61*
924471	*AB2-096*	*31.8*
925302	*AB2-191 E*	*1.04*
926311	*AC1-109 1*	*1.43*
926321	*AC1-109 2*	*1.43*
926331	*AC1-110 1*	*1.43*
926341	*AC1-110 2*	*1.43*
926351	*AC1-111 1*	*0.57*
926361	*AC1-111 2*	*0.57*
926371	*AC1-111 3*	*0.57*
926381	*AC1-111 4*	*0.57*
926391	*AC1-111 5*	*0.57*
926401	*AC1-111 6*	*0.57*
927511	*AC1-113 1*	*0.89*
927521	*AC1-113 2*	*0.89*
926431	*AC1-114*	*1.78*
927451	*AC1-142A 1*	*3.22*
927461	*AC1-142A 2*	*3.22*
926821	*AC1-168 C O1*	*0.85*
926822	*AC1-168 E O1*	*5.72*
927091	*AC1-204 1*	*55.48*
927101	*AC1-204 2*	*55.4*

Appendix 6

(CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 131.17% to 149.16% (AC power flow) of its emergency rating (1399 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT4-5__'. This project contributes approximately 249.95 MW to the thermal violation.

CONTINGENCY 'COMED_P4_112-65-BT4-5__'
TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765
TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1 / WILTO;4M 345 WILTO; 765
TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1 / WILTO;4M 345 WILTO; R 345
TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1 / WILTO;4M 345 WILTO;4C 33
END

Bus Number	*Bus Name*	*Full Contribution*
932881	*AC2-115 1*	*2.5*
932891	*AC2-115 2*	*2.5*
932921	*AC2-116*	*0.87*
933411	*AC2-154 C*	*2.32*
933412	*AC2-154 E*	*3.78*
933911	*AD1-013 C*	*1.92*
933912	*AD1-013 E*	*3.07*
933931	*AD1-016 C*	*0.98*
933932	*AD1-016 E*	*1.59*
934101	*AD1-039 1*	*7.31*
934111	*AD1-039 2*	*7.82*
934431	*AD1-067 C*	*0.14*
934432	*AD1-067 E*	*0.58*
934701	*AD1-098 C O1*	*7.19*
934702	*AD1-098 E O1*	*5.25*
934721	*AD1-100 C*	*19.9*
934722	*AD1-100 E*	*92.88*
934871	*AD1-116 C*	*0.94*
934872	*AD1-116 E*	*1.54*
934971	*AD1-129 C*	*0.95*
934972	*AD1-129 E*	*0.63*
935001	*AD1-133 C O1*	*21.27*
935002	*AD1-133 E O1*	*14.18*
936291	*AD2-038 C O1*	*2.4*
936292	*AD2-038 E O1*	*16.06*
936371	*AD2-047 C O1*	*4.15*

936372	*AD2-047 E O1*	*20.26*
936461	*AD2-060*	*2.44*
936511	*AD2-066 C O1*	*8.7*
936512	*AD2-066 E O1*	*5.8*
936791	*AD2-102 C*	*14.83*
936792	*AD2-102 E*	*9.89*
937001	*AD2-134 C*	*2.71*
937002	*AD2-134 E*	*10.8*
937311	*AD2-172 C*	*2.58*
937312	*AD2-172 E*	*3.56*
937401	*AD2-194 1*	*8.41*
937411	*AD2-194 2*	*8.4*
938511	*AE1-070 1*	*9.89*
938521	*AE1-070 2*	*9.03*
938851	*AE1-113 C O1*	*8.56*
938852	*AE1-113 E O1*	*30.35*
938861	*AE1-114 C O1*	*4.11*
938862	*AE1-114 E O1*	*14.02*
939051	*AE1-134 1*	*1.43*
939061	*AE1-134 2*	*1.43*
939321	*AE1-163 C O1*	*6.03*
939322	*AE1-163 E O1*	*37.03*
939351	*AE1-166 C O1*	*10.65*
939352	*AE1-166 E O1*	*9.83*
939401	*AE1-172 C O1*	*5.29*
939402	*AE1-172 E O1*	*24.78*
939631	*AE1-193 C O1*	*32.49*
939632	*AE1-193 E O1*	*217.46*
939641	*AE1-194 C*	*32.49*
939642	*AE1-194 E*	*217.46*
939651	*AE1-195 C*	*32.49*
939652	*AE1-195 E*	*217.46*
939681	*AE1-198 C O1*	*96.48*
939682	*AE1-198 E O1*	*81.98*
940101	*AE1-252 C O1*	*10.61*
940102	*AE1-252 E O1*	*7.08*
LTF	*BLUEG*	*7.1*
274654	*BRAIDWOOD;1U*	*31.29*
274655	*BRAIDWOOD;2U*	*29.94*
LTF	*CALDERWOOD*	*0.11*
LTF	*CANNELTON*	*0.16*
LTF	*CARR*	*0.77*
LTF	*CATAWBA*	*0.32*
LTF	*CBM-S1*	*1.08*
LTF	*CBM-W1*	*26.5*

LTF	*CBM-W2*	*52.14*
LTF	*CHEOAH*	*0.11*
LTF	*CHOCTAW /* 35% REVERSE 4566958 4511400*	*< 0.01*
274751	*CRETE EC ;1U*	*6.62*
274752	*CRETE EC ;2U*	*6.62*
274753	*CRETE EC ;3U*	*6.62*
274754	*CRETE EC ;4U*	*6.62*
274859	*EASYR;U1 E*	*11.49*
274860	*EASYR;U2 E*	*11.49*
LTF	*G-007*	*2.16*
LTF	*GIBSON*	*0.09*
290051	*GSG-6; E*	*10.92*
LTF	*HAMLET*	*0.59*
275149	*KEMPTON ;1E*	*17.08*
274704	*KENDALL ;1C*	*4.59*
274705	*KENDALL ;1S*	*3.06*
274706	*KENDALL ;2C*	*4.59*
274707	*KENDALL ;2S*	*3.06*
274661	*LASCO STA;2U*	*28.64*
290108	*LEEDK;1U E*	*25.39*
LTF	*MEC*	*38.8*
293061	*N-015 E*	*16.42*
293516	*O-009 E1*	*9.5*
293517	*O-009 E2*	*4.82*
293518	*O-009 E3*	*5.31*
293715	*O-029 E*	*10.16*
293716	*O-029 E*	*5.57*
293717	*O-029 E*	*5.12*
LTF	*O-066*	*13.85*
293644	*O22 E1*	*12.32*
293645	*O22 E2*	*23.92*
290021	*O50 E*	*20.75*
294392	*P-010 E*	*20.85*
294763	*P-046 E*	*9.81*
274888	*PILOT HIL;1E*	*17.08*
270859	*PWR VTR EC;R*	*12.71*
LTF	*RENSSELAER*	*0.61*
274722	*S-055 E*	*11.9*
295111	*SUBLETTE E*	*2.84*
274861	*TOP CROP ;1U*	*0.54*
274862	*TOP CROP ;2U*	*1.05*
LTF	*TRIMBLE*	*0.83*
LTF	*WEC*	*8.41*
295109	*WESTBROOK E*	*5.85*

274687	*WILL CNTY;4U*	*13.05*
915011	*Y3-013 1*	*3.97*
915021	*Y3-013 2*	*3.97*
915031	*Y3-013 3*	*3.97*
916221	*Z1-073 E*	*5.64*
916502	*Z1-106 E1*	*1.33*
916504	*Z1-106 E2*	*1.33*
916512	*Z1-107 E*	*2.55*
916522	*Z1-108 E*	*2.62*
918052	*AA1-018 E*	*16.17*
919221	*AA1-146*	*18.35*
919581	*AA2-030*	*18.35*
920272	*AA2-123 E*	*2.57*
930481	*AB1-089*	*68.97*
930501	*AB1-091 O1*	*67.31*
930741	*AB1-122 1O1*	*74.6*
930751	*AB1-122 2O1*	*79.79*
924471	*AB2-096*	*44.48*
925302	*AB2-191 E*	*1.45*
926311	*AC1-109 1*	*2.*
926321	*AC1-109 2*	*2.*
926331	*AC1-110 1*	*2.*
926341	*AC1-110 2*	*2.*
926351	*AC1-111 1*	*0.8*
926361	*AC1-111 2*	*0.8*
926371	*AC1-111 3*	*0.8*
926381	*AC1-111 4*	*0.8*
926391	*AC1-111 5*	*0.8*
926401	*AC1-111 6*	*0.8*
927511	*AC1-113 1*	*1.25*
927521	*AC1-113 2*	*1.25*
926431	*AC1-114*	*2.5*
927451	*AC1-142A 1*	*4.53*
927461	*AC1-142A 2*	*4.53*
926821	*AC1-168 C O1*	*1.19*
926822	*AC1-168 E O1*	*8.01*
927091	*AC1-204 1*	*78.25*
927101	*AC1-204 2*	*78.11*

Contingencies (Light Load Analysis)

Contingency Name	Description
AEP_P1-2_#695A	CONTINGENCY 'AEP_P1-2_#695A' OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTON ; 765 1 END
AEP_P1-2_#7441-A	CONTINGENCY 'AEP_P1-2_#7441-A' OPEN BRANCH FROM BUS 242928 TO BUS 932800 CKT 1 / 242928 05MARYSV 765 932800 AC2-104 TAP 765 1 END
AEP_P1-2_#7441-B	CONTINGENCY 'AEP_P1-2_#7441-B' OPEN BRANCH FROM BUS 932800 TO BUS 246999 CKT 1 / 932800 AC2-104 TAP 765 246999 05SORENS 765 1 END
AEP_P4_#2978_05DUMONT 765_B	CONTINGENCY 'AEP_P4_#2978_05DUMONT 765_B' OPEN BRANCH FROM BUS 243206 TO BUS 243207 CKT 1 / 243206 05DUMONT 765 243207 05GRNTWN 765 1 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTON ; 765 1 END
COMED_P1-2_1094_B2	CONTINGENCY 'COMED_P1-2_1094_B2' OPEN BRANCH FROM BUS 255109 TO BUS 270677 CKT 1 / 255109 17MUNSTR 345 270677 BURNH;0R 345 1 END
COMED_P4_023-65-BT4-5__	CONTINGENCY 'COMED_P4_023-65-BT4-5__' TRIP BRANCH FROM BUS 275168 TO BUS 270607 CKT 1 / COLLI;2M 345 COLLI; 765 TRIP BRANCH FROM BUS 275168 TO BUS 270697 CKT 1 / COLLI;2M 345 COLLI; R 345 TRIP BRANCH FROM BUS 275168 TO BUS 275268 CKT 1 / COLLI;2M 345 COLLI;2C 33 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765 END

COMED_P4_112-65-BT2-3__	CONTINGENCY 'COMED_P4_112-65-BT2-3__' TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1 / WILTO; 765 COLLI; 765 TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1 / WILTO;3M 345 WILTO; 765 TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1 / WILTO;3M 345 WILTO; B 345 TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1 / WILTO;3M 345 WILTO;3C 33 END
COMED_P4_112-65-BT5-6__	CONTINGENCY 'COMED_P4_112-65-BT5-6__' TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1 / WILTO; 765 COLLI; 765 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1 / WILTO;4M 345 WILTO; 765 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1 / WILTO;4M 345 WILTO; R 345 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1 / WILTO;4M 345 WILTO;4C 33 END

Appendices (Light Load Analysis)

Appendix 1

(AEP - AEP) The 05ALLEN-05RPMONE 345 kV line (from bus 243211 to bus 242933 ckt 1) loads from 104.58% to 108.12% (**DC power flow**) of its normal rating (897 MVA) for the single line contingency outage of 'AEP_P1-2_#7441-B'. This project contributes approximately 30.9 MW to the thermal violation.

CONTINGENCY 'AEP_P1-2_#7441-B'
OPEN BRANCH FROM BUS 932800 TO BUS 246999 CKT 1 / 932800 AC2-104 TAP 765 246999 05SORENS 765 1
END

Bus Number	*Bus Name*	*Full Contribution*
243859	*05FR-11G C*	*0.53*
243862	*05FR-12G C*	*0.52*
247901	*05FR-12G E*	*2.08*
243864	*05FR-21G C*	*0.56*
247902	*05FR-21G E*	*2.22*
243866	*05FR-22G C*	*0.53*
243870	*05FR-3G C*	*1.08*
247904	*05FR-3G E*	*4.31*
243873	*05FR-4G C*	*0.83*
247905	*05FR-4G E*	*3.24*
243795	*05HDWTR1G C*	*0.68*
247963	*05HDWTR1G E*	*1.64*
246909	*05MDL-1G C*	*1.13*
247906	*05MDL-1G E*	*4.49*
246910	*05MDL-2G C*	*0.56*
247907	*05MDL-2G E*	*2.23*
246976	*05MDL-3G C*	*0.56*
247912	*05MDL-3G E*	*2.33*
246979	*05MDL-4G C*	*1.13*
247913	*05MDL-4G E*	*2.25*
246953	*05TIMB G C*	*1.11*
247911	*05TIMB G E*	*4.46*
246991	*05WLD G1 C*	*0.34*
247914	*05WLD G1 E*	*4.51*
247255	*05WLD G2 C*	*0.35*
247958	*05WLD G2 E*	*2.38*
933281	*AC2-140 C*	*3.13*
933282	*AC2-140 E*	*0.16*
933591	*AC2-176 C O1*	*0.96*
933592	*AC2-176 E O1*	*6.39*

934431	*AD1-067 C*	*0.06*
934432	*AD1-067 E*	*0.26*
934721	*AD1-100 C*	*8.87*
934722	*AD1-100 E*	*41.39*
935141	*AD1-148*	*2.41*
936291	*AD2-038 C O1*	*1.1*
936292	*AD2-038 E O1*	*7.39*
936371	*AD2-047 C O1*	*2.03*
936372	*AD2-047 E O1*	*9.93*
936721	*AD2-091*	*6.85*
936751	*AD2-096 O1*	*3.17*
936972	*AD2-131 E*	*2.89*
937001	*AD2-134 C*	*1.22*
937002	*AD2-134 E*	*4.87*
937211	*AD2-159 C*	*1.67*
937212	*AD2-159 E*	*7.82*
938851	*AE1-113 C O1*	*4.11*
938852	*AE1-113 E O1*	*12.93*
938861	*AE1-114 C O1*	*1.72*
938862	*AE1-114 E O1*	*6.56*
939321	*AE1-163 C O1*	*2.77*
939322	*AE1-163 E O1*	*17.04*
939401	*AE1-172 C*	*2.55*
939402	*AE1-172 E*	*11.98*
939631	*AE1-193 C*	*4.02*
939632	*AE1-193 E*	*26.89*
939641	*AE1-194 C*	*4.02*
939642	*AE1-194 E*	*26.89*
939651	*AE1-195 C*	*4.02*
939652	*AE1-195 E*	*26.89*
939781	*AE1-209 C*	*0.76*
939782	*AE1-209 E*	*5.11*
939791	*AE1-210 C O1*	*0.76*
939792	*AE1-210 E O1*	*5.11*
274857	*BIG SKY ;U1*	*0.66*
274858	*BIG SKY ;U2*	*0.66*
274877	*BISHOP HL;1U*	*0.54*
274878	*BISHOP HL;2U*	*0.54*
294401	*BSHIL;1U E*	*2.16*
294410	*BSHIL;2U E*	*2.16*
274848	*CAMPGROVE;RU*	*0.8*
274890	*CAYUG;1U E*	*3.38*
274891	*CAYUG;2U E*	*3.38*
274863	*CAYUGA RI;1U*	*0.85*
274864	*CAYUGA RI;2U*	*0.85*

274849	*CRESCENT ;1U*	*0.26*
274859	*EASYR;U1 E*	*2.65*
274860	*EASYR;U2 E*	*2.65*
274856	*ECOGROVE ;U1*	*0.56*
274871	*GR RIDGE ;2U*	*1.12*
274847	*GR RIDGE ;BU*	*0.88*
274855	*GSG-6 ;RU*	*0.62*
290051	*GSG-6; E*	*2.48*
275149	*KEMPTON ;1E*	*4.21*
990901	*L-005 E*	*3.21*
274872	*LEE DEKAL;1U*	*1.37*
290108	*LEEDK;1U E*	*5.71*
274850	*MENDOTA H;RU*	*0.17*
274879	*MINONK ;1U*	*1.14*
293061	*N-015 E*	*3.54*
293513	*O-009 C1*	*0.56*
293514	*O-009 C2*	*0.28*
293515	*O-009 C3*	*0.31*
293516	*O-009 E1*	*2.23*
293517	*O-009 E2*	*1.13*
293518	*O-009 E3*	*1.25*
293712	*O-029 C*	*0.6*
293713	*O-029 C*	*0.33*
293714	*O-029 C*	*0.3*
293715	*O-029 E*	*2.39*
293716	*O-029 E*	*1.31*
293717	*O-029 E*	*1.2*
293771	*O-035 E*	*1.61*
293644	*O22 E1*	*2.37*
293645	*O22 E2*	*4.61*
290021	*O50 E*	*4.57*
294392	*P-010 E*	*4.49*
294763	*P-046 E*	*2.23*
274888	*PILOT HIL;1E*	*4.21*
274887	*PILOT HIL;1U*	*1.05*
274881	*PLEAS RDG;2U*	*1.05*
274851	*PROVIDENC;RU*	*0.4*
290261	*S-027 E*	*4.16*
290265	*S-028 E*	*4.16*
247536	*S-071 C*	*0.63*
247929	*S-071 E*	*2.53*
295110	*SUBLETTE C*	*0.09*
247943	*T-127 E*	*2.25*
247521	*T-131 C*	*1.3*
247925	*T-131 E*	*5.2*

274861	*TOP CROP ;1U*	*0.59*
274862	*TOP CROP ;2U*	*1.15*
274853	*TWINGROVE;U1*	*1.04*
274854	*TWINGROVE;U2*	*1.04*
247543	*V3-007 C*	*1.35*
247935	*V3-007 E*	*9.06*
905081	*W4-005 C*	*1.16*
905082	*W4-005 E*	*5.49*
295108	*WESTBROOK C*	*0.2*
909052	*X2-022 E*	*9.23*
916211	*Z1-072 E*	*1.21*
916221	*Z1-073 E*	*1.28*
917501	*Z2-087 C*	*1.42*
917502	*Z2-087 E*	*9.5*
918051	*AA1-018 C*	*1.13*
918052	*AA1-018 E*	*7.54*
920272	*AA2-123 E*	*1.42*
924041	*AB2-047 C O1*	*1.77*
924042	*AB2-047 E O1*	*11.83*
924261	*AB2-070 C O1*	*1.29*
924262	*AB2-070 E O1*	*8.66*
925301	*AB2-191 C*	*0.35*
925302	*AB2-191 E*	*0.49*
925581	*AC1-033 C*	*0.7*
925582	*AC1-033 E*	*4.7*
925771	*AC1-053 C*	*1.29*
925772	*AC1-053 E*	*8.63*
926821	*AC1-168 C O1*	*0.56*
926822	*AC1-168 E O1*	*3.77*
926841	*AC1-171 C O1*	*0.53*
926842	*AC1-171 E O1*	*3.56*
926861	*AC1-173 C*	*0.85*
926862	*AC1-173 E*	*5.69*
927201	*AC1-214 C O1*	*1.03*
927202	*AC1-214 E O1*	*3.26*

Appendix 2

(MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 101.89% to 106.21% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765_B'. This project contributes approximately 61.11 MW to the thermal violation.

CONTINGENCY 'AEP_P4_#2978_05DUMONT 765_B'
OPEN BRANCH FROM BUS 243206 TO BUS 243207 CKT 1 / 243206 05DUMONT 765 243207 05GRNTWN 765 1
OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTON ; 765 1
END

Bus Number	*Bus Name*	*Full Contribution*
934431	*AD1-067 C*	*0.12*
934432	*AD1-067 E*	*0.49*
934721	*AD1-100 C*	*17.37*
934722	*AD1-100 E*	*81.06*
935141	*AD1-148*	*3.42*
936291	*AD2-038 C O1*	*2.08*
936292	*AD2-038 E O1*	*13.92*
936371	*AD2-047 C O1*	*4.21*
936372	*AD2-047 E O1*	*20.53*
936972	*AD2-131 E*	*3.73*
937001	*AD2-134 C*	*2.3*
937002	*AD2-134 E*	*9.18*
937211	*AD2-159 C*	*2.5*
937212	*AD2-159 E*	*11.7*
938851	*AE1-113 C O1*	*7.8*
938852	*AE1-113 E O1*	*24.51*
938861	*AE1-114 C O1*	*3.19*
938862	*AE1-114 E O1*	*12.21*
939321	*AE1-163 C O1*	*5.23*
939322	*AE1-163 E O1*	*32.1*
939401	*AE1-172 C*	*4.72*
939402	*AE1-172 E*	*22.14*
939631	*AE1-193 C*	*7.94*
939632	*AE1-193 E*	*53.17*
939641	*AE1-194 C*	*7.94*
939642	*AE1-194 E*	*53.17*
939651	*AE1-195 C*	*7.94*
939652	*AE1-195 E*	*53.17*

274857	*BIG SKY ;U1*	*1.23*
274858	*BIG SKY ;U2*	*1.23*
274877	*BISHOP HL;1U*	*0.95*
274878	*BISHOP HL;2U*	*0.95*
294401	*BSHIL;1U E*	*3.8*
294410	*BSHIL;2U E*	*3.8*
274848	*CAMPGROVE;RU*	*1.39*
274890	*CAYUG;1U E*	*6.1*
274891	*CAYUG;2U E*	*6.1*
274863	*CAYUGA RI;1U*	*1.53*
274864	*CAYUGA RI;2U*	*1.53*
274849	*CRESCENT ;1U*	*0.47*
274859	*EASYR;U1 E*	*4.91*
274860	*EASYR;U2 E*	*4.91*
274856	*ECOGROVE ;U1*	*1.05*
274871	*GR RIDGE ;2U*	*2.16*
274847	*GR RIDGE ;BU*	*1.7*
274855	*GSG-6 ;RU*	*1.17*
290051	*GSG-6; E*	*4.66*
950591	*H008*	*1.93*
950671	*J112*	*0.27*
950141	*J395*	*6.71*
950491	*J443*	*2.2*
950501	*J449*	*10.62*
952021	*J614*	*3.51*
953201	*J715*	*6.91*
954701	*J844*	*8.79*
953921	*J855*	*5.21*
954091	*J873*	*9.18*
954301	*J898*	*5.32*
954511	*J926*	*5.71*
954741	*J928*	*5.8*
275149	*KEMPTON ;1E*	*8.7*
990901	*L-005 E*	*5.58*
274872	*LEE DEKAL;1U*	*2.6*
290108	*LEEDK;1U E*	*10.83*
274850	*MENDOTA H;RU*	*0.32*
274879	*MINONK ;1U*	*2.16*
293061	*N-015 E*	*6.82*
293513	*O-009 C1*	*1.01*
293514	*O-009 C2*	*0.51*
293515	*O-009 C3*	*0.57*
293516	*O-009 E1*	*4.05*
293517	*O-009 E2*	*2.06*
293518	*O-009 E3*	*2.26*

293712	*O-029 C*	*1.08*
293713	*O-029 C*	*0.59*
293714	*O-029 C*	*0.55*
293715	*O-029 E*	*4.33*
293716	*O-029 E*	*2.37*
293717	*O-029 E*	*2.18*
293771	*O-035 E*	*2.84*
293644	*O22 E1*	*4.65*
293645	*O22 E2*	*9.02*
290021	*O50 E*	*8.66*
294392	*P-010 E*	*8.66*
294763	*P-046 E*	*4.18*
274888	*PILOT HIL;1E*	*8.7*
274887	*PILOT HIL;1U*	*2.18*
274881	*PLEAS RDG;2U*	*2.18*
274851	*PROVIDENC;RU*	*0.71*
290261	*S-027 E*	*6.65*
290265	*S-028 E*	*6.65*
295110	*SUBLETTE C*	*0.17*
295111	*SUBLETTE E*	*1.21*
274861	*TOP CROP ;1U*	*1.16*
274862	*TOP CROP ;2U*	*2.25*
274853	*TWINGROVE;U1*	*1.66*
274854	*TWINGROVE;U2*	*1.66*
295108	*WESTBROOK C*	*0.38*
295109	*WESTBROOK E*	*2.48*
909052	*X2-022 E*	*13.08*
916211	*Z1-072 E*	*2.15*
916221	*Z1-073 E*	*2.41*
917501	*Z2-087 C*	*2.44*
917502	*Z2-087 E*	*16.33*
918051	*AA1-018 C*	*2.16*
918052	*AA1-018 E*	*14.49*
920272	*AA2-123 E*	*2.72*
924041	*AB2-047 C O1*	*3.02*
924042	*AB2-047 E O1*	*20.19*
924261	*AB2-070 C O1*	*1.86*
924262	*AB2-070 E O1*	*12.43*
925301	*AB2-191 C*	*0.67*
925302	*AB2-191 E*	*0.92*
925581	*AC1-033 C*	*1.24*
925582	*AC1-033 E*	*8.3*
925771	*AC1-053 C*	*1.84*
925772	*AC1-053 E*	*12.34*
926821	*AC1-168 C O1*	*1.02*

926822	*AC1-168 E O1*	*6.82*
926841	*AC1-171 C O1*	*0.87*
926842	*AC1-171 E O1*	*5.83*
927201	*AC1-214 C O1*	*1.82*
927202	*AC1-214 E O1*	*5.77*

Appendix 3

(CE - CE) The WILTON ; B-WILTON ;3M 345 kV line (from bus 270926 to bus 275232 ckt 1) loads from 120.99% to 122.91% (**DC power flow**) of its load dump rating (1379 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT5-6__'. This project contributes approximately 44.86 MW to the thermal violation.

CONTINGENCY 'COMED_P4_112-65-BT5-6__'
TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1 / WILTO; 765 COLLI; 765
TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1 / WILTO;4M 345 WILTO; 765
TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1 / WILTO;4M 345 WILTO; R 345
TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1 / WILTO;4M 345 WILTO;4C 33
END

Bus Number	*Bus Name*	*Full Contribution*
934431	*AD1-067 C*	*0.12*
934432	*AD1-067 E*	*0.52*
934721	*AD1-100 C*	*23.03*
934722	*AD1-100 E*	*107.45*
935141	*AD1-148*	*3.82*
936291	*AD2-038 C O1*	*2.23*
936292	*AD2-038 E O1*	*14.91*
936371	*AD2-047 C O1*	*4.42*
936372	*AD2-047 E O1*	*21.59*
936972	*AD2-131 E*	*3.96*
937001	*AD2-134 C*	*2.45*
937002	*AD2-134 E*	*9.78*
937211	*AD2-159 C*	*2.89*
937212	*AD2-159 E*	*13.51*
938851	*AE1-113 C O1*	*8.31*
938852	*AE1-113 E O1*	*26.11*
938861	*AE1-114 C O1*	*3.4*
938862	*AE1-114 E O1*	*12.99*
939321	*AE1-163 C O1*	*5.6*
939322	*AE1-163 E O1*	*34.38*
939401	*AE1-172 C*	*6.3*
939402	*AE1-172 E*	*29.55*
939631	*AE1-193 C*	*5.83*
939632	*AE1-193 E*	*39.03*
939641	*AE1-194 C*	*5.83*

939642	*AE1-194 E*	*39.03*
939651	*AE1-195 C*	*5.83*
939652	*AE1-195 E*	*39.03*
274857	*BIG SKY ;U1*	*1.3*
274858	*BIG SKY ;U2*	*1.3*
274877	*BISHOP HL;1U*	*1.02*
274878	*BISHOP HL;2U*	*1.02*
294401	*BSHIL;1U E*	*4.08*
294410	*BSHIL;2U E*	*4.08*
274848	*CAMPGROVE;RU*	*1.5*
274890	*CAYUG;1U E*	*7.92*
274891	*CAYUG;2U E*	*7.92*
274863	*CAYUGA RI;1U*	*1.98*
274864	*CAYUGA RI;2U*	*1.98*
274849	*CRESCENT ;1U*	*0.5*
274859	*EASYR;U1 E*	*5.22*
274860	*EASYR;U2 E*	*5.22*
274856	*ECOGROVE ;U1*	*1.11*
274871	*GR RIDGE ;2U*	*2.4*
274847	*GR RIDGE ;BU*	*1.89*
274855	*GSG-6 ;RU*	*1.24*
290051	*GSG-6; E*	*4.97*
950591	*H008*	*2.1*
950671	*J112*	*0.3*
950141	*J395*	*7.32*
950491	*J443*	*2.39*
950501	*J449*	*11.52*
952021	*J614*	*3.8*
953201	*J715*	*7.81*
954701	*J844*	*9.72*
953921	*J855*	*5.63*
954091	*J873*	*0.37*
954301	*J898*	*5.77*
954511	*J926*	*6.19*
954741	*J928*	*6.32*
275149	*KEMPTON ;1E*	*9.15*
990901	*L-005 E*	*6.*
274872	*LEE DEKAL;1U*	*2.77*
290108	*LEEDK;1U E*	*11.55*
274850	*MENDOTA H;RU*	*0.34*
274879	*MINONK ;1U*	*2.31*
293061	*N-015 E*	*7.57*
293513	*O-009 C1*	*1.08*
293514	*O-009 C2*	*0.55*
293515	*O-009 C3*	*0.61*

293516	*O-009 E1*	*4.32*
293517	*O-009 E2*	*2.19*
293518	*O-009 E3*	*2.42*
293712	*O-029 C*	*1.15*
293713	*O-029 C*	*0.63*
293714	*O-029 C*	*0.58*
293715	*O-029 E*	*4.62*
293716	*O-029 E*	*2.53*
293717	*O-029 E*	*2.33*
293771	*O-035 E*	*3.06*
293644	*O22 E1*	*4.88*
293645	*O22 E2*	*9.48*
290021	*O50 E*	*9.22*
294392	*P-010 E*	*9.61*
294763	*P-046 E*	*4.45*
274888	*PILOT HIL;1E*	*9.15*
274887	*PILOT HIL;1U*	*2.29*
274881	*PLEAS RDG;2U*	*2.29*
274851	*PROVIDENC;RU*	*0.76*
290261	*S-027 E*	*7.9*
290265	*S-028 E*	*7.9*
295110	*SUBLETTE C*	*0.18*
295111	*SUBLETTE E*	*1.29*
274861	*TOP CROP ;1U*	*1.22*
274862	*TOP CROP ;2U*	*2.37*
274853	*TWINGROVE;U1*	*1.97*
274854	*TWINGROVE;U2*	*1.97*
905081	*W4-005 C*	*2.*
905082	*W4-005 E*	*9.48*
295108	*WESTBROOK C*	*0.41*
295109	*WESTBROOK E*	*2.64*
909052	*X2-022 E*	*14.61*
916211	*Z1-072 E*	*2.32*
916221	*Z1-073 E*	*2.56*
917501	*Z2-087 C*	*2.98*
917502	*Z2-087 E*	*19.95*
918051	*AA1-018 C*	*2.33*
918052	*AA1-018 E*	*15.58*
920272	*AA2-123 E*	*2.89*
924041	*AB2-047 C O1*	*3.68*
924042	*AB2-047 E O1*	*24.61*
924261	*AB2-070 C O1*	*2.09*
924262	*AB2-070 E O1*	*14.01*
925301	*AB2-191 C*	*0.71*
925302	*AB2-191 E*	*0.98*

925581	*AC1-033 C*	*1.33*
925582	*AC1-033 E*	*8.91*
925771	*AC1-053 C*	*2.07*
925772	*AC1-053 E*	*13.87*
926821	*AC1-168 C O1*	*1.1*
926822	*AC1-168 E O1*	*7.4*
926841	*AC1-171 C O1*	*0.94*
926842	*AC1-171 E O1*	*6.29*
927201	*AC1-214 C O1*	*1.95*
927202	*AC1-214 E O1*	*6.21*

Appendix 4

(CE - CE) The WILTON ; R-WILTON ;4M 345 kV line (from bus 270927 to bus 275233 ckt 1) loads from 123.54% to 125.5% (**DC power flow**) of its load dump rating (1379 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT2-3__'. This project contributes approximately 45.82 MW to the thermal violation.

CONTINGENCY 'COMED_P4_112-65-BT2-3__'
TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1 / WILTO; 765 COLLI; 765
TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1 / WILTO;3M 345 WILTO; 765
TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1 / WILTO;3M 345 WILTO; B 345
TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1 / WILTO;3M 345 WILTO;3C 33
END

Bus Number	*Bus Name*	*Full Contribution*
934431	*AD1-067 C*	*0.13*
934432	*AD1-067 E*	*0.53*
934721	*AD1-100 C*	*23.48*
934722	*AD1-100 E*	*109.58*
935141	*AD1-148*	*3.9*
936291	*AD2-038 C O1*	*2.28*
936292	*AD2-038 E O1*	*15.23*
936371	*AD2-047 C O1*	*4.51*
936372	*AD2-047 E O1*	*22.04*
936972	*AD2-131 E*	*4.04*
937001	*AD2-134 C*	*2.5*
937002	*AD2-134 E*	*9.98*
937211	*AD2-159 C*	*2.94*
937212	*AD2-159 E*	*13.78*
938851	*AE1-113 C O1*	*8.48*
938852	*AE1-113 E O1*	*26.67*
938861	*AE1-114 C O1*	*3.47*
938862	*AE1-114 E O1*	*13.26*
939321	*AE1-163 C O1*	*5.72*
939322	*AE1-163 E O1*	*35.12*
939401	*AE1-172 C*	*6.42*
939402	*AE1-172 E*	*30.13*
939631	*AE1-193 C*	*5.96*
939632	*AE1-193 E*	*39.86*
939641	*AE1-194 C*	*5.96*

939642	*AE1-194 E*	*39.86*
939651	*AE1-195 C*	*5.96*
939652	*AE1-195 E*	*39.86*
274857	*BIG SKY ;U1*	*1.33*
274858	*BIG SKY ;U2*	*1.33*
274877	*BISHOP HL;1U*	*1.04*
274878	*BISHOP HL;2U*	*1.04*
294401	*BSHIL;1U E*	*4.17*
294410	*BSHIL;2U E*	*4.17*
274848	*CAMPGROVE;RU*	*1.53*
274890	*CAYUG;1U E*	*8.08*
274891	*CAYUG;2U E*	*8.08*
274863	*CAYUGA RI;1U*	*2.02*
274864	*CAYUGA RI;2U*	*2.02*
274849	*CRESCENT ;1U*	*0.51*
274859	*EASYR;U1 E*	*5.33*
274860	*EASYR;U2 E*	*5.33*
274856	*ECOGROVE ;U1*	*1.14*
274871	*GR RIDGE ;2U*	*2.45*
274847	*GR RIDGE ;BU*	*1.93*
274855	*GSG-6 ;RU*	*1.27*
290051	*GSG-6; E*	*5.07*
950591	*H008*	*2.14*
950671	*J112*	*0.3*
950141	*J395*	*7.48*
950491	*J443*	*2.45*
950501	*J449*	*11.76*
952021	*J614*	*3.88*
953201	*J715*	*7.97*
954701	*J844*	*9.92*
953921	*J855*	*4.75*
954301	*J898*	*5.89*
954511	*J926*	*6.33*
954741	*J928*	*6.46*
275149	*KEMPTON ;1E*	*9.34*
990901	*L-005 E*	*6.12*
274872	*LEE DEKAL;1U*	*2.83*
290108	*LEEDK;1U E*	*11.79*
274850	*MENDOTA H;RU*	*0.35*
274879	*MINONK ;1U*	*2.35*
293061	*N-015 E*	*7.73*
293513	*O-009 C1*	*1.1*
293514	*O-009 C2*	*0.56*
293515	*O-009 C3*	*0.62*
293516	*O-009 E1*	*4.41*

293517	*O-009 E2*	*2.24*
293518	*O-009 E3*	*2.47*
293712	*O-029 C*	*1.18*
293713	*O-029 C*	*0.65*
293714	*O-029 C*	*0.6*
293715	*O-029 E*	*4.71*
293716	*O-029 E*	*2.58*
293717	*O-029 E*	*2.38*
293771	*O-035 E*	*3.12*
293644	*O22 E1*	*4.99*
293645	*O22 E2*	*9.68*
290021	*O50 E*	*9.42*
294392	*P-010 E*	*9.81*
294763	*P-046 E*	*4.55*
274888	*PILOT HIL;1E*	*9.34*
274887	*PILOT HIL;1U*	*2.34*
274881	*PLEAS RDG;2U*	*2.34*
274851	*PROVIDENC;RU*	*0.78*
290261	*S-027 E*	*8.06*
290265	*S-028 E*	*8.06*
295110	*SUBLETTE C*	*0.18*
295111	*SUBLETTE E*	*1.32*
274861	*TOP CROP ;1U*	*1.25*
274862	*TOP CROP ;2U*	*2.42*
274853	*TWINGROVE;U1*	*2.01*
274854	*TWINGROVE;U2*	*2.01*
905081	*W4-005 C*	*2.04*
905082	*W4-005 E*	*9.67*
295108	*WESTBROOK C*	*0.42*
295109	*WESTBROOK E*	*2.7*
909052	*X2-022 E*	*14.91*
916211	*Z1-072 E*	*2.36*
916221	*Z1-073 E*	*2.62*
917501	*Z2-087 C*	*3.04*
917502	*Z2-087 E*	*20.36*
918051	*AA1-018 C*	*2.38*
918052	*AA1-018 E*	*15.92*
920272	*AA2-123 E*	*2.95*
924041	*AB2-047 C O1*	*3.75*
924042	*AB2-047 E O1*	*25.11*
924261	*AB2-070 C O1*	*2.14*
924262	*AB2-070 E O1*	*14.3*
925301	*AB2-191 C*	*0.73*
925302	*AB2-191 E*	*1.*
925581	*AC1-033 C*	*1.36*

925582	*AC1-033 E*	*9.1*
925771	*AC1-053 C*	*2.11*
925772	*AC1-053 E*	*14.15*
926821	*AC1-168 C O1*	*1.13*
926822	*AC1-168 E O1*	*7.55*
926841	*AC1-171 C O1*	*0.96*
926842	*AC1-171 E O1*	*6.42*
927201	*AC1-214 C O1*	*2.*
927202	*AC1-214 E O1*	*6.34*

Appendix 5

(CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 117.5% to 129.88% (AC power flow) of its emergency rating (1557 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765_B'. This project contributes approximately 197.48 MW to the thermal violation.

CONTINGENCY 'AEP_P4_#2978_05DUMONT 765_B'
OPEN BRANCH FROM BUS 243206 TO BUS 243207 CKT 1 / 243206 05DUMONT 765 243207 05GRNTWN 765 1
OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTON ; 765 1
END

Bus Number	*Bus Name*	*Full Contribution*
934431	*AD1-067 C*	*0.1*
934432	*AD1-067 E*	*0.44*
934721	*AD1-100 C*	*15.25*
934722	*AD1-100 E*	*71.18*
935141	*AD1-148*	*2.69*
936291	*AD2-038 C O1*	*1.83*
936292	*AD2-038 E O1*	*12.23*
936371	*AD2-047 C O1*	*3.15*
936372	*AD2-047 E O1*	*15.37*
936972	*AD2-131 E*	*2.82*
937001	*AD2-134 C*	*2.06*
937002	*AD2-134 E*	*8.23*
937211	*AD2-159 C*	*2.01*
937212	*AD2-159 E*	*9.4*
938851	*AE1-113 C O1*	*7.17*
938852	*AE1-113 E O1*	*22.54*
938861	*AE1-114 C O1*	*2.86*
938862	*AE1-114 E O1*	*10.94*
939321	*AE1-163 C O1*	*4.59*
939322	*AE1-163 E O1*	*28.21*
939401	*AE1-172 C*	*4.03*
939402	*AE1-172 E*	*18.92*
939631	*AE1-193 C*	*25.67*
939632	*AE1-193 E*	*171.81*
939641	*AE1-194 C*	*25.67*
939642	*AE1-194 E*	*171.81*
939651	*AE1-195 C*	*25.67*
939652	*AE1-195 E*	*171.81*

274857	*BIG SKY ;U1*	*1.1*
274858	*BIG SKY ;U2*	*1.1*
274877	*BISHOP HL;1U*	*0.84*
274878	*BISHOP HL;2U*	*0.84*
294401	*BSHIL;1U E*	*3.35*
294410	*BSHIL;2U E*	*3.35*
274848	*CAMPGROVE;RU*	*1.22*
274890	*CAYUG;1U E*	*5.2*
274891	*CAYUG;2U E*	*5.2*
274863	*CAYUGA RI;1U*	*1.3*
274864	*CAYUGA RI;2U*	*1.3*
274849	*CRESCENT ;1U*	*0.41*
274859	*EASYR;U1 E*	*4.39*
274860	*EASYR;U2 E*	*4.39*
274856	*ECOGROVE ;U1*	*0.94*
950751	*G858*	*1.93*
274871	*GR RIDGE ;2U*	*2.*
274847	*GR RIDGE ;BU*	*1.58*
274855	*GSG-6 ;RU*	*1.05*
290051	*GSG-6; E*	*4.18*
950591	*H008*	*1.96*
950761	*H071*	*2.03*
950671	*J112*	*0.28*
950141	*J395*	*6.8*
950221	*J416*	*7.61*
950491	*J443*	*2.23*
950501	*J449*	*10.79*
952021	*J614*	*3.56*
953201	*J715*	*6.89*
954701	*J844*	*8.88*
953921	*J855*	*5.3*
954091	*J873*	*10.4*
954301	*J898*	*5.41*
954511	*J926*	*5.81*
954741	*J928*	*5.89*
275149	*KEMPTON ;1E*	*6.51*
990901	*L-005 E*	*4.89*
274872	*LEE DEKAL;1U*	*2.33*
290108	*LEEDK;1U E*	*9.73*
274850	*MENDOTA H;RU*	*0.29*
274879	*MINONK ;1U*	*1.99*
293061	*N-015 E*	*6.31*
293513	*O-009 C1*	*0.9*
293514	*O-009 C2*	*0.46*
293515	*O-009 C3*	*0.5*

293516	*O-009 E1*	*3.6*
293517	*O-009 E2*	*1.83*
293518	*O-009 E3*	*2.01*
293712	*O-029 C*	*0.96*
293713	*O-029 C*	*0.53*
293714	*O-029 C*	*0.49*
293715	*O-029 E*	*3.85*
293716	*O-029 E*	*2.11*
293717	*O-029 E*	*1.94*
293771	*O-035 E*	*2.51*
293644	*O22 E1*	*4.76*
293645	*O22 E2*	*9.24*
290021	*O50 E*	*7.96*
294392	*P-010 E*	*8.01*
294763	*P-046 E*	*3.76*
274888	*PILOT HIL;1E*	*6.51*
274887	*PILOT HIL;1U*	*1.63*
274881	*PLEAS RDG;2U*	*1.63*
274851	*PROVIDENC;RU*	*0.63*
295110	*SUBLETTE C*	*0.15*
295111	*SUBLETTE E*	*1.09*
274861	*TOP CROP ;1U*	*1.19*
274862	*TOP CROP ;2U*	*2.31*
295108	*WESTBROOK C*	*0.34*
295109	*WESTBROOK E*	*2.22*
909052	*X2-022 E*	*10.28*
916211	*Z1-072 E*	*1.9*
916221	*Z1-073 E*	*2.16*
917501	*Z2-087 C*	*2.06*
917502	*Z2-087 E*	*13.78*
918051	*AA1-018 C*	*1.84*
918052	*AA1-018 E*	*12.31*
920272	*AA2-123 E*	*2.45*
924041	*AB2-047 C O1*	*2.54*
924042	*AB2-047 E O1*	*17.01*
924261	*AB2-070 C O1*	*1.47*
924262	*AB2-070 E O1*	*9.82*
925301	*AB2-191 C*	*0.6*
925302	*AB2-191 E*	*0.83*
925581	*AC1-033 C*	*1.09*
925582	*AC1-033 E*	*7.32*
925771	*AC1-053 C*	*1.45*
925772	*AC1-053 E*	*9.73*
926821	*AC1-168 C O1*	*0.91*
926822	*AC1-168 E O1*	*6.08*

926841	*AC1-171 C O1*	*0.75*
926842	*AC1-171 E O1*	*4.98*
927201	*AC1-214 C O1*	*1.6*
927202	*AC1-214 E O1*	*5.09*

Appendix 6

(CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 103.24% to 105.67% (**DC power flow**) of its normal rating (971 MVA) for the single line contingency outage of 'AEP_P1-2_#695A'. This project contributes approximately 23.62 MW to the thermal violation.

CONTINGENCY 'AEP_P1-2_#695A'
OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTON ; 765 1
END

Bus Number	*Bus Name*	*Full Contribution*
934431	*AD1-067 C*	*0.08*
934432	*AD1-067 E*	*0.35*
934721	*AD1-100 C*	*12.14*
934722	*AD1-100 E*	*56.67*
935141	*AD1-148*	*2.14*
936291	*AD2-038 C O1*	*1.53*
936292	*AD2-038 E O1*	*10.26*
936371	*AD2-047 C O1*	*2.83*
936372	*AD2-047 E O1*	*13.8*
937001	*AD2-134 C*	*1.62*
937002	*AD2-134 E*	*6.47*
937211	*AD2-159 C*	*1.6*
937212	*AD2-159 E*	*7.49*
938851	*AE1-113 C O1*	*5.49*
938852	*AE1-113 E O1*	*17.27*
938861	*AE1-114 C O1*	*2.24*
938862	*AE1-114 E O1*	*8.58*
939321	*AE1-163 C O1*	*3.85*
939322	*AE1-163 E O1*	*23.66*
939401	*AE1-172 C*	*3.23*
939402	*AE1-172 E*	*15.14*
939631	*AE1-193 C*	*3.07*
939632	*AE1-193 E*	*20.55*
939641	*AE1-194 C*	*3.07*
939642	*AE1-194 E*	*20.55*
939651	*AE1-195 C*	*3.07*
939652	*AE1-195 E*	*20.55*
274857	*BIG SKY ;U1*	*0.86*
274858	*BIG SKY ;U2*	*0.86*
274877	*BISHOP HL;1U*	*0.66*
274878	*BISHOP HL;2U*	*0.66*

294401	*BSHIL;1U E*	*2.63*
294410	*BSHIL;2U E*	*2.63*
274848	*CAMPGROVE;RU*	*0.96*
274890	*CAYUG;1U E*	*4.15*
274891	*CAYUG;2U E*	*4.15*
274863	*CAYUGA RI;1U*	*1.04*
274864	*CAYUGA RI;2U*	*1.04*
274849	*CRESCENT ;1U*	*0.32*
274859	*EASYR;U1 E*	*3.44*
274860	*EASYR;U2 E*	*3.44*
274856	*ECOGROVE ;U1*	*0.74*
274871	*GR RIDGE ;2U*	*1.57*
274847	*GR RIDGE ;BU*	*1.24*
274855	*GSG-6 ;RU*	*0.82*
290051	*GSG-6; E*	*3.29*
950141	*J395*	*5.2*
953201	*J715*	*5.32*
954741	*J928*	*4.51*
275149	*KEMPTON ;1E*	*5.85*
990901	*L-005 E*	*3.84*
274872	*LEE DEKAL;1U*	*1.84*
290108	*LEEDK;1U E*	*7.66*
274850	*MENDOTA H;RU*	*0.23*
274879	*MINONK ;1U*	*1.52*
293061	*N-015 E*	*4.94*
293513	*O-009 C1*	*0.7*
293514	*O-009 C2*	*0.36*
293515	*O-009 C3*	*0.4*
293516	*O-009 E1*	*2.82*
293517	*O-009 E2*	*1.43*
293518	*O-009 E3*	*1.58*
293712	*O-029 C*	*0.75*
293713	*O-029 C*	*0.41*
293714	*O-029 C*	*0.38*
293715	*O-029 E*	*3.02*
293716	*O-029 E*	*1.65*
293717	*O-029 E*	*1.52*
293771	*O-035 E*	*1.97*
293644	*O22 E1*	*3.08*
293645	*O22 E2*	*5.98*
290021	*O50 E*	*6.1*
294392	*P-010 E*	*6.27*
294763	*P-046 E*	*2.95*
274888	*PILOT HIL;1E*	*5.85*
274887	*PILOT HIL;1U*	*1.46*

274881	*PLEAS RDG;2U*	*1.46*
274851	*PROVIDENC;RU*	*0.49*
290261	*S-027 E*	*4.37*
290265	*S-028 E*	*4.37*
295110	*SUBLETTE C*	*0.12*
274861	*TOP CROP ;1U*	*0.77*
274862	*TOP CROP ;2U*	*1.49*
274853	*TWINGROVE;U1*	*1.09*
274854	*TWINGROVE;U2*	*1.09*
905081	*W4-005 C*	*1.11*
905082	*W4-005 E*	*5.26*
295108	*WESTBROOK C*	*0.27*
909052	*X2-022 E*	*8.17*
916211	*Z1-072 E*	*1.49*
916221	*Z1-073 E*	*1.7*
917501	*Z2-087 C*	*1.64*
917502	*Z2-087 E*	*11.*
918051	*AA1-018 C*	*1.67*
918052	*AA1-018 E*	*11.16*
920272	*AA2-123 E*	*1.93*
924041	*AB2-047 C O1*	*2.03*
924042	*AB2-047 E O1*	*13.58*
924261	*AB2-070 C O1*	*1.17*
924262	*AB2-070 E O1*	*7.81*
925301	*AB2-191 C*	*0.47*
925302	*AB2-191 E*	*0.65*
925581	*AC1-033 C*	*0.86*
925582	*AC1-033 E*	*5.74*
925771	*AC1-053 C*	*1.16*
925772	*AC1-053 E*	*7.74*
926821	*AC1-168 C O1*	*0.71*
926822	*AC1-168 E O1*	*4.78*
926841	*AC1-171 C O1*	*0.59*
926842	*AC1-171 E O1*	*3.91*
927201	*AC1-214 C O1*	*1.26*
927202	*AC1-214 E O1*	*4.*

Appendix 7

(CE - CE) The WILTON ; 765/345 kV transformer (from bus 275232 to bus 270644 ckt 1) loads from 112.23% to 115.48% (**DC power flow**) of its load dump rating (1379 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT5-6__'. This project contributes approximately 44.86 MW to the thermal violation.

CONTINGENCY 'COMED_P4_112-65-BT5-6__'
TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1 / WILTO; 765 COLLI; 765
TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1 / WILTO;4M 345 WILTO; 765
TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1 / WILTO;4M 345 WILTO; R 345
TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1 / WILTO;4M 345 WILTO;4C 33
END

Bus Number	*Bus Name*	*Full Contribution*
934431	*AD1-067 C*	*0.12*
934432	*AD1-067 E*	*0.52*
934721	*AD1-100 C*	*23.03*
934722	*AD1-100 E*	*107.45*
936291	*AD2-038 C O1*	*2.23*
936292	*AD2-038 E O1*	*14.91*
936371	*AD2-047 C O1*	*4.42*
936372	*AD2-047 E O1*	*21.59*
937001	*AD2-134 C*	*2.45*
937002	*AD2-134 E*	*9.78*
937211	*AD2-159 C*	*2.89*
937212	*AD2-159 E*	*13.51*
938851	*AE1-113 C O1*	*8.31*
938852	*AE1-113 E O1*	*26.11*
938861	*AE1-114 C O1*	*3.4*
938862	*AE1-114 E O1*	*12.99*
939321	*AE1-163 C O1*	*5.6*
939322	*AE1-163 E O1*	*34.38*
939401	*AE1-172 C*	*6.3*
939402	*AE1-172 E*	*29.55*
939631	*AE1-193 C*	*5.83*
939632	*AE1-193 E*	*39.03*
939641	*AE1-194 C*	*5.83*
939642	*AE1-194 E*	*39.03*
939651	*AE1-195 C*	*5.83*

939652	*AE1-195 E*	*39.03*
274857	*BIG SKY ;U1*	*1.3*
274858	*BIG SKY ;U2*	*1.3*
274877	*BISHOP HL;1U*	*1.02*
274878	*BISHOP HL;2U*	*1.02*
294401	*BSHIL;1U E*	*4.08*
294410	*BSHIL;2U E*	*4.08*
274848	*CAMPGROVE;RU*	*1.5*
274890	*CAYUG;1U E*	*7.92*
274891	*CAYUG;2U E*	*7.92*
274863	*CAYUGA RI;1U*	*1.98*
274864	*CAYUGA RI;2U*	*1.98*
274849	*CRESCENT ;1U*	*0.5*
274859	*EASYR;U1 E*	*5.22*
274860	*EASYR;U2 E*	*5.22*
274856	*ECOGROVE ;U1*	*1.11*
274871	*GR RIDGE ;2U*	*2.4*
274847	*GR RIDGE ;BU*	*1.89*
274855	*GSG-6 ;RU*	*1.24*
290051	*GSG-6; E*	*4.97*
275149	*KEMPTON ;1E*	*9.15*
990901	*L-005 E*	*6.*
274872	*LEE DEKAL;1U*	*2.77*
290108	*LEEDK;1U E*	*11.55*
274850	*MENDOTA H;RU*	*0.34*
274879	*MINONK ;1U*	*2.31*
293061	*N-015 E*	*7.57*
293513	*O-009 C1*	*1.08*
293514	*O-009 C2*	*0.55*
293515	*O-009 C3*	*0.61*
293516	*O-009 E1*	*4.32*
293517	*O-009 E2*	*2.19*
293518	*O-009 E3*	*2.42*
293712	*O-029 C*	*1.15*
293713	*O-029 C*	*0.63*
293714	*O-029 C*	*0.58*
293715	*O-029 E*	*4.62*
293716	*O-029 E*	*2.53*
293717	*O-029 E*	*2.33*
293771	*O-035 E*	*3.06*
293644	*O22 E1*	*4.88*
293645	*O22 E2*	*9.48*
290021	*O50 E*	*9.22*
294392	*P-010 E*	*9.61*
294763	*P-046 E*	*4.45*

274888	*PILOT HIL;1E*	*9.15*
274887	*PILOT HIL;1U*	*2.29*
274881	*PLEAS RDG;2U*	*2.29*
274851	*PROVIDENC;RU*	*0.76*
290261	*S-027 E*	*7.9*
290265	*S-028 E*	*7.9*
295110	*SUBLETTE C*	*0.18*
295111	*SUBLETTE E*	*1.29*
274861	*TOP CROP ;1U*	*1.22*
274862	*TOP CROP ;2U*	*2.37*
274853	*TWINGROVE;U1*	*1.97*
274854	*TWINGROVE;U2*	*1.97*
905081	*W4-005 C*	*2.*
905082	*W4-005 E*	*9.48*
295108	*WESTBROOK C*	*0.41*
295109	*WESTBROOK E*	*2.64*
916211	*Z1-072 E*	*2.32*
916221	*Z1-073 E*	*2.56*
917501	*Z2-087 C*	*2.98*
917502	*Z2-087 E*	*19.95*
918051	*AA1-018 C*	*2.33*
918052	*AA1-018 E*	*15.58*
920272	*AA2-123 E*	*2.89*
924041	*AB2-047 C O1*	*3.68*
924042	*AB2-047 E O1*	*24.61*
924261	*AB2-070 C O1*	*2.09*
924262	*AB2-070 E O1*	*14.01*
925301	*AB2-191 C*	*0.71*
925302	*AB2-191 E*	*0.98*
925581	*AC1-033 C*	*1.33*
925582	*AC1-033 E*	*8.91*
926821	*AC1-168 C O1*	*1.1*
926822	*AC1-168 E O1*	*7.4*
926841	*AC1-171 C O1*	*0.94*
926842	*AC1-171 E O1*	*6.29*
927201	*AC1-214 C O1*	*1.95*
927202	*AC1-214 E O1*	*6.21*

Appendix 8

(CE - CE) The WILTON ; 765/345 kV transformer (from bus 275233 to bus 270644 ckt 1) loads from 115.69% to 119.01% (**DC power flow**) of its load dump rating (1379 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT2-3__'. This project contributes approximately 45.82 MW to the thermal violation.

CONTINGENCY 'COMED_P4_112-65-BT2-3__'
TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1 / WILTO; 765 COLLI; 765
TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1 / WILTO;3M 345 WILTO; 765
TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1 / WILTO;3M 345 WILTO; B 345
TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1 / WILTO;3M 345 WILTO;3C 33
END

Bus Number	*Bus Name*	*Full Contribution*
934431	*AD1-067 C*	*0.13*
934432	*AD1-067 E*	*0.53*
934721	*AD1-100 C*	*23.48*
934722	*AD1-100 E*	*109.58*
936291	*AD2-038 C O1*	*2.28*
936292	*AD2-038 E O1*	*15.23*
936371	*AD2-047 C O1*	*4.51*
936372	*AD2-047 E O1*	*22.04*
937001	*AD2-134 C*	*2.5*
937002	*AD2-134 E*	*9.98*
937211	*AD2-159 C*	*2.94*
937212	*AD2-159 E*	*13.78*
938851	*AE1-113 C O1*	*8.48*
938852	*AE1-113 E O1*	*26.67*
938861	*AE1-114 C O1*	*3.47*
938862	*AE1-114 E O1*	*13.26*
939321	*AE1-163 C O1*	*5.72*
939322	*AE1-163 E O1*	*35.12*
939401	*AE1-172 C*	*6.42*
939402	*AE1-172 E*	*30.13*
939631	*AE1-193 C*	*5.96*
939632	*AE1-193 E*	*39.86*
939641	*AE1-194 C*	*5.96*
939642	*AE1-194 E*	*39.86*
939651	*AE1-195 C*	*5.96*

939652	*AE1-195 E*	*39.86*
274857	*BIG SKY ;U1*	*1.33*
274858	*BIG SKY ;U2*	*1.33*
274877	*BISHOP HL;1U*	*1.04*
274878	*BISHOP HL;2U*	*1.04*
294401	*BSHIL;1U E*	*4.17*
294410	*BSHIL;2U E*	*4.17*
274848	*CAMPGROVE;RU*	*1.53*
274890	*CAYUG;1U E*	*8.08*
274891	*CAYUG;2U E*	*8.08*
274863	*CAYUGA RI;1U*	*2.02*
274864	*CAYUGA RI;2U*	*2.02*
274849	*CRESCENT ;1U*	*0.51*
274859	*EASYR;U1 E*	*5.33*
274860	*EASYR;U2 E*	*5.33*
274856	*ECOGROVE ;U1*	*1.14*
274871	*GR RIDGE ;2U*	*2.45*
274847	*GR RIDGE ;BU*	*1.93*
274855	*GSG-6 ;RU*	*1.27*
290051	*GSG-6; E*	*5.07*
275149	*KEMPTON ;1E*	*9.34*
990901	*L-005 E*	*6.12*
274872	*LEE DEKAL;1U*	*2.83*
290108	*LEEDK;1U E*	*11.79*
274850	*MENDOTA H;RU*	*0.35*
274879	*MINONK ;1U*	*2.35*
293061	*N-015 E*	*7.73*
293513	*O-009 C1*	*1.1*
293514	*O-009 C2*	*0.56*
293515	*O-009 C3*	*0.62*
293516	*O-009 E1*	*4.41*
293517	*O-009 E2*	*2.24*
293518	*O-009 E3*	*2.47*
293712	*O-029 C*	*1.18*
293713	*O-029 C*	*0.65*
293714	*O-029 C*	*0.6*
293715	*O-029 E*	*4.71*
293716	*O-029 E*	*2.58*
293717	*O-029 E*	*2.38*
293771	*O-035 E*	*3.12*
293644	*O22 E1*	*4.99*
293645	*O22 E2*	*9.68*
290021	*O50 E*	*9.42*
294392	*P-010 E*	*9.81*
294763	*P-046 E*	*4.55*

274888	*PILOT HIL;1E*	*9.34*
274887	*PILOT HIL;1U*	*2.34*
274881	*PLEAS RDG;2U*	*2.34*
274851	*PROVIDENC;RU*	*0.78*
290261	*S-027 E*	*8.06*
290265	*S-028 E*	*8.06*
295110	*SUBLETTE C*	*0.18*
295111	*SUBLETTE E*	*1.32*
274861	*TOP CROP ;1U*	*1.25*
274862	*TOP CROP ;2U*	*2.42*
274853	*TWINGROVE;U1*	*2.01*
274854	*TWINGROVE;U2*	*2.01*
905081	*W4-005 C*	*2.04*
905082	*W4-005 E*	*9.67*
295108	*WESTBROOK C*	*0.42*
295109	*WESTBROOK E*	*2.7*
916211	*Z1-072 E*	*2.36*
916221	*Z1-073 E*	*2.62*
917501	*Z2-087 C*	*3.04*
917502	*Z2-087 E*	*20.36*
918051	*AA1-018 C*	*2.38*
918052	*AA1-018 E*	*15.92*
920272	*AA2-123 E*	*2.95*
924041	*AB2-047 C O1*	*3.75*
924042	*AB2-047 E O1*	*25.11*
924261	*AB2-070 C O1*	*2.14*
924262	*AB2-070 E O1*	*14.3*
925301	*AB2-191 C*	*0.73*
925302	*AB2-191 E*	*1.*
925581	*AC1-033 C*	*1.36*
925582	*AC1-033 E*	*9.1*
925771	*AC1-053 C*	*2.11*
925772	*AC1-053 E*	*14.15*
926821	*AC1-168 C O1*	*1.13*
926822	*AC1-168 E O1*	*7.55*
926841	*AC1-171 C O1*	*0.96*
926842	*AC1-171 E O1*	*6.42*
927201	*AC1-214 C O1*	*2.*
927202	*AC1-214 E O1*	*6.34*

Attachment 1: Single Line Diagram